FLEXIBLE HOUSING IN THE 21ST CENTURY: THREE CONTEMPORARY CASE STUDIES

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ABSTRACT

FLEXIBLE HOUSING IN THE 21ST CENTURY: THREE CONTEMPORARY CASE STUDIES

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This thesis is an investigation of the current position of flexible housing practiced today. Flexibility is observed since the most initial shelters functioned as demountable dwellings. The objective of this research is to explore whether flexible housing in current practice displays new pioneering solutions or continue with established models. In order to achieve the goal, the historic background of flexible housing is examined first, focusing on acknowledged precedents in this field. Then, selected case studies are analyzed and compared to them in terms of three contrasting pairs of criteria: Rate of user participation and empowerment of architect, individual and communal life in dwellings, conventionality and novelty of building methods and materials. In the end, it is found that selected case studies do not offer an impactful novelty like an avant-garde although they are not identical with precedents.

Keywords: Flexible Housing, User Participation, Empowerment of Architect, Individual and Communal Life, Conventionality and Novelty.

ÖZ

21. YÜZYILDA ESNEK KONUT: ÜÇ ÇAĞDAŞ ÖRNEK ÇALIŞMA

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Bu tez, esnek konutun güncel konumunun araştırıldığı bir çalışmadır. Esneklik, sökülüp taşınabilir mesken olarak işlev gösteren ilk barınaklardan beri uygulanagelmiştir. Araştırmanın hedefi, günümüzde esnek konut pratiğinin yeni öncü çözümler mi ürettiği yoksa yerleşmiş modeller üzerinden devam mı ettiğini incelemektir. Bunun için, esnek konut alanında literatüre girmiş öncü modeller göz önünde tutularak öncelikle esnek konutun tarihçesi analiz edilmiştir. Sonrasında seçilmiş örnek projeler, kıyaslama yapılabilir üç kriterde – kullanıcı katılımı ve mimarın yetki gücü, meskenlerin bireysel ve toplumsal yaşayışı, bina yapım yöntem ve malzemelerinin konvansiyonelliği ve yeniliği – analiz edilerek önceki örneklerle karşılaştırılmıştır. Çalışma sonunda seçili örnek projelerin öncülüğünü yaptıkları bir yenilik getirmedikleri; ancak önceki modellerle birebir özdeş olmadıkları sonucuna ulaşılmıştır.

Anahtar Kelimeler: Esnek Konut, Kullanıcı Katılımı, Mimarın Yetki Gücü, Bireysel ve Toplumsal Yaşayış, Konvansiyonellik ve Yenilik.

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TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

CHAPTER 1

INTRODUCTION

Flexible housing is the dwelling that is capable of responding to changes arising within time (Kronenburg, 2007). Traces of flexible housing can be found since the most initial dwellings erected in the form of demountable shelters. In order to analyze the recent status of flexible housing, this thesis undertakes the comparison of acknowledged precedents in flexible housing design with contemporary case studies from current practice.

1.1.Problem Definition

The central problem in this study is whether flexible housing practiced today has similarities with precedents in this field or is producing new, innovative solutions. It is searched to what extent recent projects rely on established models and what new features are observable. In order to achieve the goal, flexible housing proposals introduced from different time intervals are reviewed, three case studies from current practice are analyzed, and those two groups are compared respectively.

1.2.Research Questions

Since the thesis concentrates on the state of flexible housing implemented in current practice, one major question is formed: What is new and customary with flexible housing today? Related to this major question, secondary questions are as follows:

- In which ways comparisons can be made with flexible housing proposals introduced in different time intervals?
- Which similarities and differences can be observed in flexible housing proposals introduced in different time intervals?
- Which aspects remind previous solutions and which aspects are totally new and innovative in the field?

1.3.Literature Review

In order to study flexible housing, eight major sources are utilized. The first three of them center on flexible housing introduced in the 1960s-1970s, which can be chronologically listed as follows: John Habraken's book, "Supports: An Alternative to Mass Housing" (1972), followed by those of John Turner and Christopher Alexander named "Housing by People: Towards Autonomy in Building Environments" (1976) and "A Pattern Language: Towns, Buildings, Construction" (1977) respectively.

The remaining five sources center on flexible housing applied in the 2000s which can be chronologically listed as follows: Three articles of Schneider and Till that are "Flexible Housing: The Means to the End" (2005a), "Flexible Housing: Opportunities and Limits" (2005b) and "The Opportunities of Flexible Housing" (2005c) followed by a book of them entitled "Flexible Housing" (2007), and the last one is an article of John Habraken named "Design for Flexibility" (2008).

All of these sources are the most relevant studies made within the scope of flexible housing addressing origins and primary notions of flexible housing that were triggered at the modern age and questioning what kind of implementations were carried out in different parts of the world.

Habraken (1972) claims that user participation should be taken into account in housing design in "Supports: An Alternative to Mass Housing". In the book, he

distinguishes stable building parts that user participation does not take place from dynamic parts in which user participation is actively included.

Similar to Habraken, Turner (1976) asserts that user intervention should be taken into account in housing. However, compared to Habraken, Turner argues that users should be authorized more and as he proposes total exclusion of architect and maximum authorization of user in theory.

Alexander (1977) asserts that contradictions and dissatisfactions between occupants and dwellings are likely to occur when dwellings that are designed totally out of user involvement are submitted to occupants in totally finished states. Similar to Turner, Alexander expects users to build their own house. He tells that an architect should present the most basic schemes and templates (which he calls "patterns") that include the minimum level of intervention of architect while giving occupants the chance of maximum customization.

In their book, Schneider and Till (2007) center on flexibility via its definition, compare "adaptability" and" flexibility", and introduce the history of flexible housing by beginning from the 1920s respectively. In the end, by criticizing housing policies and unsuccessful implementations in the UK, they present built samples of flexible housing.

Habraken (2008) negatively criticizes and centers on missing points and deficiencies of Schneider and Till's book, "Flexible Housing". He argues that Schneider and Till limit and place the concept of flexibility in a narrowed context, because they only analyze any flexible housing according to a framework formed by them which is comprised of "use", "plan", "construction", and "services". From his point of view, these tools are tremendously dependent on architect's authority, excluding user participation. According to him, utilization of this framework places flexible housing in a static state with closed endings and a totally determinate approach managed by architect only. However, according to his ideas, a dwelling should undergo changes,

these changes should depend on user's customizations, and there should be open endings. In Habraken's idea, there are two components: static instruments that do not undergo changes and decided by architects, and dynamic elements that are open to modification of users. When his idea and Schneider and Till's approach are compared, it is observable that Schneider and Till's approach only includes tools that are equivalent to static instruments of Habraken's idea, which shows that for Habraken, Schneider and Till's approach have missing elements and that is not a comprehensive approach touching all aspects of flexible housing. Habraken also adds that four-element framework only relies on physical spatial modification tools such as sliding panels, outdoor spaces without definite functions, and so on. However, for him, a flexible housing sample does not always require that sort of tools, and that kind of an approach lacks conceptual inputs and ideas related to flexible housing, demonstrating that Habraken finds Schneider and Till's approach idealess (out of concept).

Schneider and Till (2007) claim that in order to design usable flexible housing projects, during the making process, four terms should be taken into account and planned from the very early stages : "Use", "plan", "construction", and "services". These four terms are elaborated by them as follows:

- "Use" and "plan" are categorized under three titles on their own: "Building level", "unit level", "room level".
- "Construction" is composed of two categories: "Construction with principles" and "construction and building"
- "Services" are divided into "horizontal services" and "vertical services".

1.4.Method and Structure of the Thesis

This study concentrates on detection of recent features of flexible housing practiced over the past decades. In order to accomplish the goal, the research is composed of several steps which can be put in the following order:

1. Introduction of themes and terminology relatable to flexible housing.
2. Introduction of the framework of Schneider and Till (2007) comprised of "use", "plan", "constructions" and "services" for examination of the case studies.
3. A brief overview of history of flexible housing for making comparisons with the case studies.
4. Analysis of the case studies, which are Villa Verde Housing of Elemental (2010), Sustainable Housing of Tatiana Bilbao (2015), and Plugin Tower of PAO (2016).
5. Comparison of the case studies with precedents so as to explore what is seminal and customary with flexible housing in current practice.

Choosing projects as different as possible makes up the focus of determination of the case studies. The selection process is conducted according to three points below.

1. Each project is located in different countries with different housing policies as Villa Verde, Sustainable Housing and Plugin Tower are located in Chile, Mexico, and China respectively.
2. Each project is designed for different user profiles (with different needs) so that they could be designed for diverse purposes. Villa Verde was designed for laborers of a forestry company operating in Chile, Sustainable Housing was designed for Mexican citizens living in Mexico (country) with low income, and Plugin Tower was designed for every Chinese citizen dwelling in China who lack political power.

3. Each project has different typologies (e.g. being composed of mass housing units or independent housing units, being mobile or immobile,, etc.) as Villa Verde is a multi-residential housing project in which customized additions could be made within borders of each single house, Sustainable Housing is composed of separate single houses with the ability to expand beyond their boundaries and Plugin Tower is comprised of totally moveable independent single houses composed of lightweight modules.

During examination of the case studies, they are studied and compared with precedents according to three subcategories below:

1. Rate of user participation and empowerment of architect,
2. Individual and communal spaces,
3. Conventionality and novelty of building methods and materials.

Analysis of case studies according to the framework of Schneider and Till (2007) provides acquisition of the data for the three above and by use of the data, it is aimed to compare case studies with previous models so as to observe what is seminal and customary with flexible housing in current practice.

CHAPTER 2

DEFINITIONS OF KEY TERMS AND THE CONCEPTUAL FRAMEWORK

In this chapter, it is aimed to define terms relatable to flexible housing and the case studies. Terms are classified under two categories: Directly relatable terms which are composed of flexible housing, adaptable housing and incremental housing; and terms indirectly relatable to flexible housing, which consist of social housing, affordable housing, collective housing, public housing and mass housing. Despite the fact that flexible housing is accepted as the umbrella term in this study, the inclusion of remaining themes is also necessary since flexible housing does not stand alone in most of the projects, including the case studies chosen for analysis. Subsequently, the framework of Schneider and Till (2007) used during analysis of case studies is introduced.

2.1.Key Terms

2.1.1. Directly Relatable Terms

"Flexible housing" is defined as follows (from top to bottom below, the rate of comprehensiveness declines):

- Flexible housing is the housing designed to respond easily to change throughout their lifetime (Kronenburg, 2007).
- Flexible housing is the housing that can adapt to the changing needs of users (Schneider & Till, 2005c, p. 2).
- Flexible housing is providing potential dwellers with a flexible dwelling space in which they can create their own preferred dwelling solution and

modify it according to their dwelling needs as they change over time (Karni, 1995).

- Flexible housing is the ability to change floor area and function, and providing valid conditions so as to achieve different space layouts via changing boundaries of a residence and adding new construction (Habraken et al., 1976).

Depending on these above, it is clear that one ultimate single description for flexible housing cannot be made as moving from top to bottom above, the scope of flexible housing becomes narrowed down. For this study, Kronenburg's definition above is accepted as the main definition.

"Adaptable housing" is described as:

- Adaptable housing is the housing that is ready for different functions, patterns of use, and specific requirement (Kronenburg, 2007).
- Adaptable housing is comprised of housing units which can be easily altered as circumstances changes (Rabeneck, Sheppard & Town, 1973).

With respect to statements above, it is evident that adaptable and flexible housing cannot be sharply differed from each other. Adaptable housing and flexible housing are not radically different and the difference between them is not clear as Schneider and Till (2005a) assert that flexible housing covers adaptable housing itself in a way. Schneider and Till's expression is as follows (2005a, p. 287):

> Our definition determines flexible housing as housing that can adapt to the changing needs of users. This definition is deliberately broad. It includes the possibility of choosing different housing layouts prior to occupation as well as the ability to adjust one's housing over time. It also includes the potential to incorporate new technologies over time, to adjust to changing demographics, or even to completely change the use of the building from housing to something else. So flexible housing in our definition is a wider category than that of adaptable housing, which is the term generally used to denote housing that can adapt to users' changing physical needs, in particular as they grow older or lose full mobility.

Taking the consideration above into account, flexible housing can cover adaptable housing itself which indicates that the scope of flexible housing is larger than that of adaptable housing.

“Incremental housing” is called “core housing “as well (Beattie, Mayer & Yıldırım, 2010). It is described as follows:

> Incremental housing is a step-by-step process. It goes by different names (starter house, phased-development house, owner-driven house), but fundamentally, incremental housing is an integral urban development process, building housing communities and citizens. It is not quick, immediate or complete, but choice remains with the owner (Goethert, 2010, p. 23).

Developmental phases of incremental housing is described as follows:

> It starts with a starter core shelter. The starter core may be a kitchen/bathroom unit or just a bare lot with utility connection potential. But recommended is a multi-purpose room with basic kitchen/bath facilities. Owners control the expansion of their housing based on their needs and resources. Incremental housing is an affordable way to rapidly resettle many families at a minimum housing and services level by linking the energy of families with the large-scale city planning. It provides secure title and maximum flexibility in housing decisions. (Goethert, 2010, p. 23).

The depiction above indicates that user participation and customization takes place in incremental housing and that is why flexible solutions always emerge in incremental housing projects. The “starter core” mentioned above is exemplified via “kitchen/ bathroom units”. These spaces can be regarded as services in a dwelling which are usually stable and fixed, and from Goethert’s point of view above, rest of the dwelling is designed according to desires and needs of users, which denotes user participation and customization. In incremental housing, since only a core house with voids or free zones waiting for being filled by residents is introduced, incremental and flexible housing are directly related terms since there is the flexibility to customize free zones in incremental housing projects by inhabitants.

2.1.2. Terms Indirectly Relatable to Flexible Housing

"Social housing" is described as:

- Housing provided for people on low incomes or with particular needs by government agencies or non-profit organizations ("Social Housing | Oxford Dictionaries", 2019).
- Houses and flats that are owned by local government or by other organizations that do not make a profit, and that are rented to people who have low incomes ("Social Housing | Cambridge English Dictionary", 2019)

During the design phase of social housing, principles of flexible housing can be utilized, or social housing samples may well stand as flexible housing units.

"Affordable housing" is defined as:

- Housing which is deemed affordable to those with a median household income or below (Bhatta, 2010, p. 23).
- Housing which is reasonably adequate in standard and location for lower or middle income households and does not cost so much that a household is unlikely to be able to meet other basic needs on a sustainable basis ("QAHC - About Affordable Housing", 2019).

The relationship between "flexible housing" and "affordable housing" is similar to the link between "flexible housing" and "social housing". Flexibility and affordability can emerge in the same project or they can independently arise on their own alone. It is remarked that "affordable housing is not the same as social housing" ("How is affordable housing different to social housing?", 2019). The major difference is expressed below:

> Affordable housing is open to a broader range of household incomes than social housing, so households can earn higher levels of income and still be eligible. Households do not have to be eligible for social housing to apply for affordable housing, though people who are eligible for social housing may also be eligible for affordable housing properties. ("How is affordable housing different to social housing?", 2019)

The expression above shows that in "affordable housing", compared to "social housing", the user profile is likely to hold greater income levels, and owing to the

cause, each “affordable housing” dweller cannot apply for owning a “social housing” unit, but on the opposite, it is possible.

With regard to “collective housing”, in the USSR, in the early years of socialism, there was migration from countryside to cities resulting in housing crisis occurring at Soviet cities (Per, Mozas & A+T research group, 2013). In order to handle, collective housing was introduced and one example is Narkomfin Building erected around the 1930s which was designed with the intention of providing common services, bathrooms and kitchens (Per, Mozas & A+T research group, 2013). During development of the design, there was “an emphasis on communal uses and on the socialization of household tasks”, and therefore, the project consisted of communal spaces like the “social club, kitchen, stadiumnasium, library, kindergarten and roof gardens” (Per, Mozas & A+T research group, 2013). Citizens arrived at cities from rural zones in search of better living conditions, housing crisis arose after the advent of the Industrial Revolution and collective housing was introduced as a solution after adopting “a subsistence economy to save on production resources” (Per, Mozas & A+T research group, 2013, p. 66).

“Public housing” is “accommodations owned and managed by public – that is, governmental – bodies” in the UK (Best, 1996, p. 536). Public housing policy in the UK and the USA are different, and even in the UK; Northern Ireland, Scotland and England possess their own policies (Best, 1996, p. 536). This demonstrates that it is impossible to submit a common public housing policy that is appropriate to every country. In the USA, public housing served the poorest citizens and individuals who generally paid rent equivalent to 30% of their adjusted gross income (McCarty, 2015). This signifies that public housing was introduced to support poor citizens in meeting their housing expenditures. The difference between social housing and public housing is expressed as follows:

> “Social housing” is a term used throughout the member countries of the European Union to refer not just to public housing but to other

> accommodation subsidized by public sources. In the United Kingdom, social housing can embrace public housing (often called “council housing”) and also the homes of housing associations, many of which are also registered charities, and are similar to community development corporations in the United States (Best, 1996, p. 537).

As detectable above, social housing owns a scope greater than that of public housing. Although separate countries have their unique specifications on public housing, their common purpose can be generalized as financially helping poor citizens to pay their housing expenses.

“Mass housing” is defined as “dense and repetitive housing solutions that has emerged as a complement of urban regeneration projects to cover the acute shortage of housing (especially in the big cities)” ("Mass Housing | Cambridge English Dictionary", 2020). Mass housing can either be implemented together with social housing programs or flexible housing. In urban mediums, mass housing is not always utilized to provide citizens with low housing costs unlike social housing programs, but it is utilized so as to establish a residential zone from scratch rapidly, and dwellings do not always stand as low-cost housing units. Mass housing can be described as repetitive construction of one single or few housing samples in its most comprehensive context.

2.1.3. Evaluation of Links between Terms

Depending on explanations of key terms above, a categorization of them under separate subtitles is possible. However, these should not be conceived as totally disconnected terms as differentiations are not always apparent which can be exemplified via the connection between flexible housing and adaptable housing.

On one hand, in flexible housing, adaptable housing and incremental housing, since the chance of customization of individual dwellings is provided for users, these are categorized as directly relatable terms.

On the other hand, because provision of the chance mentioned in the previous paragraph is not the main case (yet it can be embraced as well) in social housing, affordable housing, public housing, collective housing, and mass housing, these terms are classified as indirectly relatable terms with flexible housing.

Table 2.1. The prime objective of directly relatable terms.

FLEXIBLE HOUSING	ADAPTABLE HOUSING	INCREMENTAL HOUSING
↓	↓	↓
Prime objective: Provision of a dwelling that can fulfill future needs and wills of users.		

Table 2.2. The prime objective of indirectly relatable terms with flexible housing.

SOCIAL HOUSING	AFFORDABLE HOUSING	COLLECTIVE HOUSING	PUBLIC HOUSING	MASS HOUSING
↓	↓	↓	↓	↓
Prime objective: Provision of a dwelling with low housing costs so as to meet the housing need of low-income citizens.				

2.2. A Guide for Analysis of Flexible Housing

Schneider and Till (2007, pp. 181-199) list subtitles that can be used to analyze a flexible housing project under the main heading, “A Manual for Flexible Housing”. In this part of the thesis, the framework of Schneider and Till, which is explained in their book, “Flexible Housing” (2007), is described since their framework is adopted for inspection of projects in CHAPTER 4. Components of the framework are “use”, “plan”, “construction” and “services”.

2.2.1. Use

The first subcategory is use. This subcategory is the ability of the building complex to provide dissimilar uses at different levels which are listed as follows: Building level, unit level, room level.

2.2.1.1.Use at Building Level

At building level, the building should be transformed into another building program and designers should implement tools for the transformation that could be easily transformed by users without needing specialists' help (e.g. building master). Although it is possible to convert any building program into another one with massive modifications, by implementation of special tools, it could be possible without carrying out that kind of massive interferences. It is told that a building should "allow change of use from residential" (Schneider & Till, 2005c, p. 2).

2.2.1.2.Use at Unit Level

At unit level, a dwelling should accommodate a variety of living patterns. To make an illustration, in one of the case studies, Villa Verde, each dwelling had its own void for its personal spatial expansion. Those voids were free zones without definite functions, and since they were customized individually by different resident profiles in each house, typological variety occurred and houses differred from each other.

2.2.1.3.Use at Room Level

At room level, it is examined if the room can be used for multifunctional purposes and if furniture can be used for multifunctional purposes or not. It is remarked (referring to the room) that "interior layout of a unit either has to be adjustable to allow for different patterns of use" (Schneider & Till, 2005c, p. 2). For example, as a kid grows older, the room should be adaptable to changing and renewed needs.

2.2.2. Plan

Similarly, just as it is in the previous subtitle, Use, Plan is also analyzed under three subcategories: Building Level, Unit Level and Room Level.

2.2.2.1.Plan at Building Level

At building level:

- The building should be designed in a way so that vertical additions and horizontal additions can be made in the future easily and cheaply.
- The building should host diverse housing units in the future.
- Circulation should be considered so as to achieve flexibility in plan level.
- Outdoor spaces which are not typical indoor residential spaces (e.g. kitchen, living room, dining room, etc.) should be undesignated so that users can customize them as they willed which are called slack spaces.

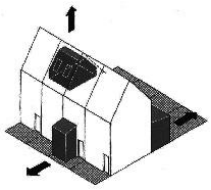


Figure 2.1. Horizontal additions in form of small rectangular prisms (Schneider & Till, 2007, p. 183)

In Figure 2.1., horizontal additions can be examined. With regard to horizontal additions, access (circulation), light (natural daylight coming from windows), structure/construction (positions and dimensions of structural elements) and services (positions and dimensions) should be considered in the beginning as their original conditions before making horizontal additions should be preserved.

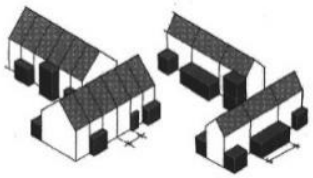


Figure 2.2. Vertical additions (Schneider & Till, 2007, p. 184)

About vertical additions, in gable, hip, pyramid hip, etc. roofs, use of fixed and stable structural systems such as roof trusses should be avoided, and it is possible to make vertical additions in both angular and flat roofs.

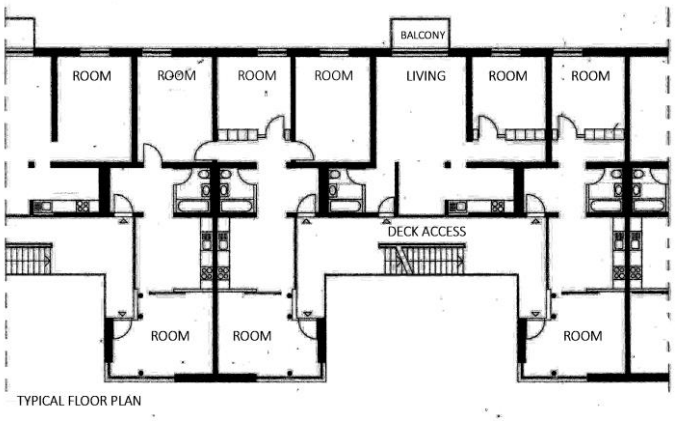


Figure 2.3. Überbauung Hellmutstrasse by ADP Architektur und Planung (A.D.P. Walter Ramseier, 1991)

About circulation, communal circulation is composed of spaces where societies convene to take common actions, and they can be both exterior and interior. In Figure 2.3., "deck access" is an element of common circulation where occupants in the building complex can perform communal activities. This space can be given as a model showing the idea of communal living in an urban neighborhood.

The final element of plan at building level is undesignated spaces which are left to will of users. They are slack spaces. These spaces are outdoor zones without definite functions whose functions is decided by users later.

Figure 2.4. Donnybrook Quarter Housing by Peter Barber Architects (von Sternberg, 2006)

In Figure 2.4., terraces labeled with black dashed rectangles indicate slack spaces. These areas are unprogrammed and operate as an invitation to residents to appropriate them.

2.2.2.2.Plan at Unit Level

In plan at unit level, “individual units should be equipped” so as to “allow for expansion or reduction of unit size” (Schneider & Till, 2005c, p. 2). The first component is functionally neutral rooms. Functionally neutral rooms are the rooms with undetermined functions in a dwelling and except wet spaces, furnishing is not implemented because all of these are left to user decisions. There is no predefined bedroom, dining room, etc. and their furnishings are not pre-programmed in presence of functionally neutral rooms (see Figure 2.5.).

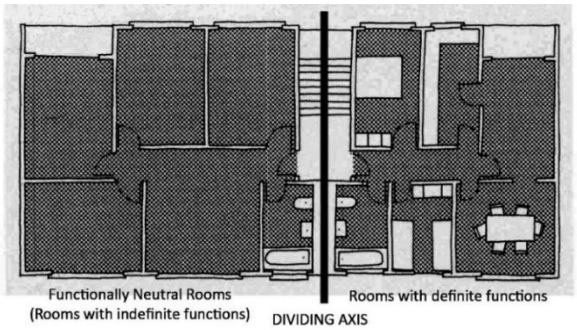


Figure 2.5. Functionally neutral rooms and rooms with definite functions (Schneider & Till, 2007, p. 186)

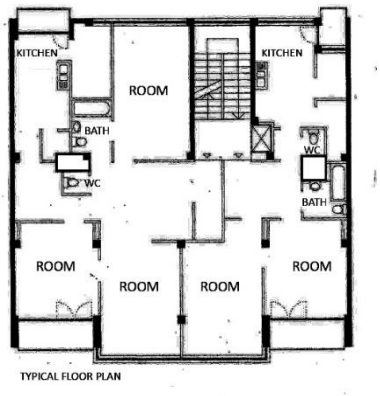


Figure 2.6. Letohradska Apartment by Evzen Rosenberg (Rosenberg, 1935-1937, p. 72)

In Figure 2.6., a built project with rooms that are indeterminate in functions can be observed.

The second component in plan at unit level is circulation. If corridors, halls or other circulatory volumes are designed bigger than their minimum, they can be used for more than a circulation element. For example, when width of a corridor becomes greater than its minimum (maybe greater than 90 cm – varies according to specification), it becomes available for a variety of uses like a play space for children, a big wardrobe room, a space for a desk and so on.

The third and fourth elements in plan at unit level are joining and dividing up in which separate and consecutive apartments in the same flat are predicted to be joined and separated horizontally.

The fifth component in plan at unit level is shared room. The concept depends on a common room standing between two adjacent housing units which is capable of being used by both of them at different times but not at the same time. For a definite period, the room can be used by apartment 1 and in another period, it can be used by apartment 2 thanks to crosswalls and multiple separate entrances.

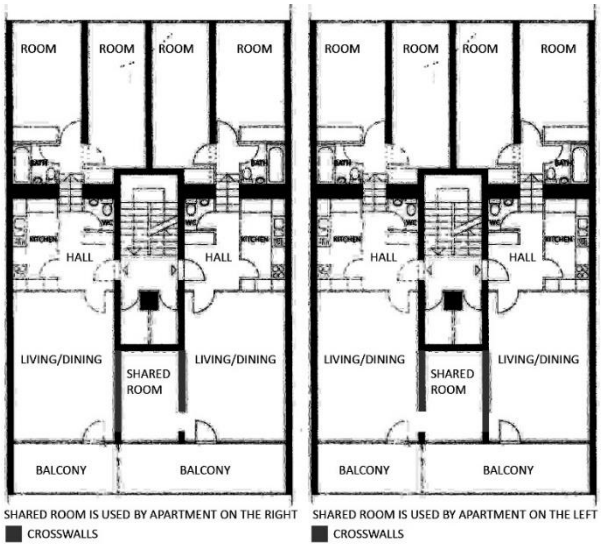


Figure 2.7. Asemwald by 0. Jáger, U. Müller, H. Papst, H. Wirth (Jager & Müller, 1964, p. 504).

In Figure 2.7., the shared room can be used by two apartments at different times yet not at the same time thanks to crosswalls that are juxtaposed.

The sixth element in plan at unit level is service core which is described as (Schneider & Till, 2007, p. 189):

> The position of the service core is critical in determining flexibility of a unit, since it often defines the most permanent elements in plan, the kitchen and bathroom.

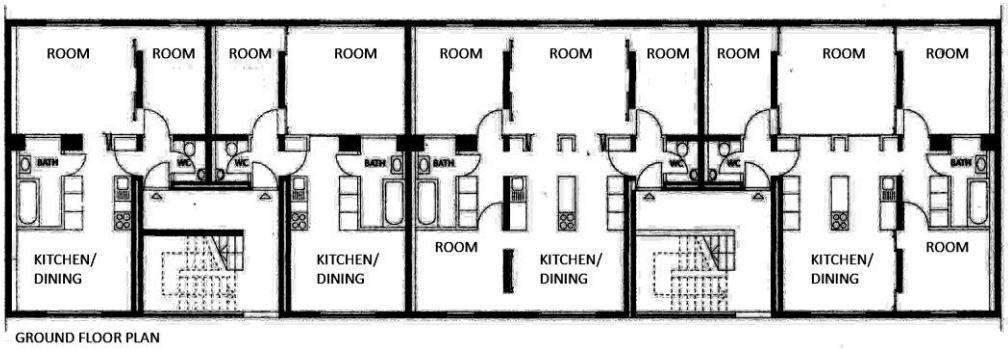


Figure 2.8. Housing Graz-StraBgang by Riegler Rieue Architekten (Riewe, 1994)

In Figure 2.8., WCs and baths are juxtaposed inside every apartment, and kitchens are placed between baths and WCs that ends up with the situation that all rooms are free from services.

The last component in plan at unit level is raw space which is described as follows (Schneider & Till, 2007, p. 189):

> This is the principle of the loft or the speculative office, where the tenants take on an empty space with basic services and then fit it out themselves. The bigger spaces are easier to sub-divide and to re-arrange than small residences.

The quotation above shows that raw space is actually an empty space. At a glance, raw space bears resemblance to slack space in terms of holding indefinite functions. However, slack space is involved in the building level and it is an additional outdoor space without a typical residential function like kitchen, whereas the raw space is designed for conversion into one or multiple residential spaces in future. In conclusion, similar to slack space, raw space can be explained as the space in which

the function is not predetermined and it is expected to be decided by the future user so that the space can host numerous uses and functions.

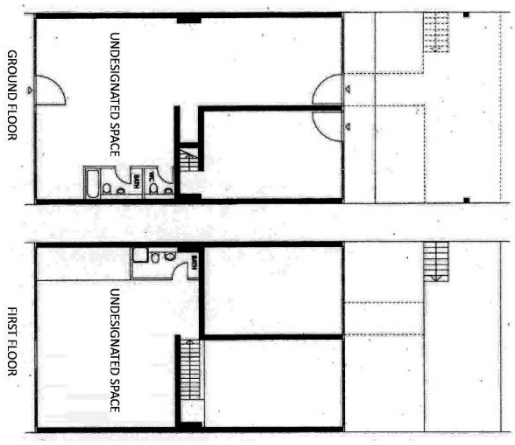


Figure 2.9. Kõlner Brett by Brandlhuber & Kniess (Brandlhuber, 1997)

In Figure 2.9., undesignated spaces denote raw spaces which are the spaces with undetermined functions so as to hold space-programs which vary from a dental prosthetic's laboratory to an engineer's office, and from a photographer's studio to units just used for residential purposes.

2.2.2.3.Plan at Room Level

In plan at room level, the examination is made under two categories: Flexibility within each room individually and flexibility between multiple rooms.

The first component of plan at room level is connections between rooms. Its properties are listed below as follows:

- Rooms can be joined and divided via sliding or folding walls or panels.
- If standard doors which are not folding or sliding are placed and if a room contains multiple standard doors, position of doors should be considered carefully so as to avoid spatial constraints in which the space (the room) should still be useful.

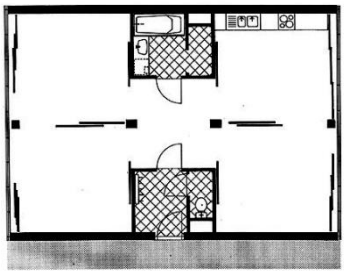


Figure 2.10. Grieshofgasse, Vienna ("Wohnbau Grieshofgasse", 1996)

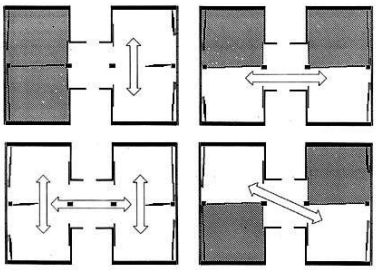


Figure 2.11. Different spatial layouts in Grieshofgasse, Vienna ("Wohnbau Grieshofgasse", 1996)

As observable in Figure 2.10., except wet spaces, all other spaces are undesignated with regard to their functions and future residents are expected to determine activities which shows that rooms can be joined and divided via sliding elements. In Figure 2.11., it can be recognized that more than one possible scenario can be obtained if sliding elements are located differently.

The second element of plan at room level is foldable furniture. In kitchens, horizontally or vertically moveable tables, and in other spaces, sofas that can be converted into beds or used as wardrobes can be given as other examples. These solutions are used where space is limited and built in furniture allows the user to change the use of the room on a daily basis.

The third component of plan at room level is movable and sliding walls. These elements can be used to form a vast united space or divided subspaces, and various day and night uses can be composed.

The final element of plan at room level is divisible room. It is the room which is capable of being set apart into two smaller rooms.

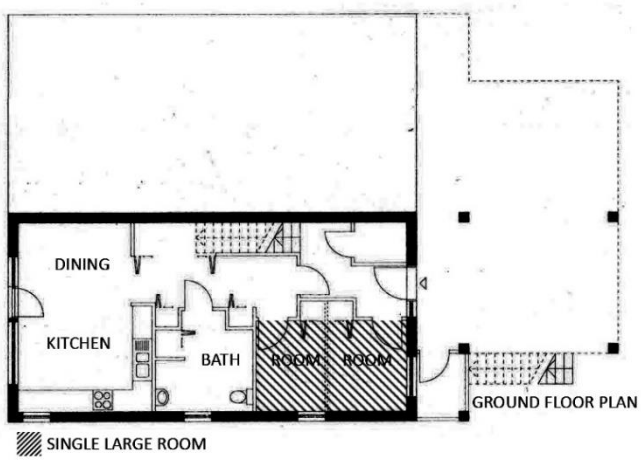


Figure 2.12. London Flexhouse of Nouvelle Development Corporation (CMHC, 1999, p. 52)

In Figure 2.12., the divisible room is the hatched area which is comprised of combination of two rooms that can be united and split up by utilization of lightweight sliding or folding walls.

2.2.3. Construction

On the issue of construction, Schneider and Till say that:

> …outdated and inherently inflexible construction techniques are the norm. Internal partitions are often load-bearing and roof spaces generally filled with trussed rafters which means that they can never be converted in the future (2005b, p. 164).

The statement above shows that so as to attain flexibility, internal partitions should be free from load-bearing elements as much as possible. So as to give the opportunity of making vertical additions especially, static constructional elements such as trusses at roof level should be avoided. In order to avoid constrained flexibility, "consideration of the construction" is essential that the number of "load-bearing or solid internal partitions" should be plunged and "the avoidance of forms of roof construction" should also be realized since they "close down the possibility of future expansion" (Schneider and Till, 2005a, p. 287).

The significance of construction is described below by Schneider and Till (2007, p. 192) as follows:

> To achieve real flexibility both plan and construction have to be considered together. As with the design of the plan, the starting point for the construction of flexible housing is to design out inflexibility. Much of the standard construction in the UK house building industry is inherently inflexible: cavity walls, load-bearing internal partitions, roofs full of trussed rafters, buried services: all these and more hinder future changes.

2.2.4. Services

In terms of services, "services are fitted in a time-honored and now outmoded manner, buried into walls or floors and so extremely difficult to add or to upgrade" (Schneider and Till, 2005b, p. 164). This shows that via this tactic, calling a specialist might even be unnecessary. In order to prevent obsolescence, involvement of non-accessible or non-adaptable services should be avoided.

The key principle is defined as follows (Schneider & Till, 2007, p. 198):

> The key principle in any servicing strategy for flexible housing is how the services are distributed.

The major question is (Schneider & Till, 2007, p. 197):

> Can the services be upgraded in the future?

Quotes above show that services are predicted to be updated easily and placed in locations with easily accessible points.

Under the title, "vertical distribution" of services, it is stated that (Schneider & Till, 2007, 198):

> Services should be collected in vertical stacks or risers, and the main serviced rooms should be grouped around these stacks. As important is that these stacks should be accessible for future upgrading.

The quotation above indicates that in a dwelling, all services such as wet spaces (bathroom, WC, kitchen) should be juxtaposed by the designer so that one common duct can be sufficient to. The rest of the space can be free from limitations that are likely to occur due to services with static elements (see Figure 2.13.)

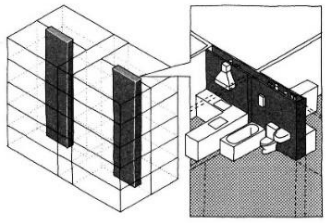


Figure 2.13. Vertical service distribution (Schneider & Till, 2007, p. 198)

In Figure 2.13., a diagram showing the juxtaposed position of wet spaces can be examined. Since all wet spaces stand side by side, the common wall between them can be used to place common ducts, etc. and remaining spaces are free from them (plumbing tools, etc.) ending up with greater flexibility.

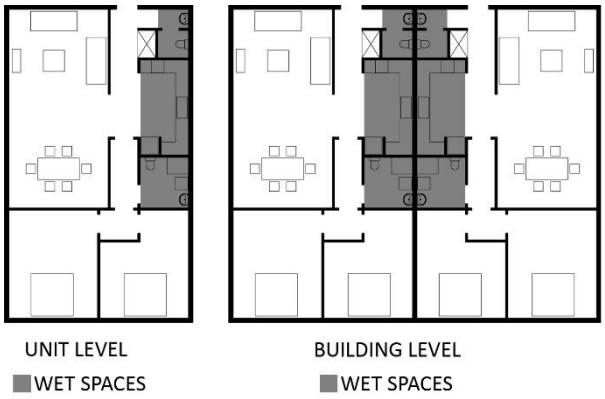


Figure 2.14. Wet space distribution in an apartment and multiple apartments (by the author)

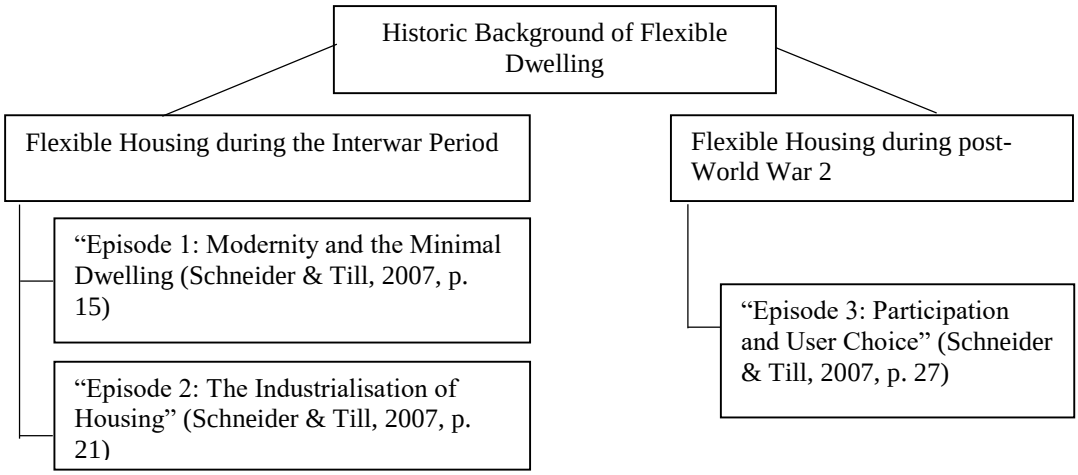
In Figure 2.14., the optimum arrangement of wet spaces (services) can be realized. At unit level (see Figure 2.14.), because all wet spaces are juxtaposed, all the remaining space is free and ducts, plumbing collectors, etc. can be placed within walls standing between wet spaces. At building level, if apartments are positioned just as they are in Figure 2.14., service ducts and so on can be located within walls between wet spaces, and all other spaces stay free.

CHAPTER 3

HISTORIC BACKGROUND OF FLEXIBLE DWELLING

This chapter concentrates on historic background of flexible dwelling. The chronology is analyzed under two main groups: Interwar Period and post-WW2 respectively.

Table 3.1. Historic Background of Flexible Dwelling (by the author)



3.1.Flexible Housing during the Interwar Period

In terms of the Interwar Period, Schneider and Till (2007, pp. 15-21) analyze flexible housing history under two episodes:

1. "Modernity and The Minimal Dwelling" (1920s)
2. "The Industrialisation of Housing" (1930s)

3.1.1. Episode 1: Modernity and The Minimal Dwelling

Episode 1 took place in the 1920s (Schneider & Till, 2007). In those years, there was a rapid migration to cities from rural regions in European nations, and governments triggered social housing programs and relied on mass housing provision (Schneider & Till, 2007). The title, "Episode 1: Modernity and The Minimal Dwelling", named by Schneider and Till (2007) refers to the desire of the authorities to reduce space standards as well as costs. Since there were two plunges (drops took place both in prices and dimensions), the situation can be interpreted as two minimizations, which can be related with the adjective, "minimal". The main cause why governments inclined to decrease those two is the purpose of providing each citizen with a dwelling in cities (Schneider & Till, 2007).

After World War I, flexible housing strategies revolved around designation of multifunctions to one single space, and moveable mechanisms (e.g. sliding or folding walls and slabs) were used for that cause (Forty, 2000). In the Second CIAM Congress with the title,"The Dwelling for Minimal Existence" (1929), designers convened to debate on the issue of housing crisis in Europe, and flexible housing was introduced as one appropriate solution (Schneider & Till, 2007). In the encounter, designers addressed significance of flexible housing which was declared in one sentence: "If there was to be less space, then that space needed to be used in as efficient and flexible a manner as possible" (Schneider & Till, 2007, p. 16). After introduction of flexible housing in the meeting, different European countries developed various strategies as in Germany, "standardization of the size, division and furniture of dwellings" occurred (Fassbinder & Eldonk, 1989, p. 66), implying that renewed (minimized) numerical values were defined. In Netherlands, the attention was paid to "processes of use" which was composed of possible alterations in lifetime of members in a family (Fassbinder & Eldonk, 1989, p. 66).

Mang (1979) points out that during those days, there was emphasis on built-in furniture as follows: The adaptable use of furnishing elements spread after World

War I, the time when cheap housing programs were launched by Germany and Austria. There was adequately enhanced technology to activate mass production, making it possible to manufacture furnishing elements with the least modules and with the most combinations to meet changing needs of users. For instance, “aufbaumöbel”, the constructed furniture (e.g. foldable beds), was implemented in residences.

With regard to the modernists, Le Corbusier perceived renewed minimized standards in housing (utilization of flexibility in housing) to be “an appeal to scientific certainty to overcome customs of tradition” (Boudon, 1985, p. 33).

One proposal introduced in those years was Maisons Loucheur. It is observable that there were various night and day uses which were proposed thanks to folding furniture and interior dividers made of lightweight materials. The use scenarios as well as decisions on those built-in tools were made by the architect, and no user participation took place (Schneider & Till, 2007).

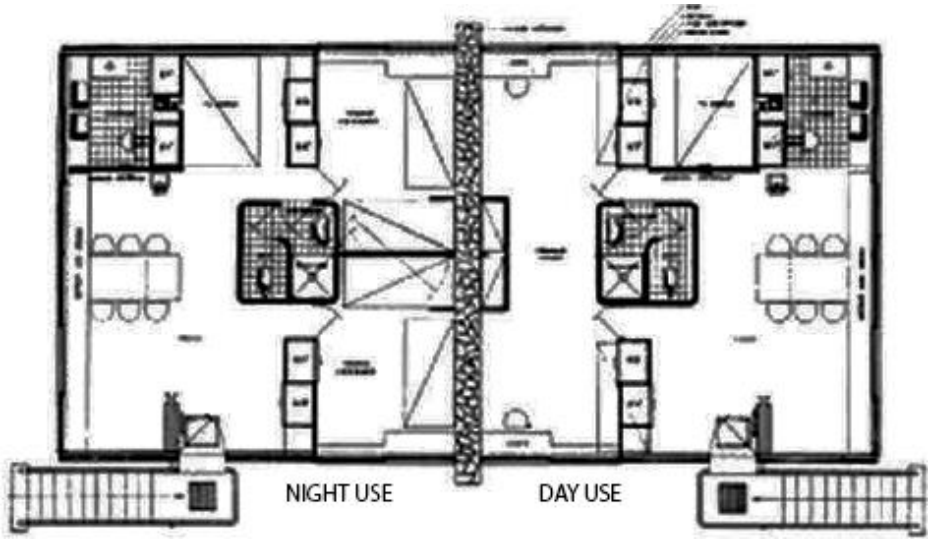


Figure 3.1. Maisons Loucheur, Le Corbusier, 1928-1929 (Živković, Keković & Kondić, 2014)

In Figure 3.1., it is visible that the living space was able to turn into a bedroom and the folding furniture (beds) was held back inside of walls during daytime. One can

express the importance of the project as the way it involved convertible spaces which literally seemed to be dealing with renewed and minimized space standards.

Referring to mechanisms involved in Maisons Loucheur, Bruno Taut suggested locating mechanisms of Maisons Loucheur (folding beds, sliding wall panels, etc.) in mass housing units (Schneider & Till, 2007). Drawing inspiration from Maisons Loucheur, Eric Mendelsohn designed a project with an extraordinary mechanism, "Drehbühne", meaning "changing stage" (Schneider & Till, 2007, p. 19). One can define the mechanism as a rotating platform resembling an immense display turntable comprised of 3 equally divided zones. However, the principle was not an appropriate and cheap one for implementation in mass housing.

Another project is Schröder House of Gerrit Rietveld. In the project, the first floor was composed of sliding wall panels that were active at night so as to separate spaces (bedrooms), and at day, they were passive in order to obtain one vast space.

To summarize, in "Episode 1: Modernity and The Minimal Dwelling", a common description for flexible housing was made and the notion of flexibility was introduced so as to take care of troubles caused by housing crisis in European nations after end of World War I. In the 1920s, in order to provide each citizen with a dwelling in cities, minimizations both in housing costs and space standards were implemented, and architects looked for solutions within the concept of "minimal dwelling". Last but not least, design process of housing was managed by architects only and users were totally and completely excluded from it (no user participation took place).

As mentioned by Johnson (1978, p. 42), in 1927, under lead of Mies, an exhibition composed of a group of houses called the Weissenhofsiedlung was made in Stuttgart, Germany. For the exhibition, Mies invited multiple architects to design dwelling plans in which some guests were Franz Schuster, Adolf Meyer, Brüder Rasch, Bruno

Taut, Peter Behrens, Le Corbusier, Oud, Gropius. Johnson (1978, p. 43) addresses attitude of Mies about flexibility as follows:

> ...By the use of movable partitions he created twelve apartments, all differently arranged, for each of the two basic units. Despite the complex interior, the exterior design is so quiet that one is apt, at first glance, to miss the subtle proportions of the window bands and the stairwell.

Mies did not decide interior dividing of every apartment himself as there were also cases in which Mies prepared only open plans and other architects determined interior divisions (Johnson, 1978). This shows that rate of participation of architects was not identical in each apartment.

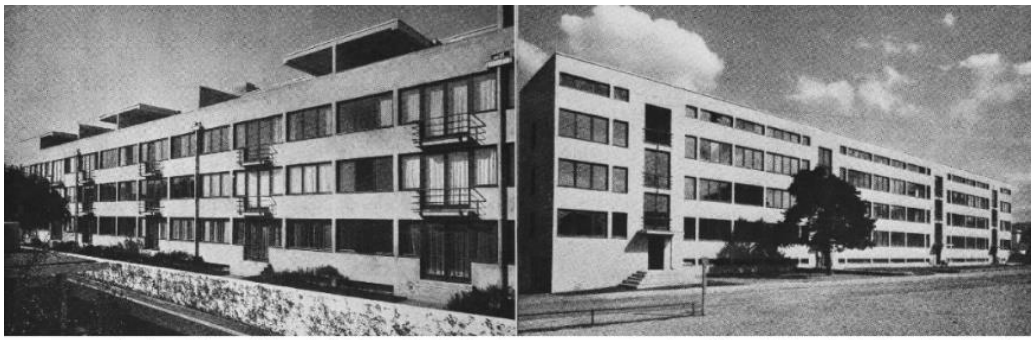


Figure 3.2. Weissenhofsiedlung, Mies van der Rohe, 1927 (Johnson, 1978, pp. 46-47).

In Figure 3.3., "Construction system" denotes the open plan prepared by Mies and other plans represent interior dividings made by both Mies and other architects.

In the project, although user participation was not included, participation of architects at different rates took place, and architects' participation during design of open plans and interior dividings diversified at different apartments.

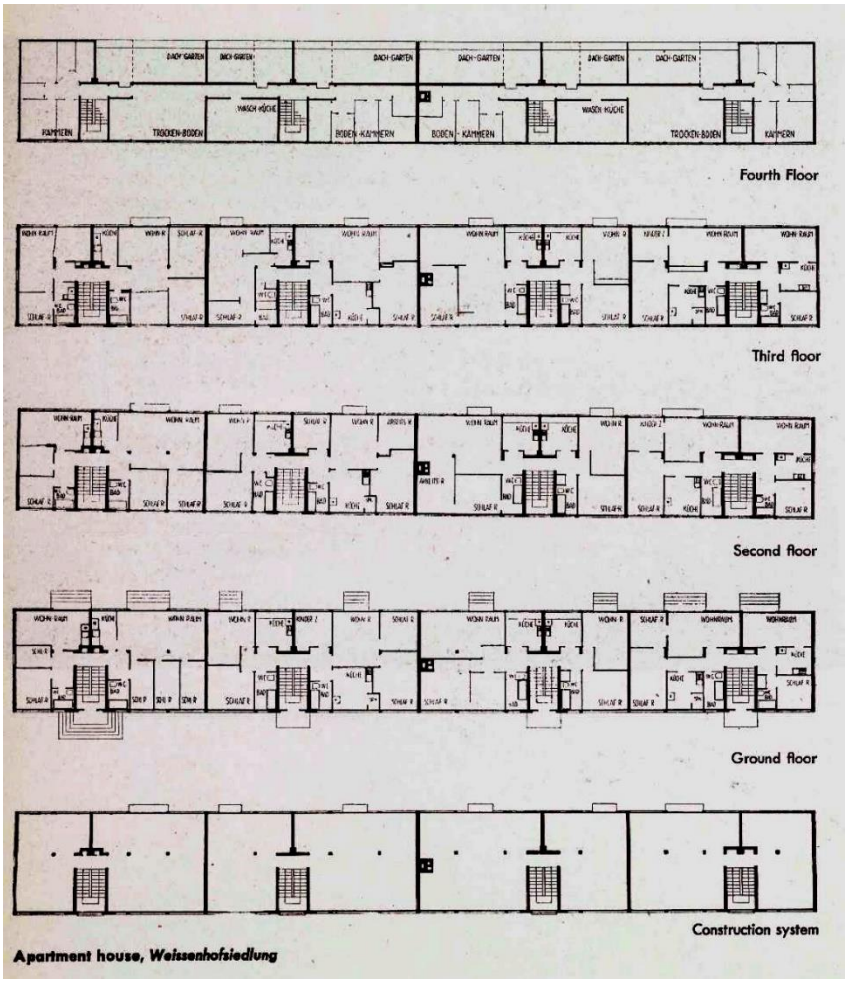


Figure 3.3. Floor plans of Weissenhofsiedlung from Mies' block (Johnson, 1978, pp. 44-45).

3.1.2. Episode 2: The Industrialisation of Housing

Episode 2 occurred in the 1930s, became remarkably popular in the 1940s and its effects continue today (Schneider & Till, 2007). If key drivers of Episode 1 were "social and economic forces", then those of Episode 2 were "technical influences, and in particular the adoption of industrialised solutions to housing provision" (Schneider & Till, 2007, p. 21). In Episode 1, there was a dramatic flow from rural zones to urban mediums in European nations, and governments attempted to reduce costs and space sizes. In 1914, Le Corbusier prepared several housing proposals by "factory production" in housing since he was the architect who developed "projects that could potentially be produced on an assembly line" such as Maison Domino

(1914), Maison Citrohan (1922) and Maisons Loucheur (1928) (Schneider & Till, 2007, p. 21). This shows that Le Corbusier set up the foundation of Episode 2, because in his proposals, he appreciated factory based production (industrial mass production), and inclined to apply its methods to housing manufacture. In the book, "Towards A New Architecture", it is not only offered that mass production could lead to emergence of reduced costs, yet it is also expressed that "the lightly constructed walls and partitions can be rearranged at any time and the plan altered at will" (Le Corbusier, 1946, p. 226). It is visible that the emphasis is on flexibility of those "lightly constructed walls" manufactured in industry.

Another architect, Walter Gropius, regarded the standardization of individual building components which referred to prefabricated components as a chance to provide the best possible diversity in the floor plan (Ludwig, 1998). For Gropius, a house was a whole made of combination of components, and it was not a totally completed production (Herbert, 1984).

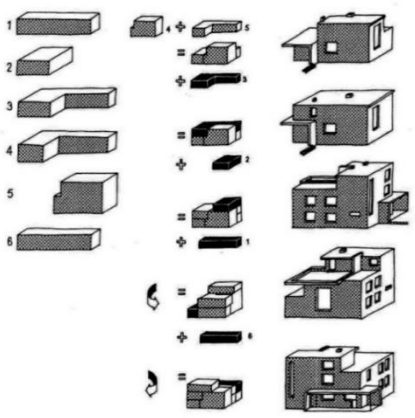


Figure 3.4. Haus Auerbach, Gropius and Meyer, 1924 (Schneider & Till, 2007, p. 22).

Figure 3.4., shows a proposal by Gropius and Meyer in which more than one definite combination is formed. This illustrates the idea of Gropius that a house was a union of prefabricated components and not a finished task (Herbert, 1984). For Gropius, progresses in industry enabled flexibility (Herbert, 1984, p. 236). In Haus Auerbach, Jurko Building System (a method using prefabricated slag concrete slabs which are

assembled on site with a crane) and Jurko Stone (large, mortar-bonded slag concrete blocks) were utilized which signify use of unconventional building method and materials ("Description – Haus Auerbach", 2013).

Between 1951-1952, Mies worked on “Core House” project. Colombo (2011) lists specialties as follows: Mies submitted a series of square floor plans that one would be selected by occupants and interior layout of each proposal would be transformed “not with walls, but with furniture, curtains, or lightweight low partition”. Simultaneously, only service spaces (two baths) were separated with static dividers. The three alternatives were as follows: 40x40 feet, 50x50 feet or 60x60 feet, and they were unable to turn into each other as boundaries of each alternative was static (cannot be expanded or contracted). It would be possible to make various interior layout compositions due to inexistence of permanent walls and presence of mobile elements. This indicates that in the proposal, flexibility was predicted to be achieved via making diverse interior layouts inside of a building with stable boundaries (see Figure 3.5.). The project has remained as a paper work.

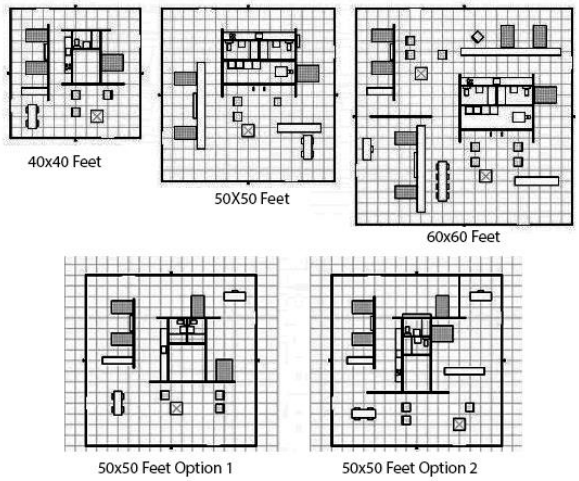


Figure 3.5. Core House, Mies, 1951-1952 (Colombo, 2011)

In conclusion, in Episode 2, flexible housing referred to rise of infinite housing choices thanks to endless combinations of prefabricated components which is most apparent in Haus Auerbach. Motto of Episode 2 can be given as customization through fabrication. Unlike Episode 1, in Episode 2, although design process of most

of the projects were still managed by architects (user participation was excluded), there was weak user participation in several projects as well.

3.2.Episode 3: Participation and User Choice

This title covers after end of WW2, and it is related to two main themes which are user participation and technological advancements that flexible housing has been practiced with since the 1960s especially. However, since origins of these two themes belong to the afore mentioned titles (Episode 1 and Episode 2), a glance at the projects from the past is also provided below.

Episode 3 rose in the 1960s, became dramatically popular in the 1970s, and its effects still go on today (Schneider & Till, 2007). The 1950s refer to the decade when humanity recovered after end of WW2 and it ended up with rise of social movements beginning in the 1960s (Şumnu, 2019). After WW2, social movements aimed at promoting individualism (Şumnu, 2019). In the 1960s, people opposed to the approaches which omitted user participation (Negroponte, 1970). The attention was paid to individualism in the rebellion. In the new approach, being flexible (being indeterminate and free from orders or pressure of architect), being personally chosen and being expression of personal wills were adopted as major focuses in architecture (Negroponte, 1970). Users were expected to participate in design process and architects were not regarded as the ultimate authorities who made every decision in housing without user participation before (Schneider & Till, 2007).

Although user participation became a central focus in the 1960s, projects in which user participation was included or somehow took place (without architect's intention) occurred before. None of the projects of Le Corbusier analyzed below (Domino House, Pessac Residences, Plan Obus) were introduced in the 1960s. However, their traces can be found in future-introduced projects that included user participation.

To begin with, in 1914, Le Corbusier introduced “Domino House”. The project was designed as a multistory building comprised of a concrete carcass. The concrete carcass contained concrete columns, slabs, foundations and stairs (Bilgin, 1999). Domino House “enables the architects to separate the interior from structure” as Le Corbusier used the term, “open plan”, to emphasize spatial flexibility which occurred as a result of this separation (Estaji, 2017, p. 39). Tafuri and Dal Co (1986) define open plan as occurrence of free plan by removal of partitions, doors and walls.

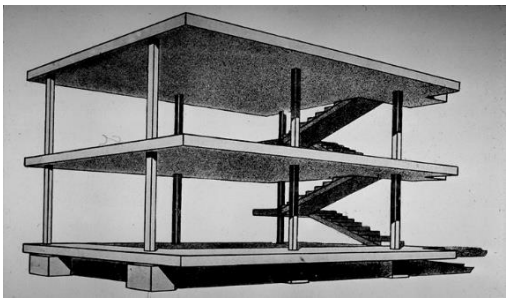


Figure 3.6. Domino House, Le Corbusier, 1914-1915 (Boesiger & Stonorov, 1965)

In Figure 3.6., the open plan is legible as no interior filling or divider was located inside by the architect. Figure 3.15. indicates whole of the Domino House designed by Le Corbusier which signifies that the architect himself did not intervene in any of the interiors. For example, there is no furnishing, no residential space with definite functions and no possible interior use scenario (e.g. there is no master bedroom with dimensions of 4m x 5m). Although mention of user participation was not explicitly made by Le Corbusier, traces of it are visible since Domino House can be interpreted as a basic framework with interior voids which were likely to be filled by occupants themselves according to their own unique wills. Since Domino House has remained as a paper work, it is impossible to make exact assessments about user participation.

In 1924, Le Corbusier presented Pessac Residences. After 47 years of construction, an architecture student, Philippe Boudon, evaluated transformation of Pessac Residences as follows (1972): The houses were erected with prefabricated concrete panels appropriate to Le Corbusier’s approach, which was comprised of non-

ornamented facades, pure geometry (cubic forms), pure white color, and flat roof in the beginning. However, roughly 40 years later, houses were modified by users, and they resembled North African cottages. Occupants did not interfere in the original functional space, yet they made alterations as well such as changing color, conversion of the flat roof into a pitched roof, turning terraces into indoor spaces, narrowing ribbon windows down, etc. Even though Le Corbusier did not cover user participation in his proposal, because habitants customized their dwellings according to their wishes, it is deduced that flexibility (and user participation) was achieved in the project unexpectedly (see Figure 3.8.)

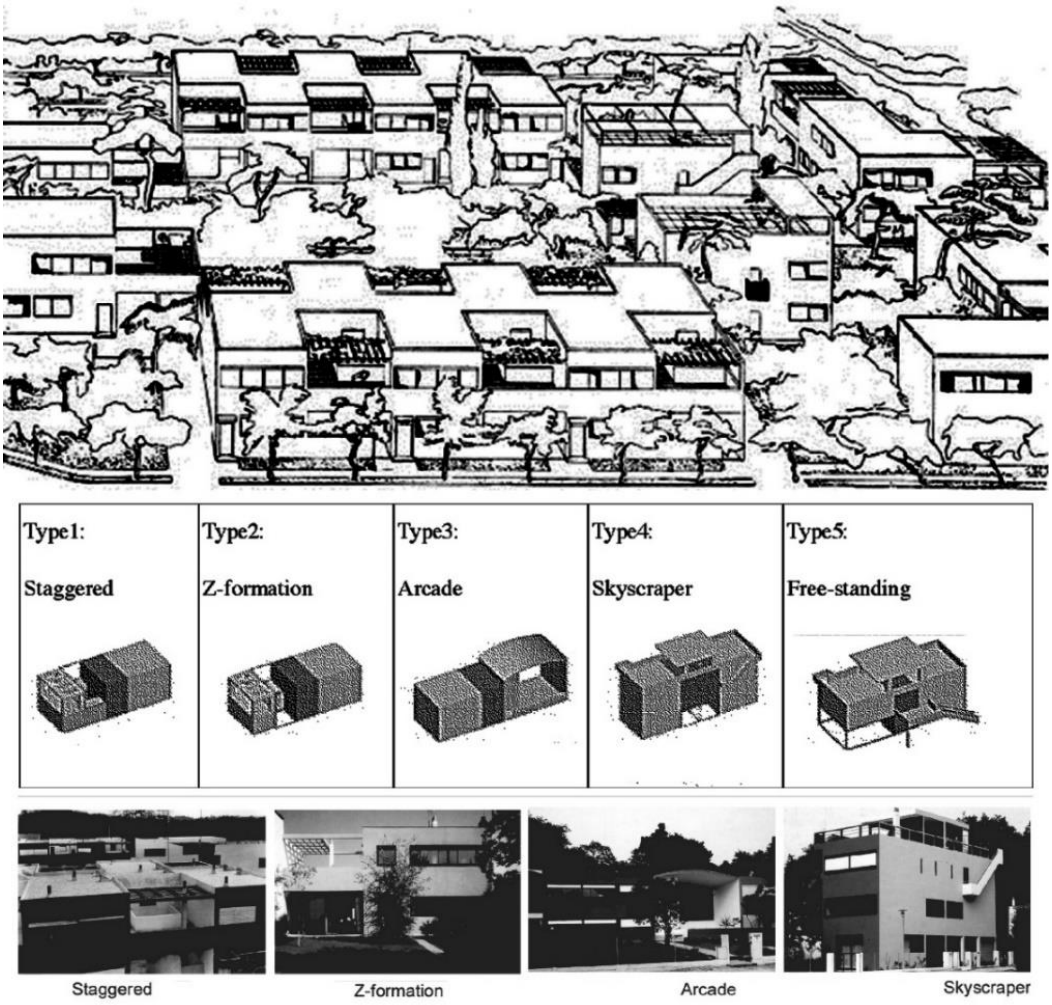


Figure 3.7. Pessac Residences, Le Corbusier, 1924 (Fondation Le Corbusier, 2014)

In Pessac Residences, Le Corbusier prepared 5 different housing options, and the whole settlement had been the product of repetitive construction of those at first (Hsu and Shih, 2006) (see Figure 3.7.). However, as each occupant customized his/her dwelling uniquely later, especially in terms of making facade-based modifications especially (simple spatial modifications such as conversion of outdoor terrraces into indoor spaces only took place), visual observation of more than those five options became possible, and greater typological variety (at facade level) occurred. (see Figure 3.8.).

Figure 3.8. Two customized Pessac Residences (Fondation Le Corbusier, 2014)

In Figure 3.8., states of two differently customized residences who had been identical before user intervention can be observed.

Between 1932-1942, Le Corbusier worked on “Plan Obus”, an urban-scale proposal made for the city of Algiers. Plan Obus includes traces from Domino House and Pessac Residences in its residential viaduct part as Le Corbusier imagined multiple interior layout alternatives for those dwellings. Those residential units were “raw spaces” that Le Corbusier believed to be filled “little by little” with homes for the working class (Ackley, 2006). This signifies that Le Corbusier did not intervene in interiors of those dwellings, and since they were expected to be filled “little by little”, it is apparent that the process of filling would mean being customized by its own user

uniquely. Colquhoun (2006, pp. 209-212) addresses specialties of residential units located at the viaduct as follows:

> Roads and housing were treated as a single, integrated system. One of the most interesting aspects of the project is the separation of infrastructure and infill, allowing the inhabitants to build their own houses within the structure as if on suburban lots.
> Algiers is an endless infrastructure with random infill.

The identifiable segregation of the "infrastructure" from "homes" denotes facilitation of user intervention in residences which can be interpreted as emergence of flexible housing in an unprecedented way. The project has remained as a paper work.

Figure 3.9. Plan Obus, Le Corbusier, 1932-1942 (Fondation Le Corbusier, 2007)

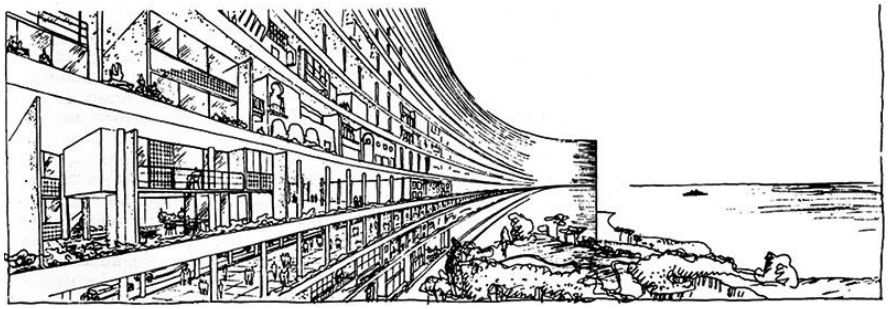


Figure 3.10. Perspective of housing units in Plan Obus (Fondation Le Corbusier, 2007)

3.2.1. Rise of User Participation

In the 1960s, architects explicitly welcomed user intervention in their projects, ending up with inclusion of indefinite components in the projects whose design decisions were expected to be made by users.

In 1961, John Habraken, published his book, “Supports: An Alternative to Mass Housing”, which was a seminal text offering user participation (Schneider & Till, 2007). Habraken (1972) describes that a house is composed of two components, “supports”, which are static elements forming the fundamental framework (columns, slabs, foundations, stairs, etc.), and “infills” (detachable units), which are mobile, moveable and should be left to the will of users. From his point of view,“supports” should be apparently identifiable from “infills”, and “support” are components forming the main framework for dwelling, and this is the point in which “supports” and “infills” resemble identifiable segregation of infrastructure from homes in Plan Obus.

In 1965, under Habraken’s lead, SAR (Stitching Architecten Research - Foundation for Architect's Research in English translation) was founded (Atasoy, 1973). Fassbinder and Proveniers (1992) describe the primary objective of SAR as involving enhanced industrial methods more in constructional stages of buildings to provide users with more freedom in plan schemes. This shows the prime objective of SAR is similar to open plan of Le Corbusier that he introduced in Domino House. According to Habraken, users should be aware and take care of their dwellings and organize their own housing unit via “infills” (Atasoy, 1973). Habraken (1972) states that a housing unit could reflect personal aims only if the dweller is able to become responsible for equipment and planning decisions. This shows that Habraken expected each user to customize his/her dwelling differently via “infills”. “Supports” are formations reflecting decisions made by the whole society, whereas individuals are predicted to determine “infills” on their own (Habraken et al., 1976). Within that hierarchy, architect’s role is not to design the whole dwelling, but to design

"supports", and "infills" consist of everything which are equal to all components operating as detachable units (non-loead-bearing walls, interior dividers, mobile furniture, locations and sizes of openings, etc.), namely except "supports" (Habraken et al., 1976).

SAR system provided flexibility with 2 stages that at the first stage, different genres of spaces could be expanded or contracted (e.g. bedrooms could be widened while living room could be shrunk), and at the second stage, spaces could be converted into others (e.g. living room could be transformed into a large bedroom) (Çelik, 1996).

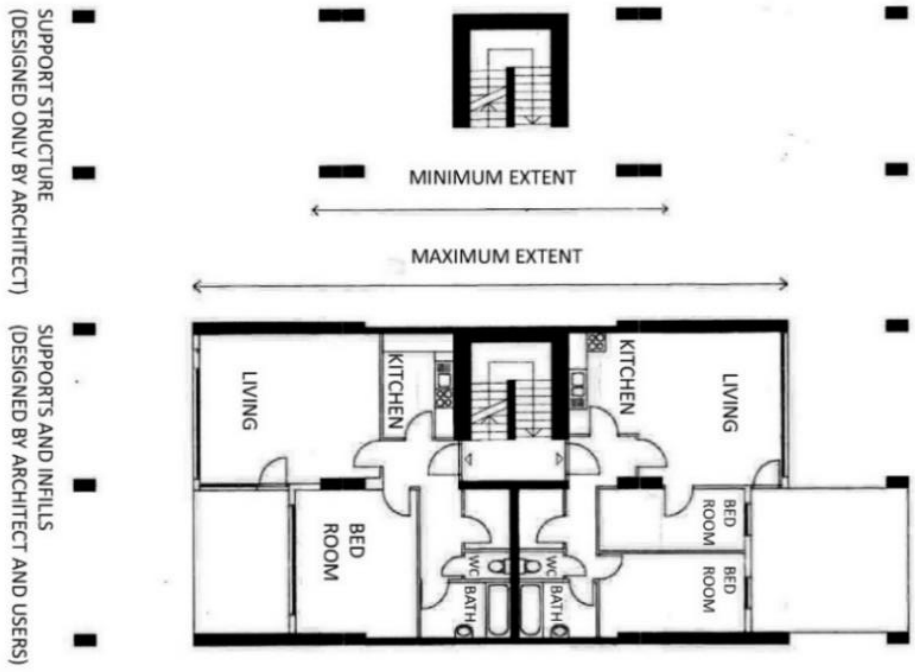


Figure 3.11. Hollabrunn project, Ottokar Uhl and Josef Weber, 1976 (Schneider & Till, 2007, p. 90).

In Figure 3.11., support structure, and support and infills together can be detected respectively. Traces of open plan is visible on the support itself alone (without infills), showing that Le Corbusier and Habraken worked on similar tools on their own. The support structure (the structure designed by architect without participation of user) was made of load-bearing structural system (columns, slabs, beams, etc.)

and cores (stairs, etc.), and all the rest (positions and sizes of walls, locations and measures of spaces, places of windows, doors, etc.) which were infills were designed together with attendance of users.

In conclusion, SAR method was based upon making diverse arrangements and spatial layouts within the same framework whose boundaries were determined, and this framework with definite limits can be called “supports”, whereas all other changeable elements (furniture, separators, non-load-bearing walls and panels, non-service elements, etc.) could be “infills”. However, one can remark that even in “infills”, occupants were not totally authorized as their design process was carried out in form of a cooperation between architects and users. This indicates that neither architects nor dwellers were totally empowered, and architects were still active at “infills”.

In France, Luc and Xavier-Arsene Henry brothers also supported user participation by citing Rabeneck and his friends as follows: “…not to reckon with the originality and unique character of each person is to negate one dimension of Man and, personally, we find that unacceptable” (Rabeneck, Sheppard & Town, 1973, p. 703). In Montereau (1971), Henry brothers designed a multistory residential flat and exhibited their pre-drawn plans, yet when no family liked their proposals, families participated in design process and architects revised the project according to their desires in which it ended up with unique plans in all apartments (Schneider & Till, 2007). After intervention of users, except service cores, all remaining spaces (their sizes, positions, etc.) were designed for wishes of families, and in all apartments, spaces were subdivided with hollow core chipboard so that new internal spatial rearrangements could be made easily (Schneider & Till, 2007). This can be called accomplishment of flexibility.

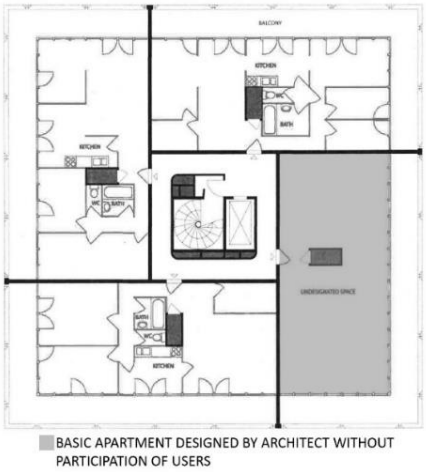


Figure 3.12. Housing Project in Montereau, Luc and Xavier-Arsene Henry, 1971 (Schneider & Till, 2007, p. 83).

In Figure 3.12., the project of Luc and Xavier-Arsene Henry can be observed as well as the basic apartment designed by them without user involvement.

Similar to Habraken's idea of user participation, Gür (1993) remarks that John Turner advised a method that he called "self-help" in which he also recommended interference of the user. At this point, a comparison between Habraken and Turner can be made. On one hand, similar to Habraken, Gür (1993) states that Turner believed occupants to be empowered with regard to their dwellings. On the other hand, contrary to Habraken, Turner (1969) envisages greater user authority as he offers user empowerment in both design and constructional phases. From Turner's point of view (1969), not just a single house, yet even a whole residential zone should be totally designed and constructed by occupants only as he exemplifies the situation via the term, barriada, a residential region comprised of multiple slums in which residences were designed and erected by inhabitants without involvement of architect in any phase (exclusion of the architect).

Turner (1979) states that modern solutions suggested for solution of housing crisis in late industrialized countries (such as South American countries) failed since their context was full of mandatory options that users had to accept and their paying

required more than users could afford. Thus, Turner (1979) points out that slums were frequently adopted and constructed by local people.

Turner believed the house was not a completely finished product, yet it was a process, and in a society, citizens were predicted to perceive house to be a tool to express their own character (Gür, 1993). Depending on this, for Turner, house was not supposed to be treated like a completed project, but what it provided users personally and specially as a process was significant (Gür, 1993). In his book, "Housing by People: Towards Autonomy in Building Environments", Turner (1976) claims that any housing unit (apartment, single house, social housing complex, etc.) that is largely pre-programmed and pre-planned is out of flexibility, and that kind of a project is likely to possess a short life. This shows that users could abandon their dwelling once they come across a chance (e.g. becoming wealthy enough or acquiring a free land to build their own house) because of being dissatisfied with their dwellings.

One of the projects in which Turner's idea was concretized is "Porres", an enclave in San Martin, Lima (Peru). Turner (1969) explains the region as follows: The region owned paved streets, cinemas, dwellings and various other urban services. Dwellers of the zone were also founders and constructers of the complex as occupants worked both in design and construction stages on their own. Residential units owned diverse sizes and the ability of division into smaller units or combination with other units to form a larger unit. For example, small families (e.g. a couple and their 2 kids) could replace residences of clans with high numbers of individuals, and they held authority to intervene in their houses (e.g. changing size of the residence). To sum up, occupants ought to be counted as an input if the case is housing design, and occupants should be active at both design and construction processes.

Similar to Turner, Christopher Alexander asserts that any user ought to be empowered and encouraged to design and build his/her own dwelling (Gür, 1993). According to Alexander, a foreign proposal with a sudden emergence prepared by

foreign architects could not be accepted by locals and thus, impact of the architect could be as weak as possible and local residents could erect their own homes (Gür, 1993). Alexander (1977) remarks that modernist architecture was responsible for eradicating the connection between the urban medium and society. He claims that modernist architecture presented determinate and ultimate solutions for everywhere and the city resulted in a situation in which it was designed by strangers who had never dwelled in it before.

In 1968, under lead of Alexander, he and his fellows attended an architectural competition, an experimental housing project in Previ, Lima, and Alexander inclined to concrete his ideas in the project named "Center for Environmental Structure" ("Previ/Lima. Low Cost Housing Project", 1970, p. 193). The project was submitted as a booklet comprised of a site plan, a residence plan and construction plans (multiple residences could be erected according to one single residence plan in which they all could be identical in the beginning – before habitation and thus, before customization) (Gür, 1993). Referring to the residence, it is explicitly expressed that even though "the choice process guarantees that no two houses will be exactly alike, all houses are based on one generic house" ("Previ/Lima. Low Cost Housing Project", 1970, p. 194) and "… No two houses are alike. The exact form and length of each house is determined by a choice process which allows families to fit their houses to their own needs and budgets" ("Previ/Lima. Low Cost Housing Project", 1970, p. 193). Alexander designed the whole project as a series of templates which were base structures giving the opportunity of re-modification and re-development by users (Gür, 1993). Alexander focused on economic circumstances and local construction materials of Peru as he attempted to submit a proposal that focused on low cost housing ("Previ/Lima. Low Cost Housing Project", 1970). He expected his proposal to give the chance of gain of maximum variety of solutions with a minimum quantity of pre-designed and pre-determined components, and considered the template a series of tools that provided the opportunity to obtain infinite variations

for inhabitants of Lima ("Previ/Lima. Low Cost Housing Project", 1970). These can be interpreted as implementation of typological variety through diverse types of customizations made by inhabitants on multiple samples of one single prototype. Since houses could be customized according to personal wills and budgets of dwellers, it is concluded that flexibility is covered in the project via user participation and incremental housing is also included. Gür (1993) points out that Alexander handed over a series of templates that were predicted to be formed, used and assembled by occupants. Thus, it is deduced that traces of incremental housing could be explored in his proposal as he expected his project to proceed with intervention of users who were predicted to arrange, select, etc. the series of templates as they would desire.

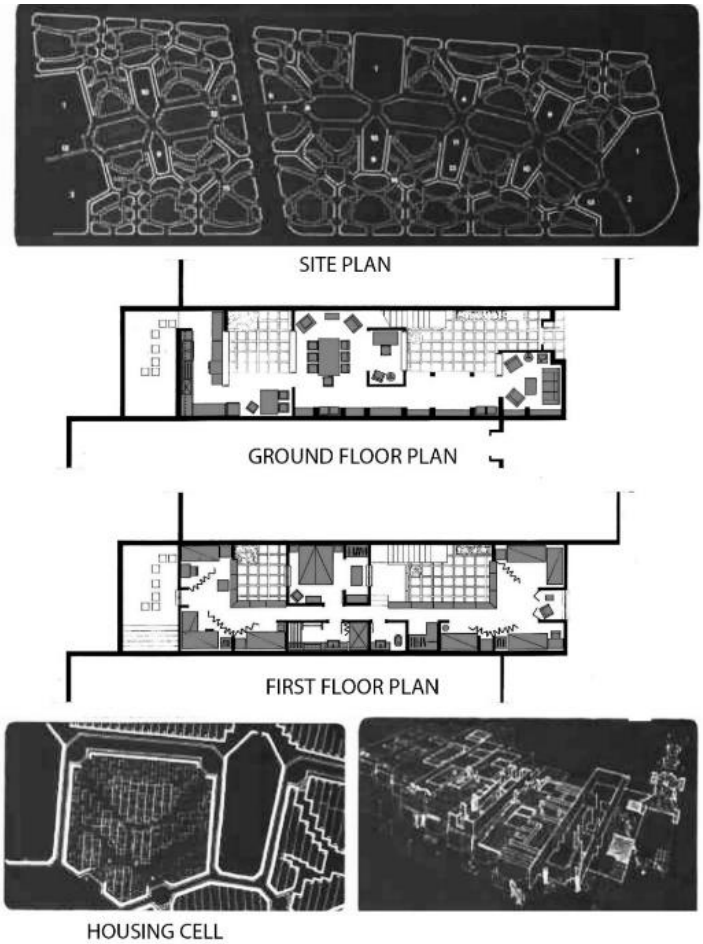


Figure 3.13. Previ/Lima Entry, Christopher Alexander, 1968 ("Previ/Lima. Low Cost Housing Project", 1970, p. 193)

Beginning from Le Corbusier, user participation-based concepts within the scope of architecture kept being introduced such as SAR of Habraken, Self-Help of Turner, and Patterns of Alexander. In 1981, by James Wines, a member of SITE, a new project in which users would own greater area for intervention was introduced: Highrise of Homes. In the project, users were not envisioned to own dwellings only, but more than that, they would own customizable lots. Presence of artificial lots with different styles that could be customized to meet user preferences is common in both Plan Obus and Higrise of Homes. Highrise of Homes is described as follows (Cline & McQuaid, 2002, p. 220):

> … The developer would sell lots within this frame, each lot the site for a house and garden in a style chosen by the purchaser.
> …Whereas urban skyscrapers are normally made of identical, stacked, boxlike units, the Highrise of Homes would allow flexibility and individual choice. The wide variety of house styles, gardens, hedges, and fences described in this intricate rendering provides a sense of the personal identity and human connection that are generally erased by the austere and repetitive elements of architectural formalism.

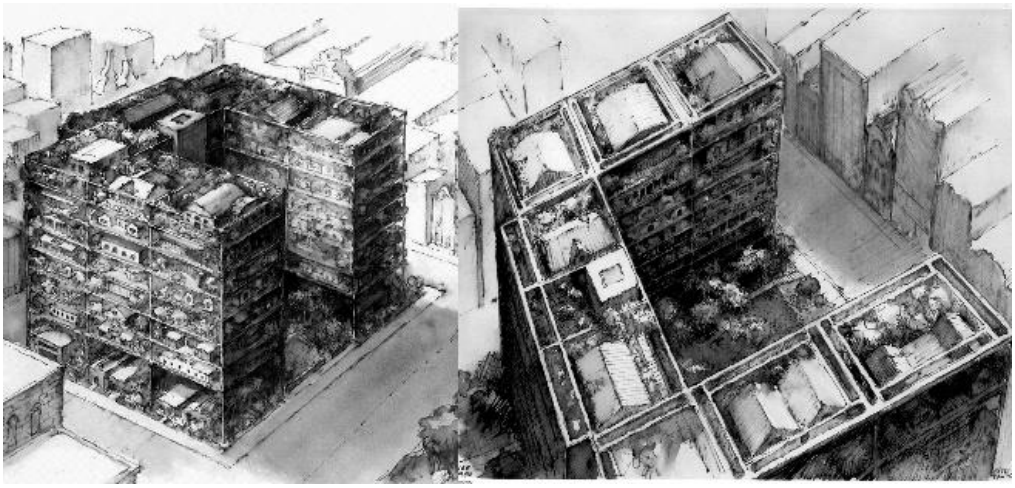


Figure 3.14. Highrise of Homes, James Wines, 1981 (SITE, 2010)

The project was expected to consist of a rectangular grid in which lots would be placed inside with diversified single houses and private gardens in each of them. This shows that occupants could customize their lots as they desired and typological

variety could be achieved by the customization as SITE (2010) summarizes the aim of the project as provision of "an alternative to conventional housing design in the cityspace – replacing it with an anti-formalist urban collage of indeterminacy, idiosyncrasy, and cultural diversity created by residents themselves". In this statement, there are cues of flexibility as "indeterminacy" and "idiosyncrasy" imply that users were expected to customize their lots as they wished (a sign of user participation and flexibility). What makes this project different than the previously introduced user participation ideas is that rather than providing residents with the intervention ability only within their residences, the opportunity would be for one whole lot. The project has remained as a paper work.

Table 3.2. Rise of user participation (by the author)

PROPOSAL	ARCHITECT	YEAR	STATE OF USER PARTICIPATION
Domino House	Le Corbusier	1914-1915	+ Open plan.
Pessac Residences	Le Corbusier	1924	+ Facade customization without permission of architect (unexpected occurrence).
Plan Obus	Le Corbusier	1932-1942	+ Identifiable segregation of infrastructure from homes and presence of open plan.
Self-Help	John Turner	1962	+ Total exclusion of architect (theoretically).
SAR	John Habraken	1965	+ Identifiable segregation of supports from infills and presence of open plan.
Patterns	Christopher Alexander	1968	+ Most basic templates and schemes undergoing massive customizations.
Highrise of Homes	James Wines	1981	+Intervention beyond homes: intervention in lots.

As the process, housing design, ongoes with user participation, multiple dwelling types are likely to occur later (after user intervention). When spatial customizations

are made (e.g. adding extra spaces or converting indoor spaces into outdoor ones), physical changes become observable via facades, too. When these possible expansion scenarios are prepared by architects (e.g. catalogues for new possible spaces) and applied by users, modifications do not end up with distortions of architectural composition. This kind of an architecture is characterized with pluralism and participation, modification of architectural forms and spaces added to original projects reflect themselves on facades without causing distortions.

One of the most initial samples can be given as Pessac Residences. In the project, changes on facades occurred as a result of spatial modifications as described in the previous title above.

Another project in which form and spatial modifications affected the outlook is Erskine's Byker Wall. The project was constructed between 1968-1980. Both the design and construction processes of the project was composed of multiple steps since user wills were taken into account and the architect made revisions for the ground. The steps of design process is listed as follows (Pendlebury, Townshend & Gilroy, 2009): In 1968, Erskine prepared the initial prototypes for the local community, and in order to get feedback from them, a council from members of the local community – whose duty was to inform both the architect and remaining citizens – was formed. After users had dwelled in those initial prototypes, they reported their feedback to the architect via the council, and Erskine made revisions. Similar to La Maison Medicale faculty housing, Byker Wall included varied dwelling types.

Figure 3.15. Byker Wall, Erskine, 1968-1980 (Minton, 2017)

In Figure 3.15., outdoor and indoor balconies or terraces repeating irregularly denote spatial additions made by users. Since they were made of lighweight structures such as timber, they were free from structure (they stood as light cantilevers), ending up with typological variety at facades.

Similar to Pessac Residences, in Lucien Kroll's La Maison Medicale faculty housing constructed between 1972-1976, user participation showed itself on facades. However, different than Pessac Residences, users – who were university students – were provided with making additional spaces via lighweight materials (most recognizable at roof level especially) by the architect directly as Kroll prepared a catalogue demonstrating the possible additional spaces (Galle & De Temmerman, 2013). Kroll did not just prepare a catalogue showing possible expansions, but taking a look at floor plan, it becomes possible to conclude that he welcomed flexibility by designing numerous options of apartments (see Figure 3.24.).

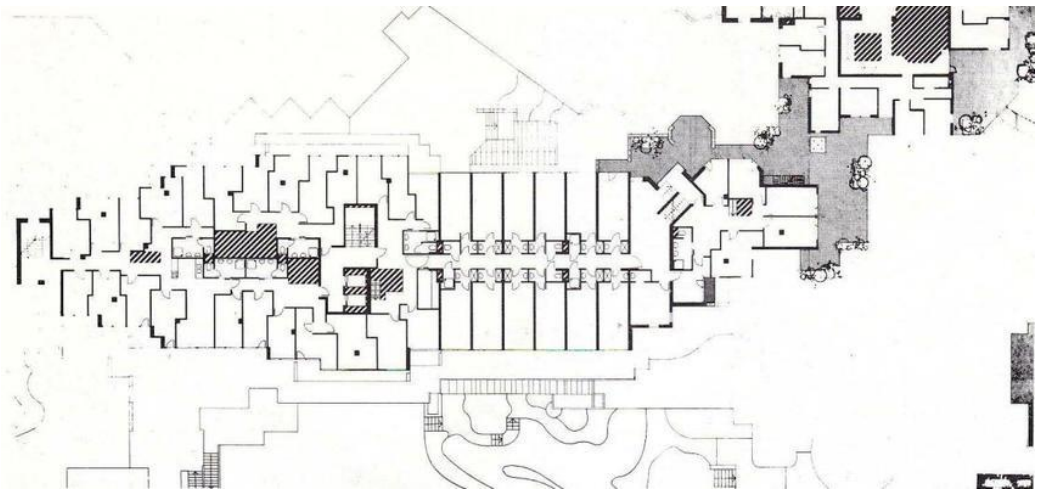


Figure 3.16. Plan of La Maison Medicale faculty housing (Strauven, 1976, p. 10)

In Figure 3.16., on the left, numerous apartment options that vary in shape, dimensions and positions, and around middle, strictly identical apartments can be recognized. Juxtaposition of varied and identical rooms shows that Kroll covered both flexibility and inflexibility. Inclusion of varied room options by Kroll can be interpreted as another similarity with Pessac Residences as in Pessac Residences, Le

Corbusier prepared multiple housing options as well. With regard to additional spaces in Kroll's project, one of them were the "barns" built on roof level with timber balloon frames (Galle & De Temmerman, 2013). Unlike Le Corbusier, Kroll explicitly expressed that he applied participatory design process after taking the 1960s social movements into account that centered on individualism, customization and self-expression (Strauven, 1976; Kroll & Pehnt, 1987; Kroll, 1990).

Figure 3.17. La Maison Medicale faculty housing, Lucien Kroll, 1972-1976 (Poletti, 2010)

In Figure 3.17., photos on the left and in the middle show the varied identity of architectural composition, and the photo on the right indicates barns constructed via timber balloon frames by users.

Table 3.3. Architect-dependent expansion scenario based flexible housing (by the author)

PROJECT	ARCHITECT	YEAR	STATE OF USER PARTICIPATION
Pessac Residences	Le Corbusier	1924	Only on facades and conversion of previously built free spaces (e.g. balcony).
La Maison Medicale faculty housing	Kroll	1972-1976	Lightweight material made additional spaces and facades as a result.
Byker Wall	Erskine	1968-1980	Lightweight material made additional spaces such as balcony, terrace, garden and facades as a result.

3.2.2. From Core Housing to Half House Paradigm

Incremental (core) housing is the housing that except submitting a core structure, architects leave the rest of the project in form of voids (see CHAPTER 2 for detailed description of core housing). The core structure is the most basic scheme that is composed of a plinth and indoor spaces with definite boundaries and definite functions (e.g. kitchen, bathroom). However, ingredients of the core structure might vary greatly. In some cases, architects may only decide boundaries of the ground floor area and number of maximum floors and they do not design any definite space. In another case, a more determinate approach might be adopted, and architects might present residential spaces with definite functions, locations, and sizes as well. In incremental housing projects, there might be an evident or blurred outlook of half house showing the pre-occupation phase.

In core housing projects, as architects allocate voids for transformation into definite spaces by users in the future, both spatial modifications and thus, changes at facades occur. Although design of a core housing project is accompanied by design of a low-cost housing intention as well, it is possible to practice principles of core housing for people with high or standard income, too (e.g. Donnybrook Quarter).

To begin with, in the 1970s and 1980s, in India, several core housing projects were introduced such as Aranya Low-Cost Housing (1982, India) of Balkrishna Doshi, Malabar Cements Township (1978-1987, India) and Belapur Incremental Housing (1984-1986, India) projects of Charles Correa respectively.

In Aranya Low-Cost Housing, each core house was composed of a plinth and service spaces (bath and kitchen) (Ekram, 1995). In the project, core housing was utilized for creating an affordable housing option for families with low-income in the region, and by inclusion of core housing, user participation took place (Ghirardo, 1996).

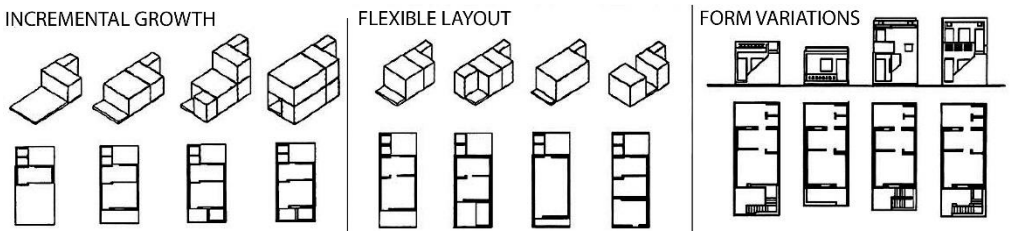


Figure 3.18. Incrementality, flexibility and typological variation in Aranya Low-Cost Housing (Ekram, 1995)

Figure 3.18. shows that the architect prepared different housing options with regard to single houses as well as diversified incremental growth scenarios and flexible layouts. This shows that even two samples belonging to the same housing option could be varied and customized differently by users. The way how typological variety was achieved bears resemblance to Pessac Residences as there were numerous housing options in Pessac Residences, too. However, in Aranya Low-Cost Housing, user participation was explicitly welcomed, and greater typological variety was accomplished.

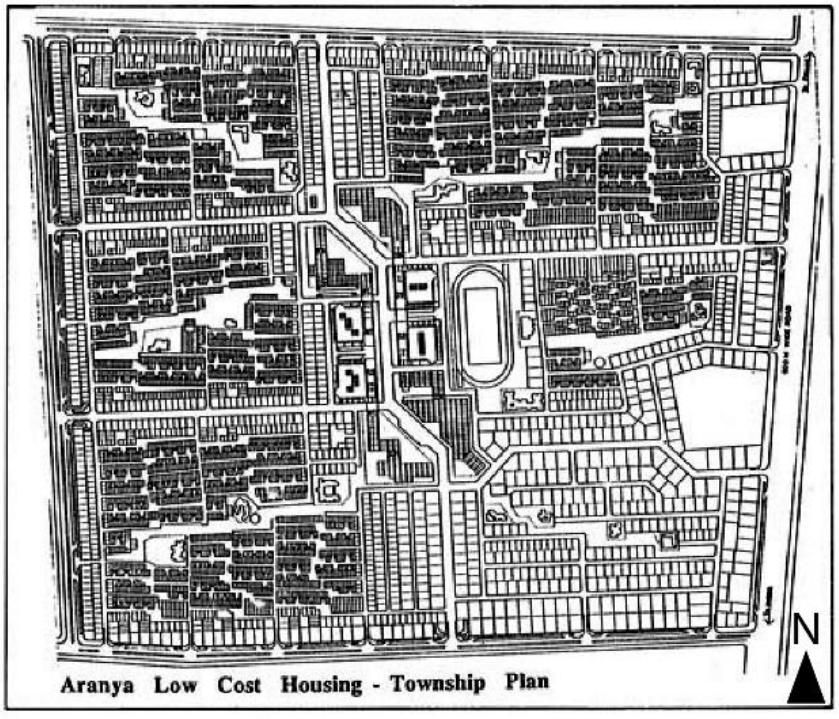


Figure 3.19. Aranya Low-Cost Housing, Doshi, 1982 (Ekram, 1995, p. 83)

In Figure 3.19., at the center, a stadium was situated and in northwest, west, and southwest of it, urban services were positioned. In western part of the whole complex, single houses accounted for the major residential type. Single houses formed three neighborhoods accompanied by three zigzag shaped open air gathering zones. Those building programmes were accompanied by flats, single houses, green areas, hospital, school, and other types of urban services in remaining directions. Aranya Low-Cost Housing was not composed of housing units only as it included various urban services, and it was submitted as an urban-scale neighborhood project.

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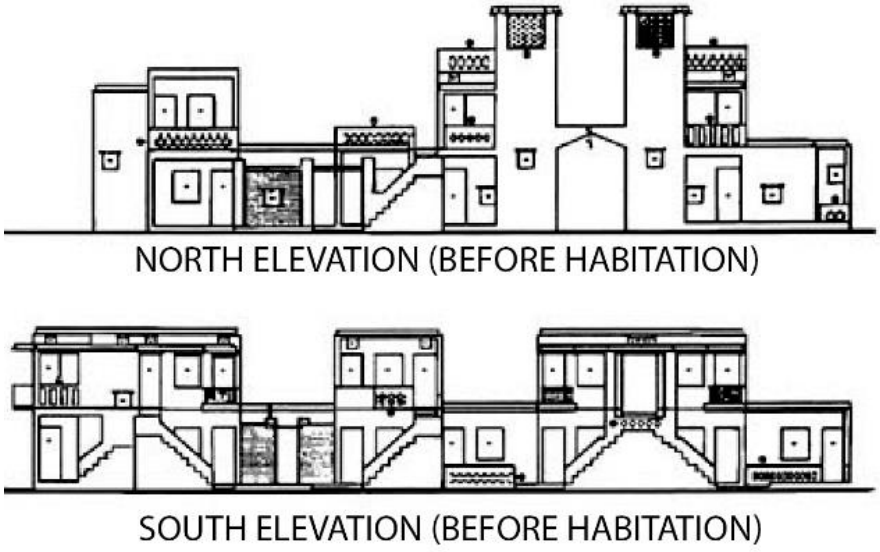


Figure 3.20. Elevations of Aranya Low-Cost Housing before habitation (Ekram, 1995)

In Figure 3.20., images of elevations from before habitation indicate the half house identity of single houses as the dynamic path of up-to-down moving voids are visible. The voids were allocated for being filled with user participation. From facades, not only the half house identity, but also vernacular and conventional architectural ornaments and forms are also observable (e.g. tower-like typology on north elevation, the concave bridge-like formation and the pentagram-shaped void between those tower-like structures, perforations on handrails and high parts of those tower-like formations). As there was multiple form and different core house options, it is

concluded that Aranya case is out of a rigidly repeating typology in both pre-occupation and post-habitation stages.

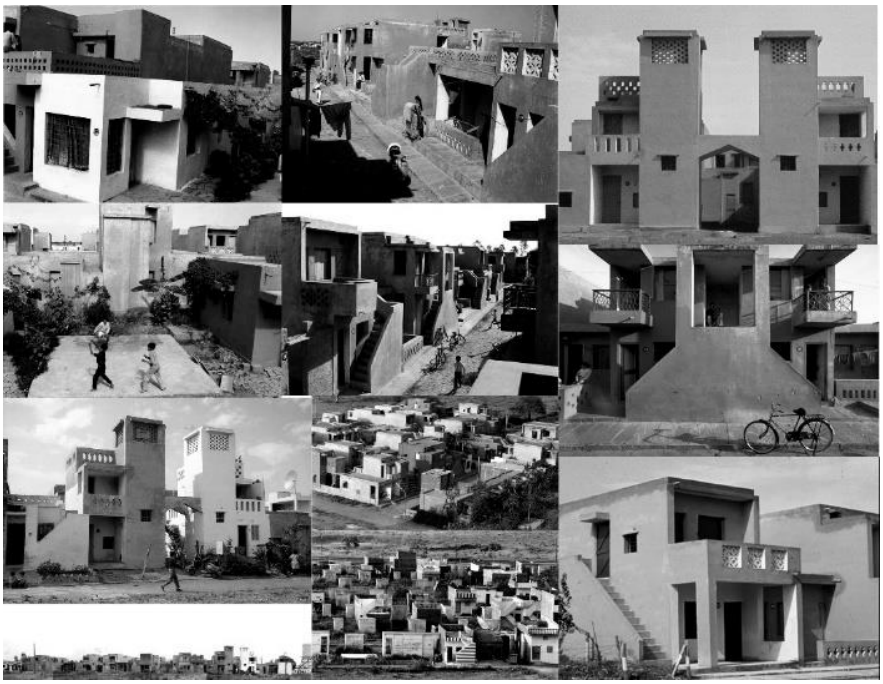


Figure 3.21. Photos of Aranya Low-Cost Housing (Ekram, 1995)

In Figure 3.21., monotonous and mixed repetition of same and different housing options respectively, kids playing in one of the zigzag shaped gathering regions, different housing typologies, vernacular convex and concave forms of voids, and core houses can be recognized.

By utilization of core housing in Aranya case, users were given the chance to develop, design and construct their own homes as well as decreasing building costs (Özbay, 1989). Although there were different housing options, in general, a core house used to consist of a room with definite boundaries initially and service elements in which additions at vertical and horizontal axes were predicted to be made by dwellers which resulted in typological variety (Özbay, 1989). In order to plunge building costs, vernacular materials were preferred (Özbay, 1989). “Brick load-bearing walls” and “cement concrete floors” which were “conventional and locally

available building materials and construction techniques" were implemented in Aranya Low-Cost Housing to obtain a cheaper housing alternative (Ekram, 1995).

Similar to Aranya Low-Cost Housing, another incremental housing project erected in India was Belapur Incremental Housing. There were similarities between them. Firstly, each included multiple core house options. Secondly, multiple single houses formed clusters in both cases. However, Aranya case was a project with a greater scale, and the whole Belapur case can be interpreted as an equivalent of only one neighborhood in Aranya case. Thirdly, there were gathering zones between divergent dwellings in both cases (see Figure 3.31. for those zones in Belapur Incremental Housing). Fourthly, in both projects, voids were individual expansion zones of each dwelling, and convention spaces were provided for gathering of separate houses.

Khan (1987) lists specialties of Belapur case as follows: In each housing unit, the ground floor area was larger than ground floor slabs so as to provide zone for individual growth. In order to aid users in individual growth, no housing unit shared any common wall with neighboring residences. Houses were structurally simple and could be erected and modified by local masons or craftsmen accompanied by participation of inhabitants themselves, showing that the structural system and materials of residences were local masonry techniques and materials respectively.

It is visible that even core houses are varied in terms of typologies (see Figure 3.22.). However, composition of multiple houses do not seem irrelevant as core house alternatives can be interpreted as derivations of each other, which makes it possible to say that those alternatives belong to the same source, one single architect. Compared to Aranya case, in Belapur case, form variation seems to be weaker (e.g. formations are not as varied as they are in Aranya case), yet both cases are out of strict repetitions.

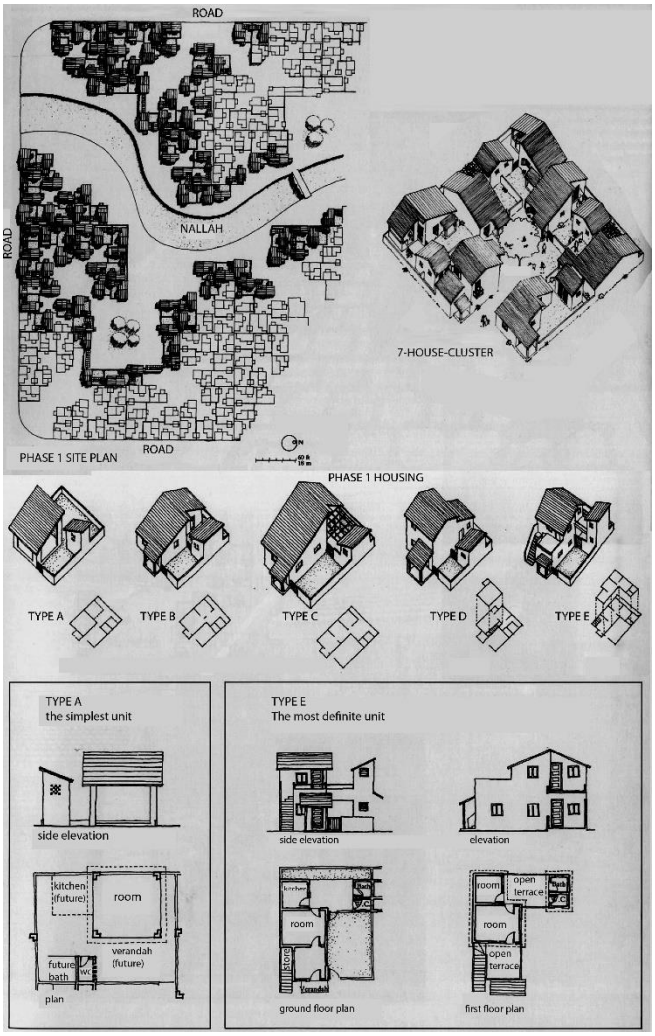


Figure 3.22.. Belapur Incremental Housing, Correa, 1984-1986 (Khan, 1987)

In the 21st century, core housing samples kept being introduced. Several examples are Elemental's Quinta Monroy (2004), Monterrey Housing (2009), Villa Verde (2010); Peter Barber's Donnybrook Quarter (2006), and Tatiana Bilbao's Sustainable Housing (2015). In the Elemental's projects, there was one unique single house model, and its monotonous repetition took place (e.g. in Villa Verde, one single model was repeated monotonously, and in Monterrey case, another one single housing model underwent the same process). In Peter Barber's project, there was no point in providing users with a low-cost housing option, but rather, the project was designed as an imagination of future homes in form of low-rise single houses. In

Tatiana Bilbao's project, there was the intention of provision of a low-cost housing option, but no neighborhood-like formation was proposed, and each single house was expected to be erected on its own alone at separate lands. Compared to Aranya, Belapur, and Sustainable Housing cases, in Elemental's and Barber's projects, half house identity is more evident (see CHAPTER 5).

Aravena and his friends (2004) provide background information about Quinta Monroy as follows: In 2002, they were commissioned by the Chilean Government to detect 100 families who illegally constructed slums for themselves at Quinta Monroy settlement, Chile. The project, Quinta Monroy Housing, was designed as a response to diversity of conformations, tastes and sensibilities of different families in which the most economic solutions were searched since the project was initiated as a social housing program. In core houses, there were individual spaces of expansion. In doing so, rather than forcing dwellers to live in totally identical dwellings, more than half of each residence was expected to be customized by users themselves via making spatial additions, spatial modifications and self-construction.

Figure 3.23. The states of Quinta Monroy zone before (on the left) and after (on the right) erection of project of Elemental (Aravena, Montero, Cortese, de la Cerda & Iacobelli, 2004, p. 30).

Different than Aranya and Belapur cases, Quinta Monroy project was not constructed on a wasteland as there was the pre-built environment composed of slums, and there was only one dwelling sample in Quinta Monroy project that was erected repeatedly. Figure 3.23. shows how the settlement changed after construction of Elemental'S project.

In the project, the key thing which could make the proposal a liveable one was not houses, but the whole neighborhood itself, and since the neighborhood had easy

access to urban services such as job opportunities, transportation, education, health and so on, social sustainability was achieved (Aravena, Montero, Cortese, de la Cerda & Iacobelli, 2004). This demonstrates that similar to Aranya case, Quinta Monroy had direct access to multiple urban services, but unlike Aranya Case, those were not included within the Quinta Monroy Housing complex.

Figure 3.24. Quinta Monroy Housing Project before customization and post-customization of users ("Quinta Monroy / ELEMENTAL", 2008)

In Figure 3.24., photos labelled with A and B denote stages of before and post-customization respectively. It is visible that although typological variety replaced monotonous facade view and the monotonously repeating typology, the original identity of houses (core houses prepared by architects) is still recognizable in form of half houses.

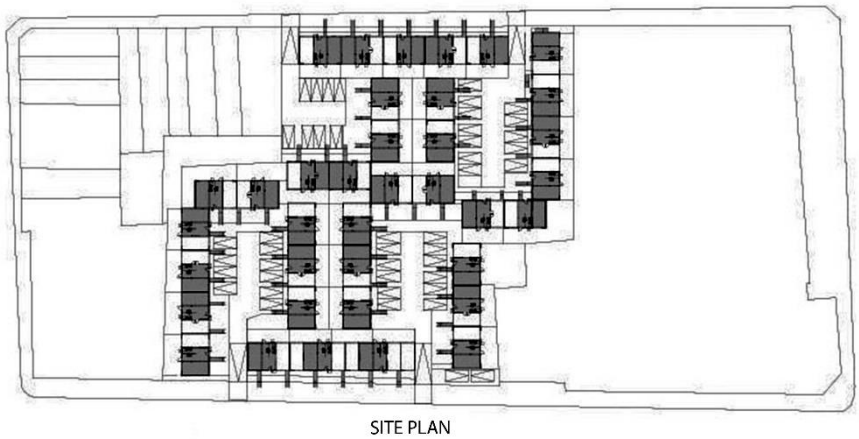


Figure 3.25. Quinta Monroy Housing, Elemental, 2004 (Aravena, Montero, Cortese, de la Cerda & Iacobelli, 2004, p. 30).

In Figure 3.25., regions of convention between divergent and facing single houses is visible which are similar elements found in Aranya Low-Cost Housing and Belapur Incremental Housing.

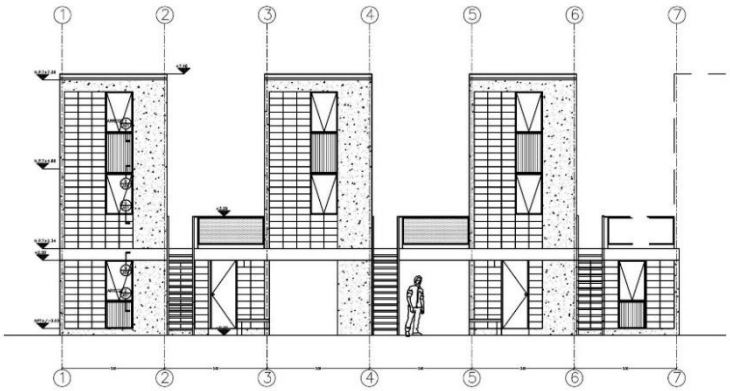


Figure 3.26. Front Elevation of Quinta Monroy Housing (Aravena, Montero, Cortese, de la Cerda & Iacobelli, 2004, p. 30).

In Figure 3.26., the elevation shows up-to-down-moving voids as well as the half house identity of the project, which is a similarity shared with Aranya case in terms of view, but the half house is more apparent in Quinta Monroy.

Another core housing proposal of Elemental is Monterrey Housing. Aravena and his friends (2010) describe the project as follows: In 2009, we were commissioned by the government of Nuevo Leon – a city in Mexico with 230 000 inhabitants – to design a group of 70 houses in which they formed a neighborhood in the end. Different than Quinta Monroy project, Monterrey Housing was finished with a comprehensive roof slab at the top of each housing block. Taking a look at photographs of the project, it becomes visible that in Monterrey Housing, there is the evident view of half house again, yet this time, voids are constrained with a plane (the roof slab), and that makes the project different than other core housing projects described above.

Figure 3.27. Monterrey Housing, Elemental, 2009-2010 (Elemental, 2010)

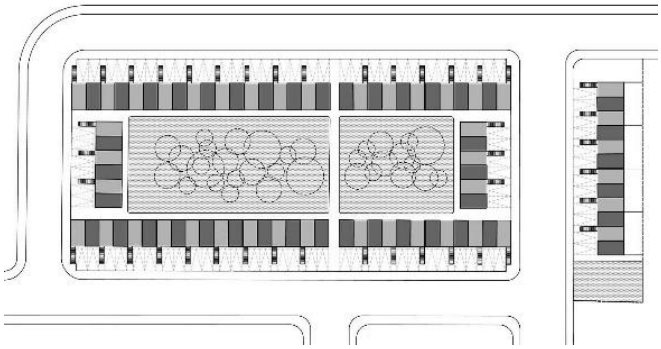


Figure 3.28. Site plan of Monterrey Housing (Elemental, 2010)

Figure 3.28. shows that the whole project was composed of 7 housing blocks, each finished with 7 separate roof slabs. Similar to the previously described core housing projects afore, there was a convention space in the middle of 6 housing blocks in form of a vast green area filled with trees called “collective space” by Aravena and his friends (2010) that was open to use of divergent residences.

Aravena and his friends (2010) address presence of incremental housing and their determinate attitude via the roof slab as follows: In each residence, there was a 40 m^2 designed area called the “first half” which included bathroom, kitchen, stair, and dividing walls. In an “expanded scenario” which is likely to occur after individual spatial additions of users, one residence could result in 76 m^2 , so one single house could expand approximately 2 times. The continuous roof slabs helps retain “rhythm” and frame a regular facade which is “more than control”.

Elemental’s decision about the roof slab shows that a more determinate approach was adopted in Monterrey Housing compared to the previous core housing projects

described. Similar to the previously described core housing projects, in Monterrey Housing, each dwelling had its own void for spatial expansion, and beyond boundaries of each house, no expansion took place again. Similar to Quinta Monroy, there was just one dwelling model that was repeated monotonously unlike Aravena and Belapur cases. Similar to Quinta Monroy, the half house is strongly visible in Monterrey housing with one difference which is the limiter, roof slab. Different than Aranya case and similar to the remaining core housing projects above, Quinta Monroy only included single houses and no flats or other building programs.

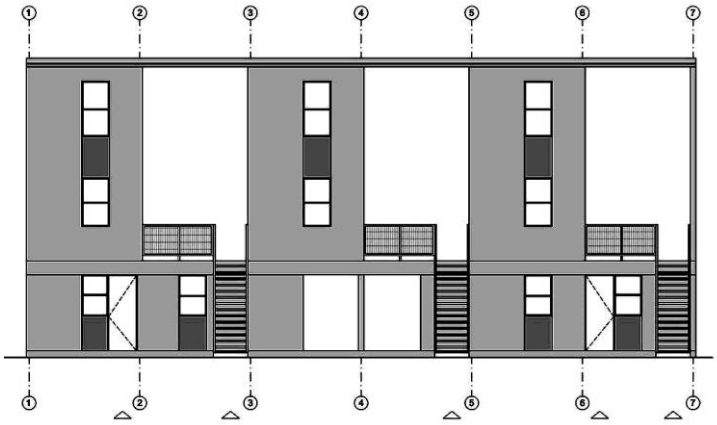


Figure 3.29. Front Facade of Monterrey Housing (Elemental, 2010)

In Figure 3.29., the strictly repeating facade as well as half houses can be seen.

Following the half house typology of the projects described afore, in 2006, at London, Peter Barber's Donnybrook Quarter project was constructed. Traces of core housing is visible in the project, yet it was not developed as a solution to introduce a low-cost housing option unlike the previously described core housing projects above, and that makes Donnybrook Quarter different.

Cousins (2008) reports that the project was developed as a "low-rise, high density new housing development" proposal. He adds that the project was designed upon the imagination in which future homes were expected to be low-rise single houses with raw spaces in form of outdoor terraces that were indefinite in function, and their functions were predicted to be decided by users in future. Taking this into account,

unlike the previously described core housing projects, it is inferred that Donnybrook Quarter can be given as a sample to show that core housing is not only utilized to create low-cost housing options, but it could be benefitted to propose housing alternatives for people with standard income who would like to own homes including spaces with indefinite functions as well.

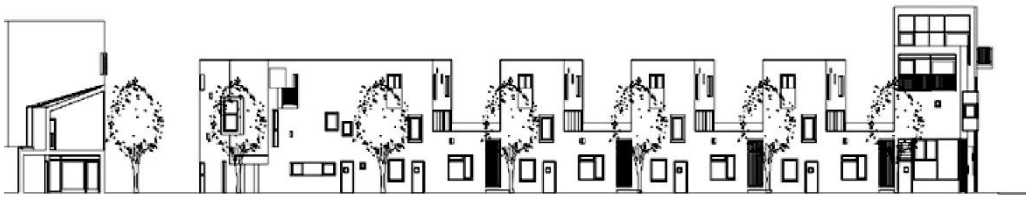


Figure 3.30. Front Elevation of Donnybrook Quarter (von Sternberg, 2006)

Except Aranya case, Donnybrook Quarter is similar to the remaining core housing projects listed above since it only included single houses and no urban services.

Most similar to Quinta Monroy and Monterrey Housing (and similar to the rest of previously described core housing projects as well), half house identity of Donnybrook is dramatically apparent.

Similar to each previously described core housing project afore, Donnybrook Quarter holds two interior streets which are convention spaces of separate residences.

3.2.3. Adjustable Dwellings Combined with Support Structures

Adjustable dwellings combined with support structures are the projects that dwellings were imagined as capsules with the ability of plugging into and out from a framework. Prominent examples can be listed as bottle-rack principle involved Unité d'Habitation of Le Corbusier (1952), Plug-in City of Archigram (1964), Nakagin Capsule Tower of Kurokawa (1972), Resi-Rise Skyscraper of Kolatan and MacDonald (2000), and Plugin Tower of People's Architecture Office (2016).

To begin with, in Unité d'Habitation, Le Corbusier devised a system called bottle-rack principle. According to it, apartments would be L-formed capsules that could be plugged into and out from the static concrete frame called a series of racks. Gans

(1987) calls voids in the frame “cells” which were open to receive those “packaged apartments” as she describes those bottles as lightweight (such as steel so as to facilitate lifting, loading and removing) prefabricated compartments. In practice, bottle-rack principle was not concretized, and Unité d'Habitation samples were erected without it. Gans highlights that Le Corbusier imagined multiple user profiles and offered various interior layouts for those capsules.

Figure 3.31. Unité d'Habitation, Le Corbusier, 1952 (Fondation Le Corbusier, 2014)

In Figure 3.31., photos on the left and right denote the unrealized bottle-rack principle and one of the erected versions of Unité d'Habitation respectively. Erected versions of Unité d'Habitation include sliding panels positioned between consecutive spaces within the same apartment which were used to divide and merge consecutive spaces, yet apartments are not capsules with the ability of plugging-into and out. The erected Unité d'Habitation samples held communal facilities such as “a garden terrace that has a running track, a club, a kindergarten, a gym, and a shallow pool” which were commonly occupied by divergent apartments (Kroll, 2010).

Along with Plan Obus, Unité d'Habitation can be interpreted as a transition project between SAR of Habraken and Domino House of Le Corbusier. In Unité d'Habitation, apartments were envisioned as mobile capsules, and they could be varied according to their unique user profiles by Le Corbusier, which means they could be equivalents of “infills” of Habraken. The rigid framework in Unité

d'Habitation was composed of stable instruments and it could be regarded as the substitute of "supports" of Habraken.

Another proposal which was made by taking the idea of plugging into and out from a framework was Archigram's Plug-in City. Similar to Unité d'Habitation, housing units were imagined as capsules that could be plugged into and out from a framework. Capsules becoming obsolete could also be updated with newer ones as well. In the project, Archigram aimed to "create a design completely adaptable to people's needs and the constant change of technology that would endure future generations" (Tsigkouni, 2013, p. 4). Chalk and his friends (1964) describe Plug-in City as follows:

> Plug-in City is set up by applying a large scale network-structure, containing access ways and essential services, to any terrain. Into this network are placed units which cater for all needs. These units are planned for obsolescence. The units are served and manoeuvred by means of cranes operating from a railway at the apex of the structure. The interior contains several electronic and machine installations intended to replace present-day work operations.

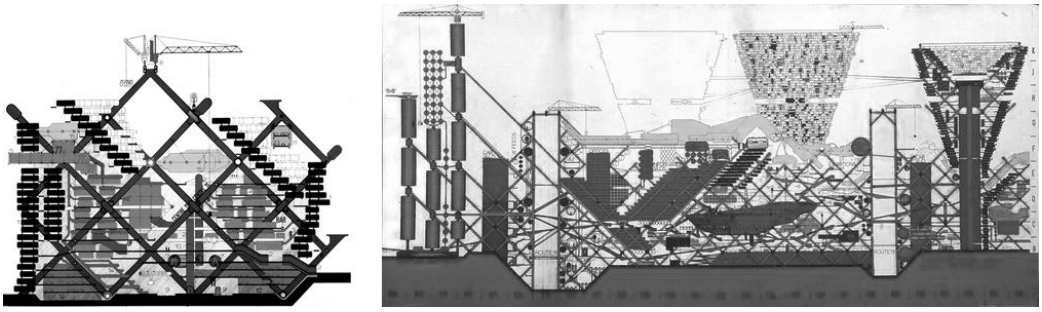


Figure 3.32. Plug-in City, Archigram, 1964 (University of Westminster, 2012)

In Figure 3.32., the moment of removal of old components from or addition of new components to the megastructure via a crane, and the system of multiple conveyors located diagonally can be noticed. The components which would be removable and updateable with their newer versions was listed as follows (Chalk, 1964):

> Bathroom, kitchen, living room floor: 3-year obsolescence
> Living rooms, bedrooms: 5-8 year obsolescence
> Location of house unit: 15 years duration
> Immediate-use sales space in shops: 6 months

Shopping location: 3-6 years
Workplaces, computers, etc: 4 years
Car silos and roads: 20 years
Main megastructure: 40 years

Having a look at predicted lifespans above, it is noticeable that changeable components vary from spaces (e.g. bedrooms) to different building programs (e.g. shops, workplaces, etc.). Here, one difference between Plug-in City and Unité d'Habitation can be found as in Plug-City, approximately all tools could operate as mobile capsules and it was an urban-scale project whereas in Unité d'Habitation, only apartments were imagined as capsules, and it stayed as a project with a much smaller scale (like a mini-city).

In Plug-in City, Chalk expected a typical residence to be made of "mass-produced, cheap and expendable, plastic and metal rooms" (Chapman, 1964), and users were expected to actively participate in "determining their own individual environment, in self-determining a way of life" (Cook, 1991, p. 17). Those show that like Unité d'Habitation, in Plug-in City, manufacture of prefabricated capsules operating as apartments was proposed. While apartments were predicted to be varied due to diverse user profiles in Unité d'Habitation under authority of Le Corbusier, active user participation was aimed in Plug-in City.

In Figure 3.33., one typical housing unit that would be included in Plug-in City can be observed. As told by Peter Cook (1991, p. 17), interior layout of each housing unit would be an "own individual environment" since they would be designed as free boxes open to user participation.

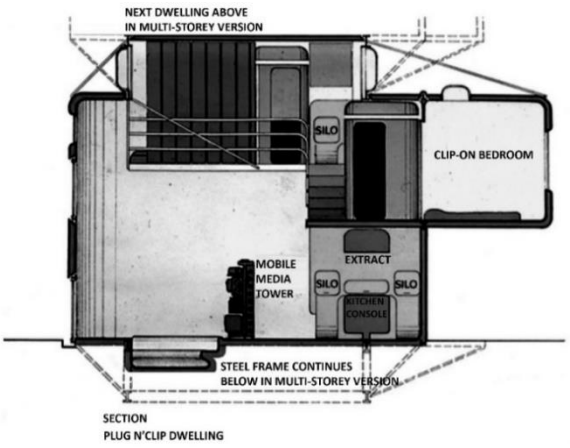


Figure 3.33. A typical dwelling in the Plugin City of Archigram (Tsigkouni, 2013, p. 7)

Dwellings and other numerous tools in Plug-in City except the major framework would be dramatically customizable, modifiable and renewable with newer ones after obsolescence. This indicates that they could be considered “infills” of SAR, while the major framework that could be utilized for update of those modifiable elements could be called “supports”. However, Habraken did not describe “infills” as capsules with the ability of plugging-into and out from a rigid structure although he described them dynamic (changeable, yet it did not mean removable/addable similar to a capsule) as well.

Another project that plugging-into and out from a framework was attempted to be implemented is Nakagin Capsule Tower of Kurokawa. Watanabe (2001) describes the project as follows: The project was composed of two concrete towers that were interconnected in which prefabricated capsules functioning as dwellings had been expected to merge and disconnect to form larger and smaller housing units respectively. Those prefabricated capsules were also planned to be replaced with newer ones, yet the process failed, and once capsules were welded, they could not be displaced. After construction of the main structure composed of two concrete towers accompanied by a steel framework had been completed, prefabricated capsules were transferred to site later and plugged into cores to form cantilevers so that their removal could be facilitated, yet it never occurred. Similar to Unité d'Habitation and

Plug-in City, apartments were designed as capsules that could be plugged into and out from a rigid framework. Similar to Unité d'Habitation and unlike Plug-in City, rather thank involving active user participation, capsules would be varied according to user profiles, and the architect would design those varied capsules himself in Nakagin Capsule Tower.

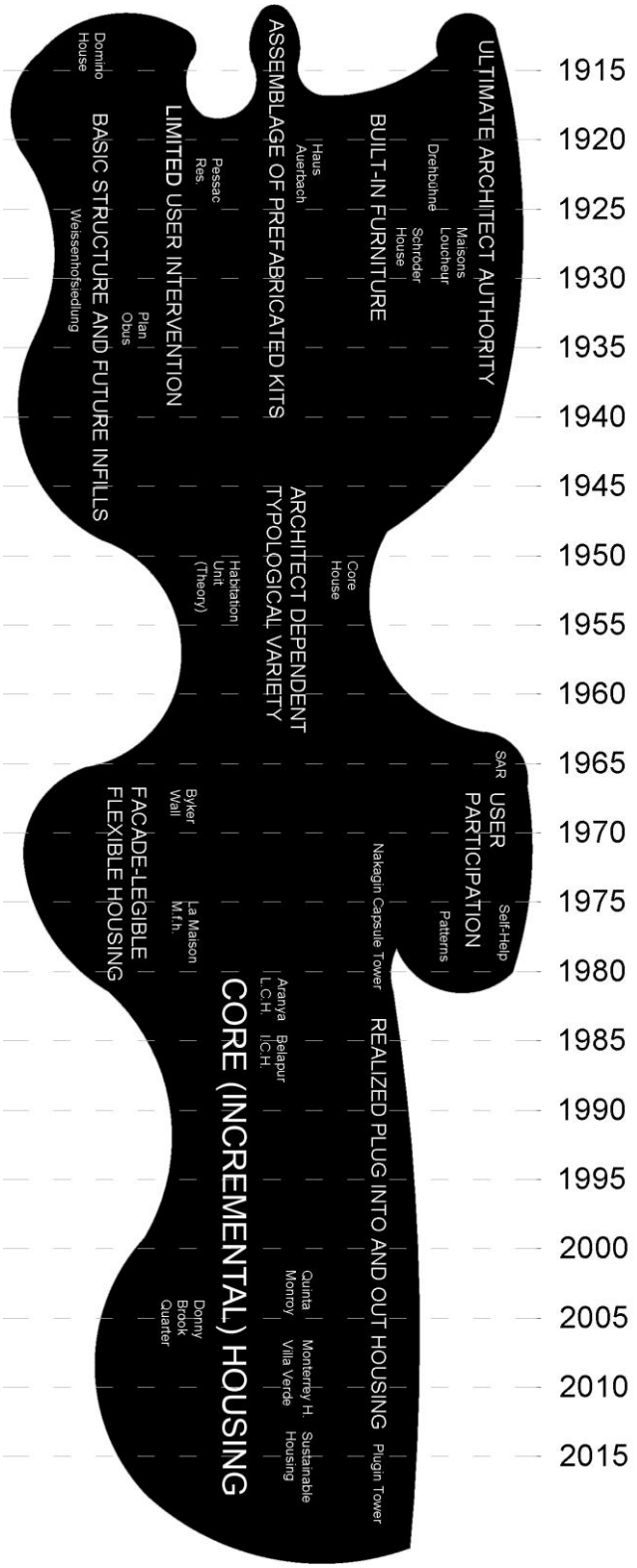
Figure 3.34. Nakagin Capsule Tower, Kurokawa, 1972 ("AD Classics: Nakagin Capsule Tower /Kisho Kurokawa", 2011)

Another project in which dwellings were imagined to plug into and out from a rigid framework is Resi-Rise of Kolatan and MacDonald. The project was composed of housing units in form of compartments that could be plugged into and out, and each time the occupant changed, compartments could be designed from scratch by architects with renewed dimensions, functions, service units, etc. or new comers would come with their own customized compartments (Kolatan & Macdonald, 2002).

Compared to the previous adjustable dwellings combined with support structures, in Resi-Rise, designers authorized themselves and let users come with their own compartments as well. This demosntrates that both user participation and empowerment of architect took place. Similar to Nakagin Capsule Tower, Resi-Rise

was also only composed of housing program except one public space, the podium part.

Table 3.4. The cloud diagram of flexible housing (by the author)



CHAPTER 4

ANALYSIS OF CASE STUDIES

4.1.Methodology for Examination of Selected Case Study Projects

In this chapter, it is aimed to identify what is seminal and customary with flexible housing practiced today. In order to attain the goal, first of all, three contemporary examples - Villa Verde Housing of Elemental (2010), Sustainable Housing of Tatiana Bilbao (2015), and Plugin Tower of People's Architecture Office (2016) - are analyzed according to framework of Schneider and Till (2007) introduced in CHAPTER 2. Secondly, each case study is assessed under three subtitles: Rate of user participation and empowerment of architect, individual and communal spaces, conventionality and novelty of building methods and materials. Finally, results obtained from the case studies are listed.

During selection of case studies, it is aimed to choose projects as diverse as possible. There are three grounds why these projects are chosen:

1. Each project is located in different countries. Thus, all of them are designed according to different housing policies as Villa Verde, Sustainable Housing and Plugin Tower are placed in Chile, Mexico and China respectively.
2. Each project focuses on different user profiles as Villa Verde, Sustainable Housing and Plugin Tower were designed for the laborers of a forestry company in Chile, low-income citizens in Mexico with low salaries and mixed-income citizens in China respectively.
3. Each project has different typologies (Villa Verde is based on a scheme of row houses, Sustainable Housing is a series of detached houses, Plugin

Tower is a totally moveable house composed of prefabricated modules). When compared, in Villa Verde, users of each single house own the chance to make spatial additions within borders of their own single house. In Sustainable Housing, inhabitants can expand their houses beyond the boundaries of their residence. Plugin Tower is composed of lightweight prefabricated modules that are mobile and assembled according to wills of users.

Since the primary aim of the thesis is observation of what is customary and seminal with flexible housing practiced currently, comparisons with precedent flexible housing proposals (covered in CHAPTER 3) are made under three titles:

1. Rate of User Participation and Empowerment of Architect

First of all, in case studies, to what extent users and architects are authorized is studied. For instance, it is searched if users can only intervene in furnishing elements or if they can make new spatial arrangements or add new spaces. Secondly, results are compared to the precedents described in CHAPTER 4.

2. Individual and Communal Spaces

Presence of individual and communal spaces is studied.

Individual Spaces: If multiple samples in the same proposal are disconnected from each other, then it is deduced that there are individual spaces.

Communal Spaces: If multiple samples of the same proposal share spaces of common use, then it is decided that there are communal spaces.

States of individual and communal spaces in case studies are contrasted with those of the previous proposals analyzed in CHAPTER 4.

3. Conventionality and Novelty of Building Methods and Materials

In case studies, it is studied if conventional building methods (e.g. site specific masonry techniques) and materials (e.g. utilization of local trees to gain timber posts etc.) are involved or not. Then, these are compared with those of the previous projects described in CHAPTER 4.

In order to obtain data from case studies selected for examination with regard to these three categories described above, Schneider and Till's framework (2007) comprised of 4 components which are "use", "plan", "construction" and "services" is utilized and the projects are analyzed according to this structure (see CHAPTER 2 for the framework).

4.2.Villa Verde Housing

Architects: Elemental
Location: Constitución, Maule Region, Chile
Category: Social Housing
Project Year: 2010
Location: Chile

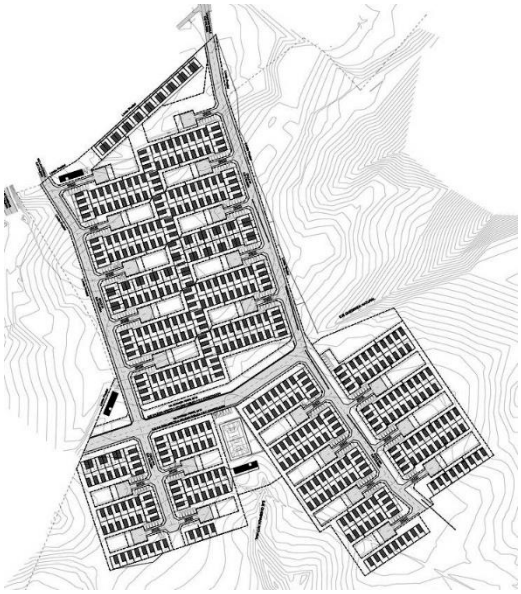


Figure 4.1. Site plan of Villa Verde Housing (Elemental, 2013)

Villa Verde Housing is a social housing project utilizing incremental housing principles in Chile whose construction ended in 2010 and it was designed by Elemental. The project is described by architects as follows:

> …The importance of this project is that on the one hand, for the first time, it allowed us to think about a design for the upper niche of the housing policy. If we developed an innovative and competitive typology, we would broaden our possible contribution to social housing. We could have taken one of our own more economic typologies and used the extra money to finish them, filling the void that families were expected to complete. But we thought of once again applying the principle of incremental construction and prioritization of the more complex components, this time with higher standards both for the initial and the final scenario. (Aravena et al., 2013, pp. 48-51).

The explanation above shows that architects allocated empty areas for interference of users. For example, referring to the phase before interference of users, Elemental (2016, p. 28) depicts each single house as "half of a good house". (see Figure 4.2.).

Figure 4.2. "Half of a good house" (top) and "Middle-class standard achieved by the residents themselves" (bottom) ("The Pritzker Architecture Prize 2016 Laureate Alejandro Aravena", 2016, p. 28).

In Figure 4.2., the photo at the top shows state of the project before inhabitation whereas the other at the bottom illustrates post-inhabitation.

On one hand, the project holds features and tools of flexible housing as architects allocated free zones as voids for future intervention of users in each single house (yet they do not make mention of flexibility explicitly). On the other hand, the project was designed with the intention of presenting a social housing project (with incremental housing principles involved), and it is explicitly expressed.

4.2.1. Use

4.2.1.1.Use at Building Level

In use at building level, the examination is conducted to explore if architects had any other building program except housing in their minds It is said by Elemental (personal communication, 2019) that except housing, there was no other building program in minds so they did not allocate space or tools that would be utilized during change of the building program. For example, no removable or mobile walls were positioned between sequential residences which would be used to obtain larger and united building blocks for transformation of multiple houses into another building program.

4.2.1.2.Use at Unit Level

In use at unit level, it is examined if dwellings could serve miscellaneous user profiles (e.g. a family with 2 kids and another one with 3 kids or one of them owns an extra garden for raising vegetables whereas the other involves one more kitchen) or not. Allocation of voids without definite functions in each single house shows that diversity between dwellings can be achieved since these voids could be customized differently according to their users. For instance, a void could be turned into a garden to raise vegetables, while another can be converted into an additional bedroom.

Figure 4.3 Voids in Villa Verde housing units (Elemental, 2013)

In Figure 4.3., the hatched areas inside of dashed trapezoids indicate voids that were allocated for interference of occupants.

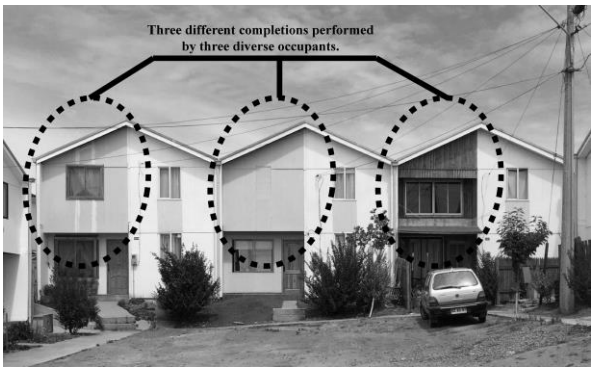


Figure 4.4. Three different completions in three houses (Elemental, 2013)

4.2.1.3.Use at Room Level

In use at room level, it is analyzed to what extent rooms of dwellings are free from definite functions and if they hold furnishing to provide users with making different arrangements inside of the room or not. No special furnishing was designed for rooms (Elemental, personal communication, 2019). This indicates adoption of an indeterminate approach at room level by the architects. There were just possible scenarios about functions, and furnishing was drawn in floor plans so as to assist occupants to comprehend the size of spaces, yet users are free to decide the function of them (Elemental, personal communication, 2019).

4.2.2. Plan

4.2.2.1.Plan at Building Level

In plan at building level, the research is done to observe if the project involves spaces of common use between multiple residences or not.

Architects did not design common residential spaces (no space of common use between multiple residences) (Elemental, personal communication, 2019). It is observable that each void was allocated for the individual use of the residence that they belong (see Figure 4.5.).

Figure 4.5. Voids that are not juxtaposed in Villa Verde Housing units (Elemental, 2013)

In Figure 4.5., the situation in which single houses possess their own voids can be noticed. This signifies implementation of individual use of voids (voids were designed for individual use of each residence). Thus, tools which are not related to individual spaces – communal circulation and slack space – are not included.

Aravena and his friends (2013) remark that although they had the chance of filling voids, they did not do it and left the process to inhabitants. This signifies that users were able to fill voids as they wanted within boundaries of their own residence.

4.2.2.2.Plan at Unit Level

To begin with, Elemental (personal communication, 2019) remarks that they prepared floor plans with furniture implying the function of the space, yet it was expected to operate just as a tool to aid users comprehend the size of spaces and users did not have to occupy the space in the way how architects furnished them. This shows that spaces except the spaces filled with static furnishing elements (bathroom and kitchen) were free from mandatory options although upper floor spaces were furnished as bedrooms. Thus, functionally neutral rooms were encompassed (see Figure 4.6.).

Because there is serial (asymmetric) repetition of residences (see Figure 4.3., 4.4., 4.5.), service spaces of consecutive dwellings do not stand adjacently which denotes lack of condensed service core.

Since each residence was designed to dwell individually (as there was no space designed for mutual use of separate residences), elements of communal dwelling which are joinable/divisible units and shared room were not included.

Elemental (personal communication, 2019) explains that in order to involve as many housing units as possible and decrease building costs, they designed spaces with minimum standards. Thus, it is observed that no large circulation space was designed.

The position of voids signifies that they were raw spaces and open to transformation (see Figure 4.5.).

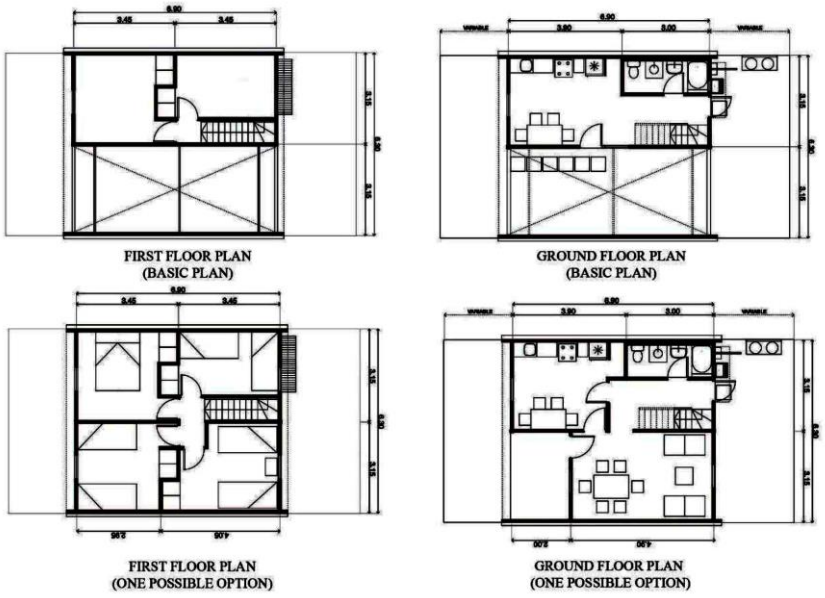


Figure 4.6. Basic and possible plans for dwellings in Villa Verde (Elemental, 2013)

In Figure 4.6., basic plans prepared only by architects, and two possible options that were likely to be applied by occupants can be recognized. Kitchen and bathroom were juxtaposed in all houses which resulted in the organization that remaining spaces became free from constraints within each residence. However, service spaces of multiple residences do not stand side by side since asymmetrical repetition of residences took place (see Figure 4.5.).

In each floor of every housing unit, there were voids which were raw spaces and they were outdoor zones, and users were free to interfere in them as they willed.

4.2.2.3.Plan at Room Level

Since the project is an incremental housing project, architects only submitted base structures composed of core houses. In case of Villa Verde, core houses were composed of service spaces with definite functions, spaces without furniture and definite functions (e.g. upper floors rooms) and voids. This indicates that architects did not adopt a determinate approach with regard to rooms. Thus, any tool in which the architect could retain control was not implemented. However, the attitude of architects in which they set users free in terms of making decisions about voids, spaces on the first floors, etc. signifies that special tools for rooms such as foldable furniture could be implemented by dwellers if they demanded.

4.2.3. Construction

In construction, the analysis is made to observe whether occupants were able to interfere in constructional elements and if so, to what extent they were empowered.

After examination of the application drawings of Villa Verde (see Figure 4.7.), it is observed that each column (which were made of local timber) held identical sizes which were 5cmx12cm and none of them were positioned inside of spaces which demonstrates that they were concealed within perimeter (exterior) walls only.

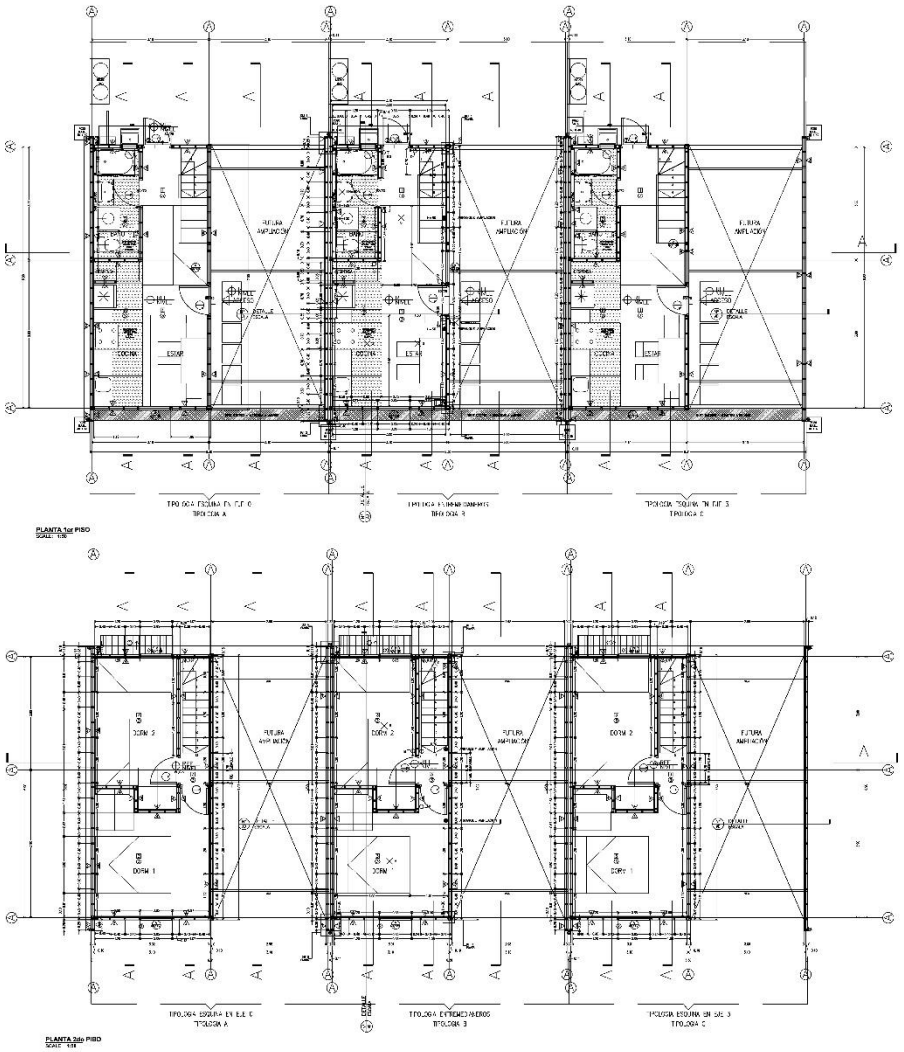


Figure 4.7. Ground floor (top) and first floor (bottom) plans of Villa Verde Housing (Elemental, 2010)

It is visible in Figure 4.7. that posts and beams account for the major structural system, while all spaces are free from columns as posts are only located only within exterior walls. This state reinforces existence of flexibility in spaces because when there is clear span inside of spaces, users have the chance of making more varied spatial arrangements, which denotes less constraint. Elemental (personal communication, 2019) states that they practiced the typical model of post-beam system rather than benefitting from a local type of load-bearing system. Elemental (personal communication, 2019) tells posts were obtained from processed

conventional Chilean trees to plunge building costs while unconventional building materials such as synthetic insulation materials were also applied, and occupants were set free to choose both unconventional and conventional building methods and materials during conversion of voids.

4.2.4. Services

In services, the search focuses to what extent users are authorized to modify service spaces, if service spaces were specially organized for future interventions by architects in other spaces and whether service elements were easily convertible or not.

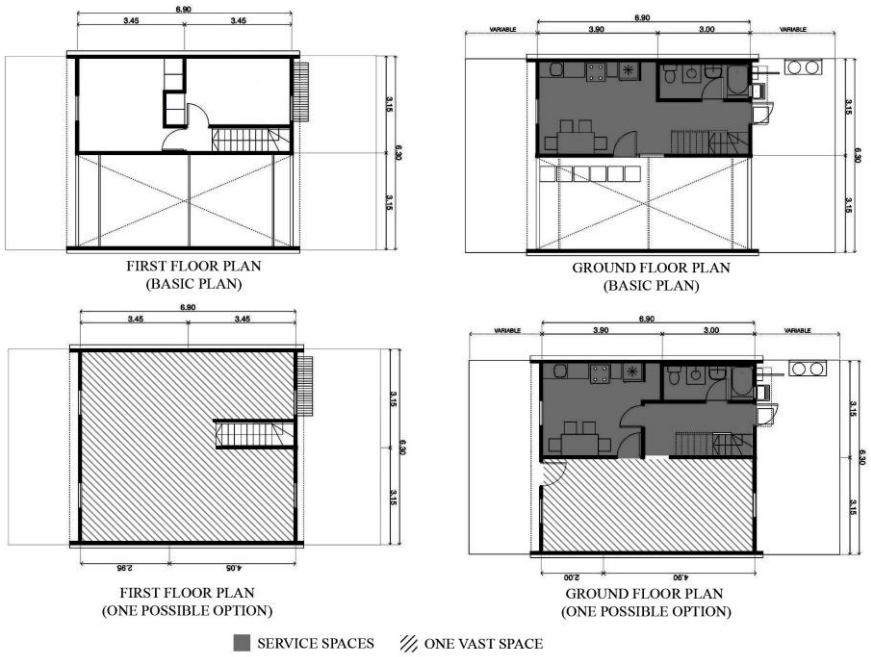


Figure 4.8. Service and post-created vast spaces in Villa Verde Housing (Elemental, 2013)

Elemental (personal communication, 2019) points out that service spaces were determined to be static. Taking a look at floor plans of a typical residence (see Figure 4.8.), it is observable that service spaces were located on the ground floor on a linear path in which no other space was positioned between them. This shows that spaces except wet spaces (bathroom and kitchen) were free from constraints that would have been caused by service spaces. It can be interpreted as the condition of possible gain

of one vast free space on ground floor (see Figure 4.8.). Another possibility is gain of a single wide space via demolishing the divider between rooms on first floor (see Figure 4.8.).

4.2.5. Evaluation of Villa Verde Housing

About rate of user participation and empowerment of architect, since the project is an incremental housing sample, core houses were submitted in which user participation was encompassed. Each core house is composed of service spaces with static positions, spaces without definite functions and without static furniture, and voids. It is recognized that user participation was able to take place in determination and transformation of voids and spaces without definite functions and static furniture (spaces on first floor). Thus, except expanding the residence beyond its boundaries and customizing service spaces, users were free to customize remaining spaces as they willed (it was free to convert voids into additional indoor or outdoor spaces, unite upper floor rooms to obtain one vast space, etc.).

About individual and communal spaces, on one hand, it is observed that architects regarded and designed voids as individual spaces of expansion for each residence, showing that they were individual spaces. On the other hand, there were recreational zones and urban spaces (school, stadium, etc.) designed for common use of multiple residences which demonstrates that communal space was included, too.

About building methods and materials, it is observed that a carcass system composed of posts and beams was applied, and local timber was utilized to obtain columns, whereas synthetic insulation materials whose ingredients were not limited with just local materials were applied as well. Thus, it is deduced that unconventional and conventional building methods and materials were applied together by architects and users were set free to practice both at spaces that they were free to interfere.

4.3.Sustainable Housing

Architects: Tatiana Bilbao ESTUDIO
Category: Affordable Housing
Area: 43 sq. meters per residence (without expansions)
Project Year: 2015
Location: Mexico (Country)

Figure 4.9. One prototype of Sustainable Housing with timber additions made by users and concrete part denotes the core house designed by architect (Frearson, 2015)

Sustainable Housing is an incremental affordable housing project which was exhibited as a prototype in Chicago Architecture Biennial 2015. Its built samples are located only in Mexico since the project was specially and only designed as a response to housing crisis in Mexico (country) (Bilbao & Keskeys, 2017). The project is described as follows (Bilbao & Keskeys, 2017):

> For eight years, we've been doing a lot of research on how affordable housing is being introduced in Mexico. However, it's a different type of housing than that which we were focusing on because we were researching affordable housing for people that have unemployment. In Mexico, it's called social housing. This house, on the other hand, targets people that have very low salaries, but they do have a salary. They have an employment, which is not

> the case with a major part of the population. With this program, people have to own the land.

In addition to the description above, it is told that “the house model was commissioned by Mexico's government as part of a program that helps people with low incomes to buy their own house, by subsidizing half the cost and offering the rest as credit” (Frearson, 2015). Those show that Bilbao designed the project to propose a low-cost housing option in Mexico only.

About Bilbao’s proposal, it is told that “the house model was commissioned by Mexico's government as part of a program that helps people with low incomes to buy their own house, by subsidizing half the cost and offering the rest as credit” (Frearson, 2015). This statement indicates that the project contains specialties of incremental housing as the architect submitted a core structure and provided the opportunity for dwellers to make additions.

The major cause why the architect ended up with designing the project as an affordable housing prototype can be observed below:

> In Mexico, there are more than 30 million houses all over the country, but with a total population of about 120 million, and with one of the fastest population growth rates in Latin America, the housing shortage constitutes a total of 9 million homes (Cruz, 2015).

The information above demonstrates that the project was designed upon the intention of providing citizens of Mexico with an incremental affordable housing option as one single house was expected to be constructed by affording “as little as $8,000” (Bilbao & Keskeys, 2017).

Referring to one single standard house of the project, it is told that “the building has a rigid core of concrete blocks, while its surrounding rooms are made of modules of more lightweight materials such as wooden pallets” (Frearson, 2015).

To summarize, the project was designed in order to create a new incremental affordable housing opportunity for citizens only in Mexico (country) due to

inadequate housing capacity and poor economic conditions. Except designing and submitting a core structure, architects left the rest referring to making additions (adding spaces) and customization to users which indicates advent of flexibility.

4.3.1. Use

4.3.1.1.Use at Building Level

In use at building level, the examination is conducted to explore if the architect had any other building program except housing in her mind during the design process or not. It is said that the project was designed as a response to low-cost housing crisis in Mexico with the aim of helping Mexicans reduce building costs in terms of housing (Bilbao & Keskeys, 2017). Bilbao (personal communication, 2019) explicitly told that except focusing on the program, low-cost housing especially, she had no other building program image in her mind.

4.3.1.2.Use at Unit Level

In use at unit level, the study is carried out so as to explore if each single house could enable divergent dwelling styles or not (e.g. a couple without kids or a family with 2 kids, or a residence with an additional dining room or another one with an extra living room, etc.). It is expressed that in any single house, at the “first phase”, there were “two bedrooms, one bathroom, one kitchen and a five-metre-high living and dining space”, and it was possible to add five extra spaces at maximum (Frearson, 2015). It is told by the architect that because spaces belonging to first phase were condensed and placed around a center in the middle and the most interior parts, extra spaces were expected to be added from outer sides and due to the cause, they could be both outdoor or indoor spaces that can contribute to diversity among residences (Bilbao, personal communication, 2019) (see Figure 4.10.).

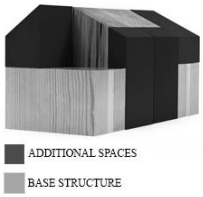


Figure 4.10. Expansions and base structure in Sustainable Housing (Cruz, 2015)

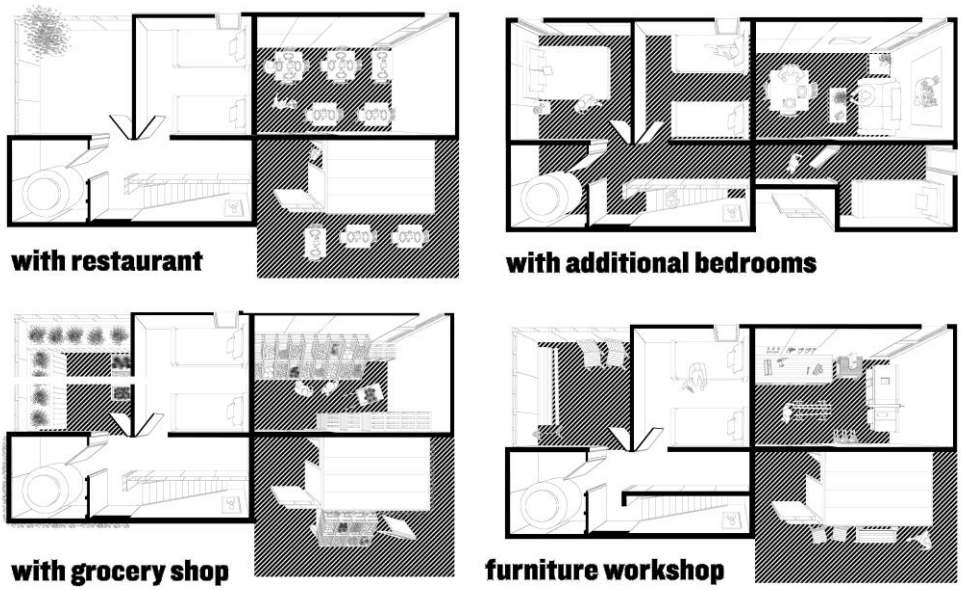


Figure 4.11. Miscellaneous functions accompanying housing program (Cruz, 2015)

In Figure 4.11., diverse scenarios accompany the major building program, housing. The restaurant, for example, is just one part of the major building program which shows that the whole building itself does not function as a restaurant. This can be given as the reason why at building level, a single unit cannot totally operate in form of another building program like restaurant.

4.3.1.3.Use at Room Level

In use at room level, it is aimed to detect if rooms in each residence owned specially designed furniture that could be used for multifunctions or not. At at room level, no special furniture was devised with a built-in mechanism or in a mobile state (Bilbao, personal communication, 2019). This indicates that the architect is not empowered

to retain control in rooms as the architect's impact is more observable in forms of the base structure referring to the core house.

4.3.2. Plan

4.3.2.1.Plan at Building Level

It is stated that each residence was designed as a separate single house (Bilbao, personal communication, 2019). Thus, no common space (communal circulation or slack spaces) between houses exists since the whole proposal does not offer juxtaposition of multiple housing units as each residence was expected to dwell on its own alone in different sites.

The project is an affordable housing proposal and inhabitants were not only expected to pay back half of the cost, yet they were unrestricted to add extra spaces which were likely to be composed of lightweight structures (Bilbao and Keskeys, 2017). Thus, it is possible to make vertical and horizontal additions by occupants (the system allows expansions in both directions).

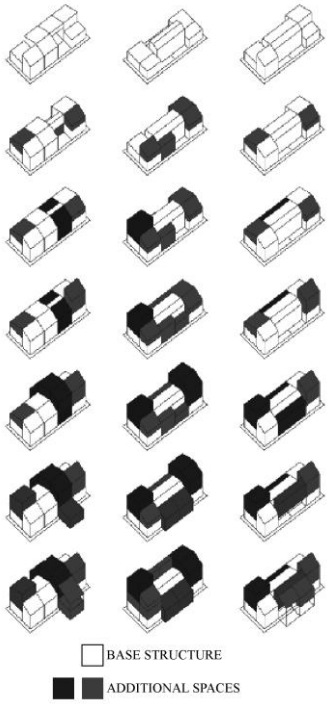


Figure 4.12. Multiple scenarios in Sustainable Housing with diversified additions (Cruz, 2015)

In Figure 4.12., both vertical and horizontal additions made on various base structures can be seen. As detectable in Figure 4.11., these additions could be indoor or outdoor spaces ending up with the position that multiple varied operations can be assigned for each residence such as an atelier (an indoor space) or a garden (an outdoor space).

4.3.2.2.Plan at Unit Level

In Figure 4.11. the same room was illustrated by the architect in which it could operate as dining hall of a restaurant, grocery shop or furniture workshop. This shows that functionally neutral rooms were implemented since the same space was out of one single definite function.

The architect placed one or multiple terrace(s) in divergent prototypes in which she also illustrated them as converted spaces (see Figure 4.13.). This shows that those terraces were raw spaces which could be transformed into any type of space (indoor/

outdoor, garden/bedroom, etc.) by occupants. In Figure 4.13., conversion of the terrace on first floor in which it was turned into an indoor space can be observed.

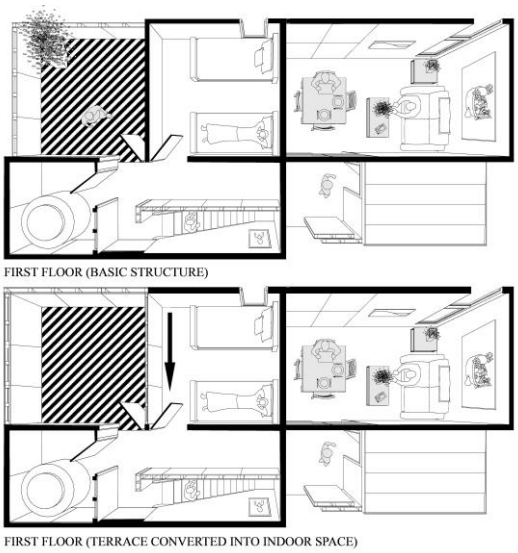


Figure 4.13. Two first floor options with the basic structure and transformed raw space (Cruz, 2015)

Transformation of and assignment of function to the terrace were dependent on wills and affordability level (financial status) of residents (Bilbao, personal communication, 2019).

Taking a look at floor plans, it is observable that service spaces were arranged on a linear path in which only the entrance hall was positioned between them. This indicates that the remaining spaces except the entrance hall are free from limitations which could have been occurred due to service spaces. However, because the project is composed of separate single houses, it is impossible to make mention of condensed service core since service spaces of multiple houses did not stand side by side.

Similar to plan at building level, as all housing units were determined to operate on their own, there was no large circulation areas, joinable and divisible housing units and shared room between distinct residences since all of them were independent single houses.

4.3.2.3.Plan at Room Level

One material option in terms of additional spaces was light materials such as wooden pallets (Frearson, 2015). By utilization of them in ground floor for instance, two adjacent rooms can be linked, yet it is dependent on the authority of user, and they were not placed in the original proposal (Bilbao, personal communication, 2019). This can be interpreted as the possible acquisition of connection between rooms, movable/sliding walls or divisible rooms dependent on resident will (see Figure 4.14.).

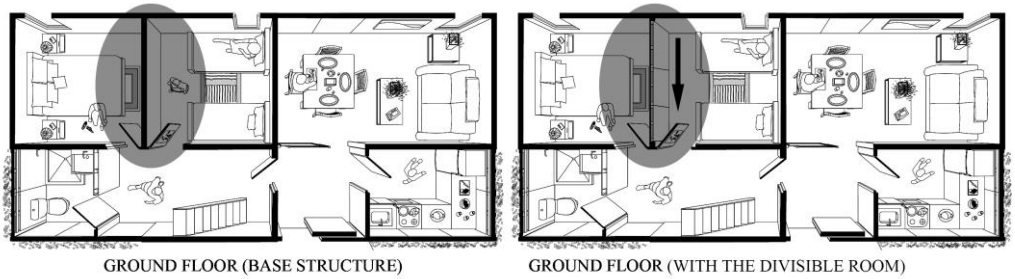


Figure 4.14. States of ground floor in base structure and modified structure in Sustainable Housing (Cruz, 2015)

The architect explains that she did not take action with regard to determination of furnishing, and owing to the ground, she did not design special kind of furnishing elements (Bilbao, personal communication, 2019). This denotes lack of foldable furniture.

4.3.3. Construction

In construction, the examination is conducted to observe to what extent the constructional decisions made by the architect provides flexibility and if users own the opportunity of interference.

Residences were built with rigid cores made of concrete blocks, whereas surrounding spaces that were expected to be added by users could be comprised of lighter and cheaper materials like wood pallets (Frearson, 2015). About materials, “by using a variety of materials and spatial layouts”, houses could be modified so that they could

“suit the variety of climates around the country” (Frearson, 2015). This signifies that constructional materials could be divergent to promote flexibility as light materials could be removed and inserted easily and inexpensively. Utilization of concrete blocks during formation of rigid cores and wood pallets at additional spaces show that unconventional and conventional materials were applied together respectively. Users were free to utilize both conventional and unconventional building methods and materials to construct their own extra spaces in their residences. In conclusion, unconventional building methods and materials were applied by the architect (concrete shear walled frame system) and residents were free to use both unconventional and conventional ones.

In order to prevent the situation in which future additions cannot be made by occupants due to constraints caused by load-bearing elements, which were concrete blocks, they were positioned near the center as close as possible so that newly added spaces could be expanded without disconnections such as small spans (Bilbao, personal communication, 2019). This indicates that collecting all load-bearing elements around a central core can rocket the rate of flexibility since beyond the core stands free from limits like presence of spaces with posts inside. However, in the project, because load-bearing elements possess a central organization in form of a structural (load-bearing) core element, additional spaces are free from them.

4.3.4. Services

In services, the study aims to analyze to what extent occupants are empowered to intervene in service spaces, whether service spaces were specially located for future interference in other spaces and if service elements can be easily modified or not. In order to let users modify remaining spaces, service spaces (bathroom and kitchen) were only placed on ground floor on a linear path in which only the entrance hall was positioned between them (Frearson, 2015) (see Figure 4.15). Via the linear organization of service spaces, it is possible to unite or divide remaining spaces

which can be depicted as achievement of flexibility. Last but not least, it is pointed out that locations of service spaces were static (Frearson, 2015).

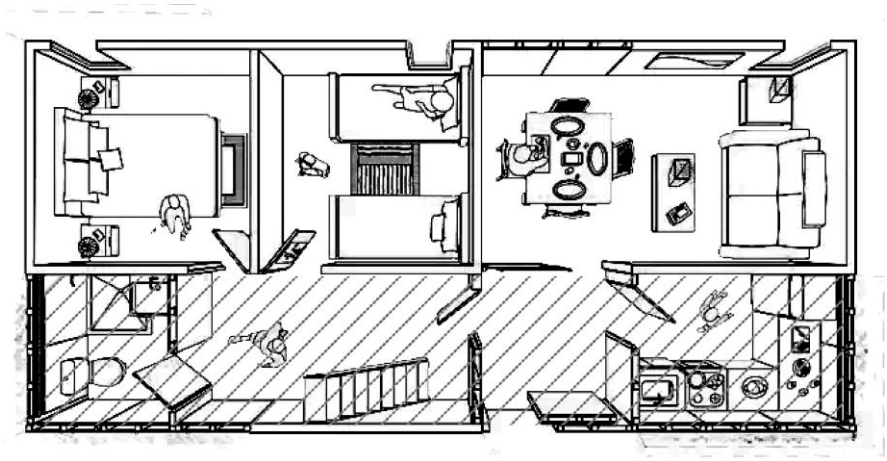


Figure 4.15. Ground floor in Sustainable Housing (Cruz, 2015)

In Figure 4.15., the linear path that service spaces were located on so as to set remaining spaces free from constraints that would have been caused by static service cores can be observed.

4.3.5. Evaluation of Sustainable Housing

About rate of user participation and empowerment of architect, the project starts with a “first phase” composed of a “core” and “surrounding rooms” which were “two bedrooms, one bathroom, one kitchen and a five-metre-high living and dining space” in which adding maximum 5 more spaces was possible (Frearson, 2015). The “first phase” was designed by the architect without participation of user which can be interpreted as a basic structure (core house), and adding 5 more space at maximum was dependent of inhabitants with regard to their functions, sizes and materials. Thus, it is concluded that both user participation and empowerment of architect took place.

About individual and communal spaces, it is observed that the proposal was out of a multi-residential organization. This shows each single house was expected to operate on its own alone at separate lands so there was explicit emphasis on individual

spaces. However, the architect remarks that if owners of separate dwellings deal with each other, then multiple residences could be erected next to each other to form a multi-residential complex. This signifies that occurrence of communal spaces is possible (Bilbao, personal communication, 2019).

About building methods and materials, Frearson (2015) tells that “rigid core of concrete blocks” were applied with regard to the “first phase” by the architect whereas users were predicted to make use of “more lightweight materials such as wooden pallets” while expanding their dwellings. Thus, it is deduced that conventional and unconventional building tools could be practiced together.

4.4.Plugin Tower

Architects: People's Architecture Office (PAO)
Category: Houses
Area: - (Modular structure without a basic core and a definite floor area)
Project Year: 2016
Location: China

Plugin Tower is a housing project designed as a response to critical housing policy in China where citizens were unable to own their land and property, showing they might had to leave the land that they had been residing on one day since the actual owner was the Chinese Government (Mok, 2016). The project is described as follows:

> Houses don't necessarily need to be permanent structures with foundations to be considered 'home', nor do they need to be dilapidated shacks if they are constructed as temporary buildings. Exploring the future of the residential building industry in China, Beijing-based design firm People's Architecture Office (PAO) created this Plugin Tower using a modular kit-of-parts that allows inhabitants to build their own homes easily, and to disassemble them quickly when needed.
> ... Plugin Tower is designed as a prefabricated system that includes a steel space frame, which can be adapted to different contexts, all without the need for a foundation (Mok, 2016).

The architects did not just make a moveable housing project, yet they combined it with principles of flexible housing as it is also called a “multistory prefab system” which was “infinitely expandable” ("Plugin Tower", 2016).

Figure 4.16. Two separate Plugin Tower proposals formed by various user groups via PAO’s system (People's Architecture Office, 2016)

4.4.1. Use

4.4.1.1.Use at Building Level

In use at building level, the analysis is made to detect if architects had another building program except housing in their minds or not.

The project was designed with the aim of providing citizens in China with an alternative mobile housing unit (Mok, 2016). However, architects did not constrain the scope of the proposal with only housing as in 2017, in Beijing, a project of PAO entitled “Lakeside Plugin Tower”, was erected. The project is composed of a cafeteria, a suit room, an office and an exhibition hall (People's Architecture Office, 2019) (see Figure 4.17.). This project signifies that during the design process, architects did not limit themselves with housing program and they designed the modules in which they included numerous building programs.

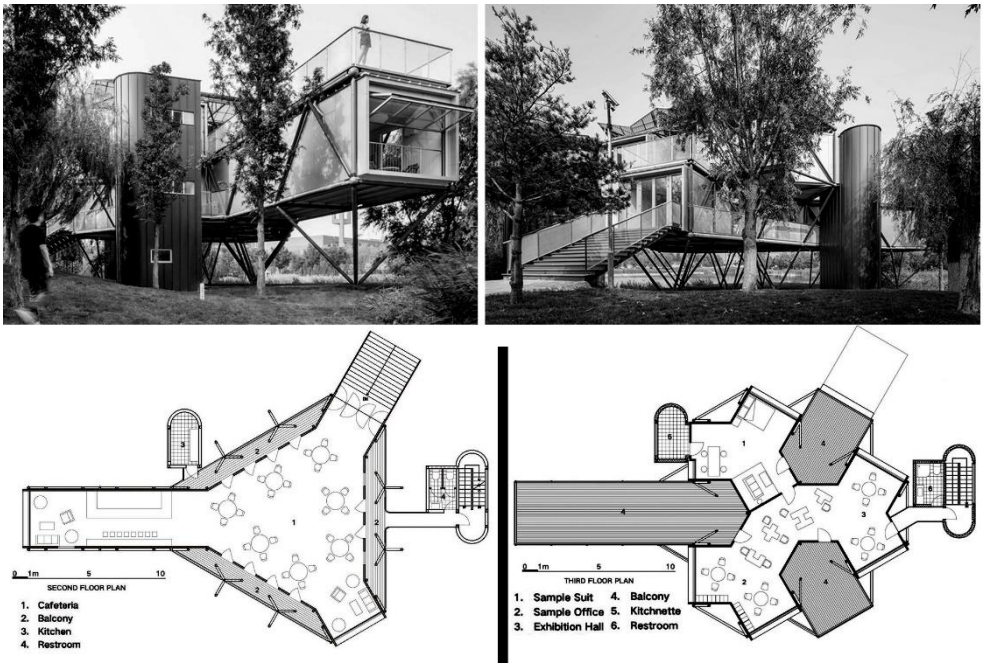


Figure 4.17. Lakeside Plugin Tower (People's Architecture Office, 2019)

The whole project was comprised of moveable single houses when it was first introduced (PAO, personal communication, 2019). This shows no multi-residential block was ever constructed, and it can be concluded that for Plugin Tower, a building was equivalent to a single house when it was first introduced in 2016 (before introduction of Lakeside Plugin Tower).

4.4.1.2.Use at Unit Level

In use at unit level, it is aimed to explore if each single house could provide various dwelling styles or not (e.g. a couple without kids or a family with 2 children, or a residence with an additional dining room or another one with an extra living room, etc.). It is explained that in the beginning, each house was predicted to possess a "double-height lounge and kitchen, roof deck, and glazing for natural daylight" and "a composting toilet and shower" (Owano, 2016). Nevertheless, those elements would only be common components of every residence, and the quantity as well as position of remaining spaces. Expansions were possible since "modules can be

plugged into or out of empty spaces within the frame whenever needed" (Mok, 2016). This shows that a housing unit might hold two bedrooms whereas another one may own 3 bedrooms and a small atelier for instance (see Figure 4.18.)

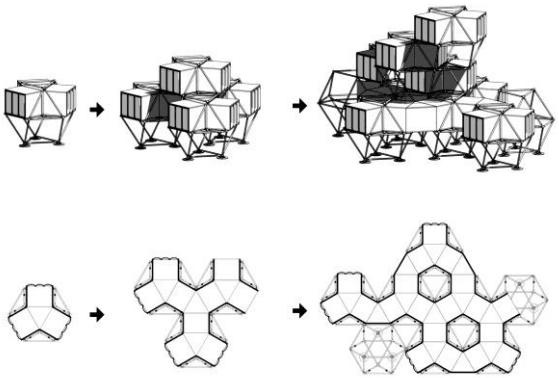


Figure 4.18. Diverse residence options in Plugin Tower (People's Architecture Office, 2016)

In Figure 4.18., diverse residences with differing sizes can be observed and each script can be converted into another or transferred to a new location. For instance, an alternative which is composed of 3 modules can be transformed into a new option with 8 modules and this cycle can be endless. There was possibility of infinite expansion for each residence (Mok, 2016). To conclude, at unit level, various types of compositions can be obtained which creates diversity.

4.4.1.3.Use at Room Level

In use at room level, the aim is to test if there was specially designed furnishing element with multifunctions or not in modules. It is remarked that architects designed toilet and shower especially with a composting system (Owano, 2016), yet architects explain that except designing miscellaneous modules with different dimensions, they did not design anything more (PAO, personal communication, 2019). This indicates non-existence of specially designed furniture. Nonetheless, modules were free from definite functions (PAO, personal communication, 2019). This signifies that architects did not assign pre-determined functions for modules as users were free to determine functions of each module.

4.4.2. Plan

4.4.2.1.Plan at Building Level

Designers explicitly state that they evaluated all housing units to operate on their own as they designed the original prototype in a single house state (PAO, personal communication, 2019). This demonstrates that communal circulation and slack spaces were not practiced.

The project owns the ability to expand infinitely via addition of new modules (Mok, 2016). This shows that horizontal and vertical additions were included (see Figure 4.19.).

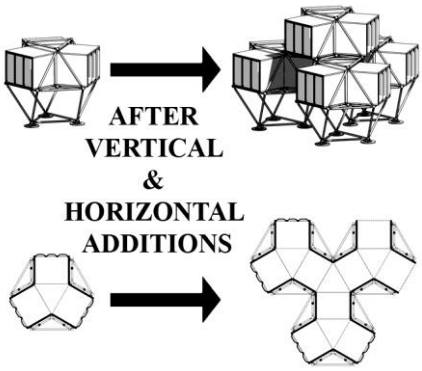


Figure 4.19. Vertical & horizontal additions in Plugin Tower (People's Architecture Office, 2016)

4.4.2.2.Plan at Unit Level

In plan at unit level, it is searched if one or more than one of the following exists: Functionally neutral rooms, large circulation areas, joinable and divisible units, shared room, condensed service core or raw spaces.

Architects only designed modules and did not present spaces with definite boundaries (PAO, personal communication, 2019). This shows that architects did not design rooms, and thus, there was inexistence of functionally neutral rooms since no formation existed that could be called a room.

Raw spaces were formed via assembled modules in the project. Except designing modules at varied scales, architects did not present anything more as architects did not decide functions of those modules and left the occupation of assigning functions to dwellers (PAO, personal communication, 2019).

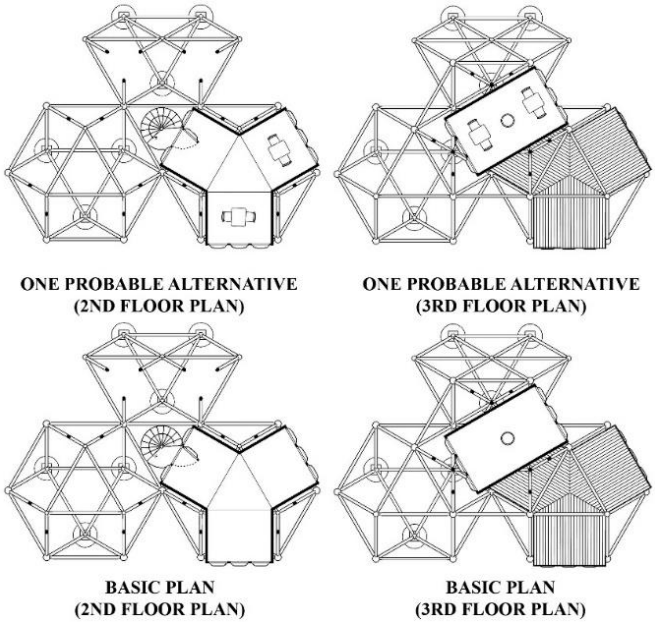


Figure 4.20. Basic and possible plan options in Plugin Tower (People's Architecture Office, 2016)

In Figure 4.20., raw spaces in assembled modules with differing dimensions filled with proposals of architects can be realized. Each module is out of a definite function and out of interior separator walls as in Figure 4.20., the furnishing was drawn just as a suggestion as told by architects (PAO, personal communication, 2019).

The project is out of interior dividing walls (PAO, personal communication, 2019). This can be given as the reason why shared room, joinable/divisible units and condensed service core were excluded.

Rather than splitting spaces with corridor-like circulation tools and interior separator walls, architects expected users to add new modules to take care (PAO, personal communication, 2019). This can be given as the case why no corridor-like large circulation area stands in the project.

4.4.2.3.Plan at Room Level

In plan at room level, the research is done to observe presence of connection between rooms, foldable furniture, movable/sliding walls or divisible rooms.

Except designing the modules (their sizes, material, size and location of openings, etc.), and the system which was about assembling and disassembling multiple modules, architects did not authorize themselves in anything more (PAO, personal communication, 2019). This demonstrates that special furniture was not devised by architects.

PAO (personal communication, 2019) says that when one vast space needed to be divided into multiple smaller spaces, rather than placing moveable dividers such as sliding walls, architects expected occupants to add one more module and they illustrated the situation as follows: A large module which was adequately spacious to include two separate bedrooms could be replaced with two smaller modules, or the big module could operate as one broad bedroom only since the project was out of interior dividing walls. Due to the cause, it can be said that the project lacks movable/sliding walls or divisible rooms.

No horizontal circulation space was designed (PAO, personal communication, 2019). Because those elements such as corridors serve as buffer zones that split spaces from each other, instead of them, the tactic which was about adding new spaces in form of modules was offered (PAO, personal communication, 2019). Since there is direct relation between modules that are assembled similar to open kitchen and living room model, it is concluded that there is neither disconnection nor connection between rooms as there is direct contact which can be interpreted as more than connection.

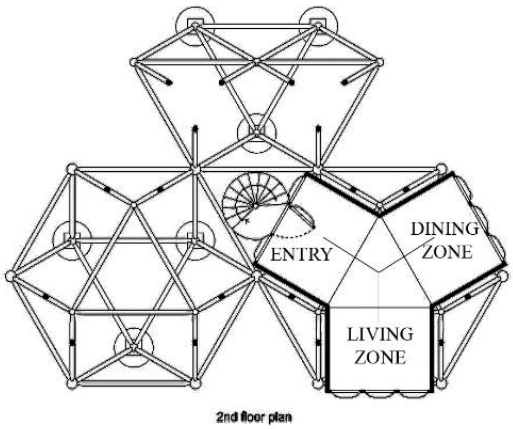


Figure 4.21. Direct contact between zones in Plugin Tower (People's Architecture Office, 2016)

4.4.3. Construction

In construction, it is searched to what extent the constructional decisions made by designers provide flexibility and if residents have the chance of intervention. Related to construction features of the project, a depiction can be observed below:

> ... Residents can pack up their homes and bring it with them if they are ever forced to relocate. Classified as a temporary structure, the Plugin Tower does not require an underground foundation, thereby circumventing the strict planning approval for permanent structures and easing the requirements for building a private house. A multistory prefab system is infinitely expandable.
> ...Units are made with PAO's proprietary Plugin Panel system, modules that incorporate insulation, wiring, plumbing, interior and exterior finishes into one molded part
> ...Plugin Panels allow living spaces to be added without heavy machinery, and does not restrict their layouts to the shape of a box ("Plugin Tower / People's Architecture Office", 2016).

It is clear that the proposal is comprised of a totally moveable housing prototype as it lacked permanent foundations. Nevertheless, rather than transporting the project in its house state with welded modules, it was determined to be conveyed in form of disassembled modules (PAO, personal communication, 2019).

Since components were prefabricated modules, the project lacked static load-bearing elements such as posts and beams, and it held a special unique construction system which belonged to architectural firm ("Plugin Tower / People's Architecture Office",

2016). Load-bearing elements can be clarified as linear steel sticks. Architects tell that those sticks can be combined both in orthogonal and angular positions in a variety of options so as to obtain different types of structural frames that modules were assembled (PAO, personal communication, 2019). This can be interpreted as achievement of flexibility in terms of construction because when structural frames end up with diversity, spatial organizations which denote positioning of modules for this project, also varies.

About building methods and materials, architects state that they introduced a framework composed of steel bars sticking to each other diagonally and modules were made of composite materials to withstand natural conditions for longer periods (PAO, personal communication, 2019). This demonstrates that unconventional building methods and materials were used.

4.4.4. Services

In services, the analysis is conducted to observe to what extent dwellers are authorized to interfere in service spaces, whether service spaces were specially located for future interference of inhabitants and if service elements are easily modifiable or not.

“A composting toilet and shower” and a “kitchen” modules were added by architects (Owano, 2016). Architects designed two of the modules in form of a bathroom and a kitchen in which they expected users to place them on the ground level so as to ease evacuation of wastes and form a beneficial composting system (PAO, personal communication, 2019).

About servicing elements except spaces, “modules carry insulation, interior and exterior finish, wiring and plumbing— all squeezed into one molded part” (Owen, 2016). This indicates that each module owned its servicing utensils in one definite part.

To assess, on one hand, service spaces and elements were not designed in a flexible manner as their positions for example were determined by architects only. On the other hand, architects specify that by making decisions about service tools, any remaining organization such as the way components of structural frame is merged or modules are arranged is left to will of users (PAO, personal communication, 2019), which can be interpreted as accomplishment of flexibility.

4.4.5. Evaluation of Plugin Tower

About rate of user participation and empowerment of architect, except determining functions of service and sizes of every module and designing the space frame structure, architects did not present anything more. This shows that how modules would be merged, which modules would be utilized, which operations would be assigned to modules, etc. were left to user wills. Thus, both user participation and empowerment of architect took place.

About individual and communal spaces, architects did not design the project as a mass housing complex, but instead, they forecast each residence to be situated at divergent lands. Multiple houses could be built together if owners of separate residences deal with each other, yet in their original proposition, architeccts did not present a scheme in which multiple residences were positioned side by side. In conclusion, individual space was explicitly included by architects and inclusion of communal spaces were dependent on users in the first proposal of the project.

About building methods and materials, PAO (personal communication, 2019) remarks that they did not limit themselves with utilization of local materials and building methods. Introduction of a specially developed space frame made of steel sticks shows that unconventional methods and materials were applied.

CHAPTER 5

COMPARISON AND CONCLUSION

In this chapter, depending on historical background of flexible dwelling and examination of the case studies (Villa Verde, Sustainable Housing, Plugin Tower) in CHAPTER 3 and CHAPTER 4 respectively, it is aimed to observe what is new and customary with flexible housing in current practice. Comparisons are made in terms of rate of user participation and empowerment of architect, individual and communal spaces, conventionality and novelty of building methods and materials respectively.

5.1.Rate of User Participation and Empowerment of Architect

5.1.1. Comparison of Flexible Housing during the Interwar Period and the Case Studies

During the Interwar Period, introduced several examples were Maisons Loucheur, Drehbühne, Schröder House, Weissenhofsiedlung, Haus Auerbach, and Core House.

In Maisons Loucheur, Drehbühne, and Schröder House, there was built-in furniture such as sliding interior panels used for dividing or joining spaces within the same dwelling which were controlled by architects, and user participation was excluded. On the contrary, in the case studies, no built-in furniture was placed by architects, and active user participation was explicitly included by architects.

In Weissenhofsiedlung, participation of multiple architects took place by the leading architect of the project, and typological variety occured due to different rates of authorizations of architects, but user participation was excluded unlike the case studies.

In Haus Auerbach, Gropius and Meyer prepared typologically varied housing options by making numeorous combinations with use of prefabricated components, yet they decided on one option in the end, and omitted user participation unlike the case studies.

In Core House, Mies proposed various interior use options himself, and he expected users to choose one of them, or convert the interior layout into other options of him, showing that users were not permitted to compose their own interior use scenarios, indicating that user participation was included differently than the case studies.

In conclusion, it is inferred that during the Interwar Period, there were projects in which user participation was excluded unlike the case studies.

5.1.2. Comparison of Flexible Housing during post-WW2 and the Case Studies

In the case studies, active user participation is explicitly included. Among the case studies, in Villa Verde and Sustainable Housing, core housing was explicitly practiced. In those two, the core house parts accounted for the static frameworks while voids or free spaces open to user participation made up dynamic components that underwent customization. Thus, those two are most relatable and comparable with the previously described core housing projects. In Plugin Tower, the idea, insertion of capsules into a framework, was implemented, and it was accompanied by user participation. Therefore, it is relatable and comparable with the previously defined adjustable dwellings combined with support structures.

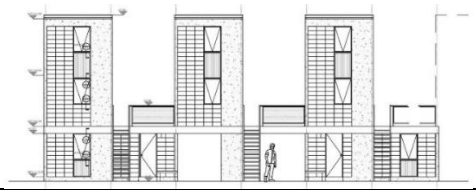
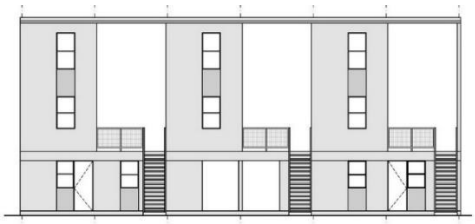
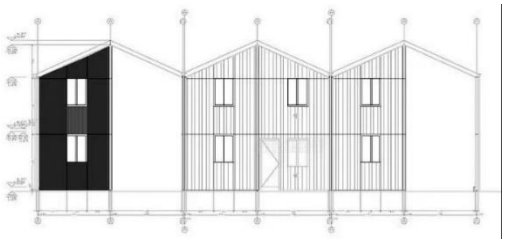
5.1.2.1. Comparison of Villa Verde

Villa Verde is comparable with Aranya Low-Cost Housing, Belapur Incremental Housing, Quinta Monroy, Monterrey Housing, and Donnybrook Quarter.

Similar to Quinta Monroy and Monterrey Housing, there was strict repetition of one single core house option with one single orientation in Villa Verde. Thus, at front facades of those projects, the viewer would see a repetitious and monotous facade in

these projects without typological variety before user participation (see Table 5.1.). In the Elemental's projects, unlike Aranya and Belapur cases, half house views are strictly apparent which makes the viewer think that half house was the main instructive tool of architects while making form decisions. Contrarily, in Aranya, Belapur, and Donnybrook cases, half house views are more blurred, and it is hard to detect them in post-habitation stages unlike the Elemental's projects.

Table 5.1. Facade comparisons of Elemental's projects (by the author)

Quinta Monroy (before user participation)	
Monterrey Housing (before user participation)	
Villa Verde (units on the left and right denote before user participation, and the middle one shows one possible post-habitation sample)	 ("Gallery Of Villa Verde Housing / Elemental - 25", 2013)

In Elemental's projects, each project had its own monotonously repeating facade views in pre-occupation phase. However, even in that stage, it is visible that architects adopted different rates of authorities in different projects. Staying within borders after making spatial additions was a must in each of them. However, in Monterrey case, housing blocks were framed with a comprehensive flat roof slab on the top, explicitly putting emphasis on the obligation that users had to stay within borders of their own dwellings even after making additions. In Villa Verde Housing,

voids were restrained with angular roof slabs similarly, yet each void was as spacious as its half house part compared to Monterrey case. Unlike Monterrey and Villa Verde cases, Quinta Monroy was free from a limiter like those void-constraining roof slabs.

In terms of colors, vivid orange was chosen as the major facade color that the core houses had in Villa Verde, whereas in Quinta Monroy, orange was replaced with multiple pale yellow tones, and in Monterrey Housing, pure white was the only major color. This shows that with regard to facade colors, in Monterrey Housing, Elemental preferred the most neutral option, white, which can be interpreted as an alternative that imposed on users nothing since it was like a tabula rasa, waiting for being dyed and then customized more massively in a way, while in the other two projects, color choices were not that neutral (yellow shades and vivid orange) which can be interpreted as more instructive alternatives compared to white.

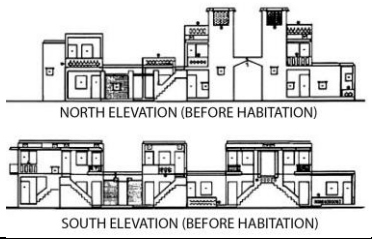
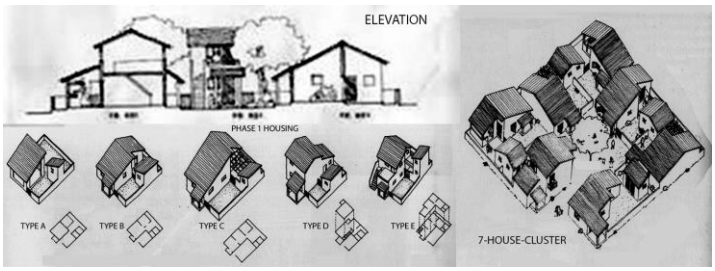
During the post-habitation stages, as each user of each dwelling customized his/her home arbitrarily, a great typological variety occurred. However, because one single housing option was devised for each housing project, there was an apparent visual segration of core houses from the future-added parts (see Table 5.2.).

Table 5.2. Facade comparisons of Elemental's projects during post-habitation (by the author)

Quinta Monroy (post-user participation)	 ("Gallery Of Quinta Monroy / Elemental - 14", 2008)
Monterrey Housing (post-user participation)	 ("Gallery Of Monterrey Housing / Elemental - 13", 2010)
Villa Verde (post-user participation)	 ("Gallery Of Villa Verde Housing / Elemental - 36", 2013)

In Aranya, Belapur and Donnybrook cases, within each project, even in the beginning, multiple core house options were proposed. For instance, in Belapur case, five core house options (type a, b, c, d, e) were developed by the architect. In those projects, even the same core house options were situated differently in which they held different orientations (e.g. in Belapur case, two samples of type a units could be juxtaposed, but one of them could have its entrace located in the east whereas that of the other could be in the south). Juxtaposition of different core house options also contributed to rise of greatly varied facade views in those projects, too. Therefore, in contrast to the Elemental's projects, those three cases were different as they lacked rigidly repeating and totally identical half houses (see Table 5.3.).

Table 5.3. Core houses with typologially varied facade views (by the author)

Aranya Low-Cost Housing (before habitation)	
Belapur Incremental Housing (before habitation)	 (Khan, 1987)
Donnybrook Quarter (before habitation)	

In Aranya, Belapur and Donnybrook cases, similar to the Elemental's projects, during post-habitation, different user profiles customized their dwellings uniquely

and arbitrarily, resulting in much greater and typologically varied form compositions and therefore, facade views.

In terms of states of future additions left to users, both in the Elemental's projects, Aranya, Belapur and Donnybrook cases, voids with definite boundaries were allocated as rectangular prisms, showing that in each of them, architects set users free at spatial additions, yet they put definite limits and decided shapes of future additions themselves.

With regard to form decisions, in Aranya case, there is strong reference to vernacular architecture as there are tower-like masses connected to each other via bridge like formations, gate-like voids under those bridge-like structures, vernacular style perforated handrails and windows, vernacular style convex and concave masses (see Table 5.4.). In Belapur case, utilization of vernacular forms is not that evident, yet there is a stronger reference to vernacular slum and housing typology (vernacular style cladded roofs, hipped roofs reminding the local climatic conditions of the region, etc.) (see Table 5.4.). In Donnybrook Quarter, utilization of pure white color, non-ornamented facades and flat roof denote strong similarity with Monterrey Housing among the Elemental's projects.

Table 5.4. Reference to regional architecture in Aranya and Belapur cases (by the author)

Aranya Low-Cost Housing	 (Ekram, 1995)
Belapur Incremental Housing	 (Khan, 1987)

To sum up, Villa Verde is most similar to Quinta Monroy and Monterrey Housing with its rigid and monotonous facade, one single core house option, neutral choices of architects (no ornaments), and different than Aranya, Belapur and Donnybrook cases since those three had varied facade views, multiple core house options, and Aranya and Belapur cases hosted much stronger reference to regional architecture.

5.1.2.2.Comparison of Sustainable Housing

Sustainable Housing is also a core house proposal. It is comparable with Aranya Low-Cost Housing, Belapur Incremental Housing, Quinta Monroy, Monterrey Housing and Villa Verde.

Sustainable Housing is different than those comparable projects for two reasons. First of all, samples of Sustainable Housing were planned to be erected in sites where users could make expansions beyond boundaries of their dwellings. Thus, unlike comparable projects, it was not a must for users to stay within borders of their dwellings in terms of making spatial expansions. Secondly, unlike comparable projects, there was no neighborhood-like formation in Sustainable Housing as each house was planned to be built at separate lands on their own alone. Sustainable Housing lacked convention spaces unlike comparable projects. For instance, in Aranya case, there was public convention spaces around the middle of the whole complex (stadium, school, basic shopping facilities, etc.), and it was similar in other comparable projects. However, in Sustainable Housing, only single houses were included.

With regard to facade view and outlook, there were multiple core house options in Sustainable Housing. As there was variation among samples of different core house options in Sustainable Housing, it was similar to Aranya, Belapur and Donnybrook cases, and different that the Elemental's projects. The architects did not choose one definite color for facades in Sustainable Housing's core houses, indicating that core houses could be multi-colored.

In terms of form decisions, common properties among different options in Sustainable Housing can be found. Each option was designed in cubic forms without ornaments, showing that Sustainable Housing was similar to the Elemental's projects and Donnybrook case, and different than Aranya and Belapur case on that issue. In Sustainable Housing, although the architects set users free in making spatial additions, voids were previously designed by the architects in a way that it became a must to make spatial additions in form of rectangular forms. At this point, Sustainable Housing is similar to all comparable projects, because in all of them, voids were allocated in form of rectangular prisms.

5.1.2.3.Comparison of Plugin Tower

In Plugin Tower, there were modules with the ability of plugging into and out from a framework. It is comparable with Unité d'Habitation, Plug-in City, Nakagin Capsule Tower and Resi-Rise.

In the initial phases of Plugin Tower, the architects only focused on the building program, housing, and prepared prefabricated modules appropriate to housing. However, the project has undergone development which ended up with emergence of modules related to other building programs as well (see Lakeside Plugin Tower). On that issue, Plugin Tower resembles Unité d'Habitation and Plug-in City as those three included multiple housing programs, and it is different than Nakagin Capsule Tower and Resi-Rise since those two only included podiums as communal spaces.

With regard to mobility, Plugin Tower was designed as a totally moveable housing proposal (in disassembled modules state, not in the assembled house state), making it different than comparable projects as they were planned to have rigid frameworks which were not moveable. However, among comparable projects, only in Plug-in City, the unmoveable framework contained moveable tools such as conveyors that could be used to replace obsolete units, and other comparable projects such as Unité d'Habitation held totally rigid and static frameworks.

In terms of rate of user participation and empowerment of architect, in Plugin Tower, it is observable that user participation was included under architect's authority, because even though users were free to utilize the modules they wanted (in terms of number, the way how they would be merged, etc.), they had to use the modules that were specially devised by the architects only. The situation was similar in Unité d'Habitation and Nakagin Capsule Tower. In those two projects, architects prepared various scenarios and apartment options themselves that were expected to be chosen by different user profiles, which means user participation would be limited with making a selection among various apartments designed by the architect. Contrarily, unlike Plugin Tower, in Plug-in City and Resi-Rise, especially interior layouts were totally dependent on user wills and users could come with their own – externally designed capsules (apartments) respectively.

Table 5.5. States of projects before and after user participation (by the author)

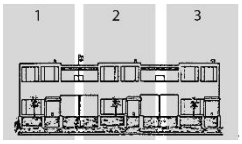
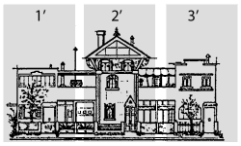
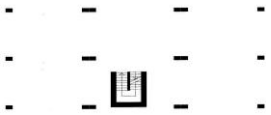
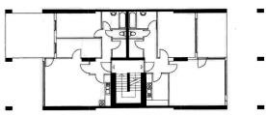
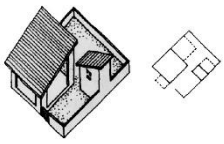
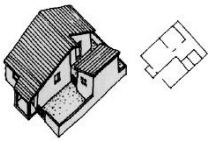
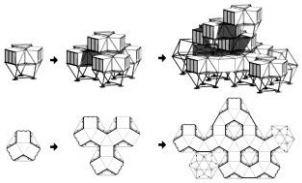
Exemplars	Before User Participation	After User Participation
+Pessac Residences		
+SAR		
+Belapur Incremental Housing		

Table 5.5. (continued)

+Quinta Monroy		
+Monterrey Housing		
+Villa Verde		
+Sustainable Housing	 (Frearson, 2015)	
+Plugin Tower		

5.2.Individual and Communal Spaces

In terms of individual and communal spaces, core (incremental) housing projects including Villa Verde and Sustainable Housing, and adjustable dwellings combined with support structures including Plugin Tower, are compared within their own categories.

Similar to Aranya case, in Villa Verde, the major building program was housing, and it was accompanied by various urban services and other building programs (e.g. basic shopping centers, stadium, etc.). However, Aranya case owned much greater scale, and in addition to single houses, it held flats, too, whereas in Villa Verde, no flats existed. On the issue of individual and communal spaces, those two were similar as there were both private spaces (dwellings) and public spaces (recreational zones).

In remaining core housing projects, only housing program was practiced and it was accompanied by open air convention spaces, indicating that individual units and communal spaces were included in each of them. However, in Sustainable Housing, no gathering space was included either. On the contrary, in Belapur, Quinta Monroy, Monterrey and Donnybrook cases, there were gathering spaces without definite functions designed for use of multiple houses.

In Porres Enclave, Turner only included communal space in his project as he envisioned dwelling exhange between dwellers of divergent residences, demonstrating that he excluded stable ownership, and thus, individual spaces.

Since Drehbühne, Haus Auerbach, Maisons Loucheur, and Schröder House were designed as one single specimen only (e.g. there is only 1 Schröder house, not multiple), there was inclusion and exclusion of individual and communal spaces respectively in those projects.

Table 5.6. Illustrations about states of individual and communal spaces (by the author)

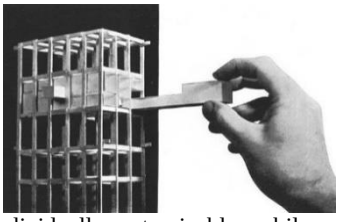
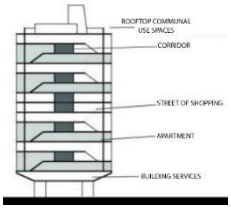
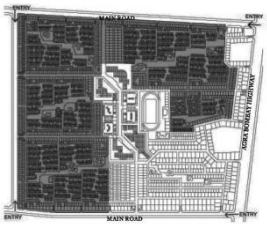
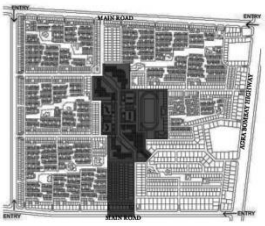
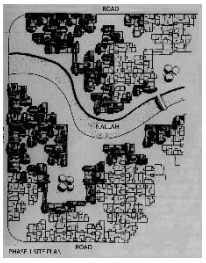
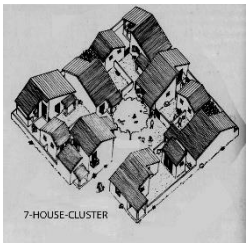
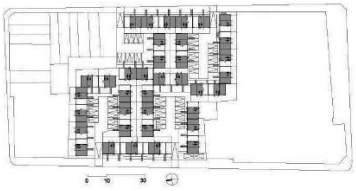
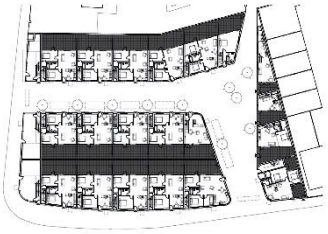
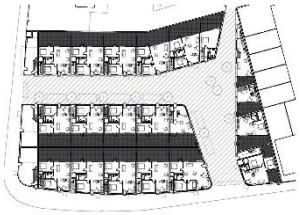
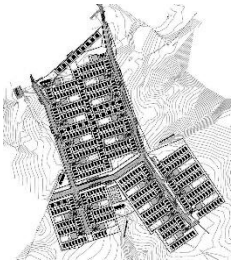
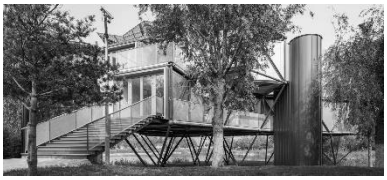
Exemplars	State of individual space	State of communal space
+Unite d' Habitation	 Individually customizable mobile apartments (theory)	 Spaces and facilities of common use (Fondation Le Corbusier, 2014)
+Nakagin Capsule Tower	 Individually customizable mobile apartments (failed) ("AD Classics: Nakagin Capsule Tower / Kisho Kurokawa", 2011)	Podium part at the bottom is communal.
+ Aranya Low-Cost Housing	 Individual spaces of expansion for each single house	 Spaces of common use.
+ Belapur Incremental Housing	 Clusters of multiple private houses	 Gathering spaces in the middle of housing clusters

Table 5.6. (continued)

+ Quinta Monroy Housing	 Clusters of private units.	 Gathering spaces between dwellings.
+ Donnybrook Quarter	 Individual outdoor spaces without definite functions.	 Interior streets operating as gathering zones of separate residences
+Villa Verde	 Spaces of individual expansion.	 Spaces of common use (gym, recreational zones, etc.).
+Sustainable Housing	 Each single house is private and expected to be located at separate sites.	Inexistence of communal spaces.
+Plugin Tower (Lakeside Project)	 Each single house project could be private and expected to be located at separate sites	 Cafeteria, office, exhibition hall like communal spaces in projects with extended modules.

5.3.Building Methods and Materials

In terms of building methods, core housing projects including Villa Verde and Sustainable Housing, and adjustable dwellings combined with support structures are evaluated under their own classes.

In Aranya and Belapur cases, conventional building methods and materials were used, signifying that reducing building cost was a major concern as well in those projects. In Aranya case, at core house parts, conventional and locally available building materials and construction methods were used by architects as brick load-bearing walls and cement concrete floors were constructed, implying that both unconventional and conventional building methods and materials were encompassed. Users were set free to utilize both during making additions.

In Villa Verde and Sustainable Housing, both conventional and unconventional building methods and materials were used. In Villa Verde Housing, local timbers were processed to obtain posts, whereas synthetic insulation materials were also applied, and the load-bearing system was composed of posts and beams. In Sustainable Housing, concrete shear walled frame system made up the major load-bearing system of the core house, and expansions were expected to be made of local lightweight timbers of Mexico.

With regard to adjustable dwellings combined with support structures, in Nakagin Capsule Tower, capsules were welded lightweight steel-truss boxes clad in galvanized, rib-reinforced steel panels covered with rust-preventative paint. The cores were rigid-frames made of a steel frame and reinforced concrete, indicating that unconventional building methods and materials were applied. Similarly, in Plugin Tower, a specially devised steel space frame was implemented, and lightweight composite materials made up modules, indicating that unconventional building tools were practiced.

In terms of flexible housing during the Interwar Period, in Schröder House, the main structure is made of reinforced concrete slabs and steel profiles while walls were made of brick and plaster, and window frames, doors and floors were made from timber, showing that both conventional and unconventional tools were used. In Haus Auerbach, Jurko Stone and Jurko Building Method (a method which relies on assembling prefabricated concrete structural elements) were utilized (unconventional tools).

5.4.Conclusion

This thesis aims to conduct a research to observe if flexible housing in current practice involves seminal aspects or not. In order to accomplish the goal, steps listed below are followed:

- In CHAPTER 1, literature review is presented and the studies which are the most relevant to flexible housing are described.
- In CHAPTER 2, terms relatable to flexible housing and then, framework of Schneider and Till (2007) composed of use, plan, construction and services, which is utilized during analysis of case studies in CHAPTER 4, are described.
- In CHAPTER 3, historical background of flexible housing is reviewed and analyzed.
- In CHAPTER 4, the case studies in current practice which are Villa Verde by Elemental, Sustainable Housing by Tatiana Bilbao Architects and Plugin Tower by PAO are examined according to framework of Schneider and Till (2007) described in CHAPTER 2.
- In CHAPTER 5, the case studies in CHAPTER 4 and precedent flexible housing models described in CHAPTER 3 are compared under the following: Rate of user participation and empowerment of architect, individual and communal spaces, building methods and materials.

So as to make clear comparisons, the case studies are put in categories in which they share the most common attributes with the projects in that same category. Regarding this, Villa Verde and Sustainable Housing are evaluated with core (incremental) housing proposals (Aranya Low-Cost Housing, Belapur Incremental Housing, Quinta Monroy, Donnybrook Quarter, and Monterrey Housing). Plugin Tower is assessed with adjustable dwelling combined with support structures (Unité d'Habitation, Plug-in City, Nakagin Capsule Tower, and Resi-Rise). These are the major comparisons. In order to make a more comprehensive research, minor comparisons are also made, and flexible housing projects introduced during the Interwar Period are also utilized during comparisons as well. After comparisons, the following results are obtained:

Rate of user participation and empowerment of architect

In core housing projects, each project began with a base structure (core hose) and some parts were allocated as voids that could be customized by users. Similar to Aranya, Belapur, Quinta Monroy, Monterrey, and Donnybrook cases, in Villa Verde, it was a must for users to stay within boundaries of their dwellings even after making spatial additions. In Sustainable Housing, making additions beyond limits was free. In Monterrey and Villa Verde cases, architects adopted a more determinate approach unlike the rest of core housing projects analyzed. In Monterrey case, the void was finished with a planar roof slab, explicitly showing that users had to stay within borders of their house, which was similar in Villa Verde, whereas this situation was in an implication form in other projects.

In adjustable dwellings combined with support structures, the greatest empowerments of architects were in Unité d'Habitation and Nakagin Capsule. In those projects, architects designed multiple capsule (apartment) options themselves by imagining several and different user types, showing that user participation would mean the chance given to users to choose the most suitable alternative for them, and each of those alternatives was designed by architects, indicating that no active user

participation would took place. In Plugin Tower and Resi-Rise, users were more authorized to decide their dwellings as in Plugin Tower, it was a must for users to utilize the modules prepared by the architects, yet they were free to compose their own use scenarios as there were modules without definite functions, use as many modules as they wanted, and arrange modules as they willed. Similarly, in Resi-Rise, users would come with their own individual apartments if they were able to devise their compartments externally, and simultaneously, the architects would design new modules for new comers as well.

Individual and communal spaces

In core housing projects, except Sustainable Housing, the remaining projects included facilities or spaces in addition to dwellings which were open to use by multiple and divergent dwellings (communal spaces were included in the projects except Sustainable Housing).

In adjustable dwellings combined with support structures, projects were not designed as flats with full of apartments only, and they included urban service spaces or other public use spaces as well (communal spaces were included).

Building methods and materials

Among core housing projects, use of conventional building tools were most evident in Aranya and Belapur cases. Unlike them, in Villa Verde and Sustainable Housing, unconventional building methods and materials were used.

In adjustable dwellings combined with support structures, in Unité d'Habitation, capsules (apartments) were envisioned as prefabricated components, and the rigid framework was exposed concrete, signifying that unconventional tools were applied. Similar to Unité d'Habitation, in Nakagin Capsule Tower and Plugin Tower, no conventional tools were practiced. In Nakagin case and Plugin Tower, specially devised structural tools and composite lightweight materials were used, signifying that unconventional building tools were practiced.

Final Evaluation

In this study, three contemporary projects, Villa Verde by Elemental, Sustainable Housing by Tatiana Bilbao Architects, and Plugin Tower by PAO, are compared to the previously introduced flexible dwelling projects after being analyzed according to framework of Schneider and Till.

For this study, Schneider and Till's framework was useful to obtain data for the criterias of comparison. However, it is deduced that Schneider and Till's framework is useful to have information about implementations carried out by architects only, and it ends up with impossibility in calculating the rate of flexibility performed by users. Thus, it is inferred that the framework could be deficient in terms of evaluating a flexible housing in which user participation takes place, yet the rate of user participation is also a critical input. For instance, in Core House of Mies, user participation was expected to occur in terms of choosing one interior layout alternative prepared by the architect, and it can be interpreted as weak user participation. But in Villa Verde of Elemental, half of dwellings were left as voids, and users were free to compose their own use scenario, which exemplifies strong user participation. As a result, it is concluded that the framework is sufficient for assessment of projects in which no user participation takes place.

In the end, it is deduced that the case studies did not pose a novelty which can be interpreted as impactful as an avant-garde, yet simultaneously, they cannot be interpreted as literal repetitions of those precedent models. Rather, they could be classified as derivations of the precedents which shared the same category with the case studies as great similarities were found between them. At the same time, especially from the precedent cases which did not share the same category with the case studies (flexible housing projects intrroduced during the Interwar Period especially), more evident differences were found. The case studies are similar to and different than the precedent models described in this study in terms of rate of user participation and empowerment of architect, individual and communal spaces, and

building methods and materials. Last but not least, studying flexible housing is still a worthy work as our lives in urban mediums still keep undergoing massive changes and our need to adapt our environment including our homes still persists.

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APPENDICES

A. Appendix A: Interview with Elemental on Villa Verde

Interviewer: Mert Durmaz (Abbreviation:MD)

Interviewee: Elemental (Abbreviation: E)

Interviewer E-Mail: mertdurmaz_1995@hotmail.com

Interviewee E-Mail: info@elementalchile.cl

Duration of the Interview: April 3, 2019 – June 8, 2019

- Whole of the interview was conducted via electronic mails.

MD: Did you have any other building program except housing in your mind during design of Villa Verde? Did you locate special built-in tools like sliding walls or panels between consecutive residences so that houses can be turned into another building program easily and rapidly without costly modifications such as demolition of walls, and so on?

E: During design of Villa Verde, Arauco forestry company, who was the employer, demanded a cheap housing solution for their workers. So, we only focused on design of a low-cost and affordable housing option. Thus, except housing, we did not concentrate on any other building program. Houses were not designed to unite one day in the future. So, no tools like sliding walls between sequential houses were designed, because each house was designed to live on its own alone and independently from the rest. However, except houses, there was an all purpose small market, a stadium, and a simple school located in the project as well.

MD: Did you conceive of flexibility as a major input during design of Villa Verde? Did you intentionally include flexibility within your project?

E: What we were looking for was a cheap housing solution, and that is how we determined to derive principles from incremental housing. Incremental housing is

not just a tool in architecture, but it is also an economicially advantageous approach as it also provides a cheap, low-cost and affordable housing option. Leaving half of the house empty is cheaper than handing it over in a totally filled form – both in terms of design expenses and construction expenses. Simultaneously, it gives users the chance to customize their homes as they wish which results in a rise of user satisfaction. So, flexibility was not a major input that we aimed to embrace deliberately, yet it embodied via incremental housing, and what we intended to design was an incremental housing option.

MD: In floor plans drawn by you (Elemental), I observed that except kitchen, bathroom and dining table in kitchen, there was no furnishing in upper floor spaces and there was no possible use, functions or furnishing options for "voids". Can we say that users are totally free to modify those as they want? Or do you have possible use scenarios for those?

E: In upper floor spaces and voids, we set users totally free. We did not prepare any possible use scenarios for those spaces. Those spaces are free from definite functions. We expect users to assign only functions to upper floor spaces, and in voids, more than designation of functions can be done such as transforming them into an additional indoor space.

MD: How do you call your project a flexible housing option? In which ways do you call it a flexible one?

E: We were not concerned with flexibility in the beginning. We did not design the project to submit a flexible housing option in the end. However, regarding your question, we could call our project a flexible one due to voids. Voids were free zones of customization of users, the zones with indefinite uses and functions. So, although one basic prototype was repeated and serially constructed, it was possible for each house to be unique owing to different customizations of those voids. Voids were tools of flexibility as well as tools to achieve typological variety. Since voids gave users the flexibility to customize their dwellings in terms of making spatial modifications, we could call the project a flexible housing option.

B. Appendix B: Interview with Tatiana Bilbao Architects on Sustainable Housing

Interviewer: Mert Durmaz (Abbreviation:MD)

Interviewee: Tatiana Bilbao Architects (Abbreviation: TBA)

Interviewer E-Mail: mertdurmaz_1995@hotmail.com

Interviewee E-Mail: info@tatianabilbao.com

Duration of the Interview: April 12, 2019 – May 5, 2019

- Whole of the interview was conducted via electronic mails.

MD: Did you have any other building program except housing in your mind during design of Sustainable Housing? As far as I know, there is no composition in which multiple houses were arranged in rows. Is there any settlement in which multiple samples of Sustainable Housing erected together to form formations like a neighborhood, district, village, etc.? If yes, then is it possible for multiple houses to turn into another building program?

TBA: The project, Sustainable Housing, was developed so as to meet low-cost and affordable housing need in Mexico (country). We were commissioned by the Federal government of Mexico to take care of the issue, affordable housing crisis. So, in this project, we aimed at developing a model so that users could own their private homes as cheap as possible – around $8,000 and up to $14,000 (depending on location, size, and so on). For those prices, it is possible to own a home in Mexico, not in the USA. So, when it comes to your question, we did not have any other building program except housing (especially affordable and low-cost housing) in our minds. Moreover, there is no settlement in which multiple houses are juxtaposed. The project was not designed for one single definite location which would become a neighborhood or another similar settlement. There is no formation composed of multiple houses.

MD: Did you conceive of flexibility as a major input during design of Sustainable Housing? Did you intentionally include flexibility within your project?

TBA: We designed the project to create a cheap, affordable, and low-cost housing option in Mexico. So, flexibility was not our main goal to achieve. The reason why we designed a housing prototype with free spaces at exterior sides depends on economic causes (decreasing building costs) rather than provision of flexibility.

MD: In floor plans drawn by you (Tatiana Bilbao Architects), I observed there was multiple use scenarios both for the spaces designed by you, and for the free zones at exterior sides. As far as I am concerned, some spaces had identical definite functions in each scenarios. Can you tell me which spaces have definite functions decided by you and which spaces are indefinite?

TBA: In the project, we submitted a base structure. The base structure had two bedrooms, one bathroom, one kitchen, and a united living and dining space. Except those spaces, we set users free to decide functions and uses of the rest. It was possible to add five extra spaces.

MD: How do you call your project a flexible housing option? In which ways do you call it a flexible one?

TBA: Flexibility was not our main focus in the project, but preparation of multiple use scenarios should be showing that we encompassed flexibility in a way. By transformation of spaces which are not parts of the core house, it is possible for every single house to be customized differently. So, allocation of free spaces at exterior sides of houses is the way how flexibility was welcomed in the project.

C. Appendix C: Interview with People's Architecture Office on Plugin Tower

Interviewer: Mert Durmaz (Abbreviation:MD)

Interviewee: People's Architecture Office (Abbreviation: PAO)

Interviewer E-Mail: mertdurmaz_1995@hotmail.com

Interviewee E-Mail: office@peoples-architecture.com

Duration of the Interview: April 5, 2019 – June 14, 2019

- Whole of the interview was conducted via electronic mails.

MD: Did you have any other building program except housing in your mind during design of Plugin Tower? As far as I know, there is no composition in which multiple houses were arranged in rows. Is there any settlement in which multiple samples of Plugin Tower erected together to form formations like a neighborhood, district, village, etc.? If yes, then is it possible for multiple houses to turn into another building program?

PAO: In 2016, we introduced the Plugin Tower for the first time. During those days, there were only conceptual drawings, and one single prototype in which the layout – the way how modules were combined, which modules were selected, etc. – was determined by us. In those days, the most initial modules were designed by us, and they were designed to function only as components of a house. However, even today, we keep enhancing the project by introducing new modules with new functions for new building programs. For example, in 2017, Lakeside Plugin Tower – the improved version of initial Plugin Tower proposal – was constructed in Beijing. The complex contained a kitchen, cafeteria, a suit room in form of a master bedroom, a sample office, toilets, balconies, and an exhibition hall.

MD: Did you conceive of flexibility as a major input during design of Plugin Tower? Did you intentionally include flexibility within your project?

PAO: In China, the government possesses a great authority as it is the only landlord with the ownership of each building site. So, one day, anyone living in China might be in a condition in which it becomes a must to relocate, because citizens are not owners of lands or sites in China. So, we developed Plugin Tower as a response to this problem. From our point of view, designing a totally movable housing unit would help people living in China to live in safe in case the trouble occurs. So, flexibility was not the main case in our design.

MD: In floor plans drawn by you (People's Architecture Office) for the initial Plugin Tower proposal, I observed there was multiple furnishings for the modules designed by you. Can you tell me if you designed that furnishing yourself? Do those modules with the furnishing have definite functions?

PAO: The furnishing was not designed by us, and we prepared those drawings just to compose one possible interior use scenario. Except bathroom and kitchen modules, all modules are free from definite functions and they vary in shapes, forms, and sizes. So, users are free to determine their functions as well as the way how they combined. Our specially devised structure provides users with making connections between any two modules.

MD: How do you call your project a flexible housing option? In which ways do you call it a flexible one?

PAO: We were not interested in provision of a flexible housing proposal, but presenting a totally moveable housing proposal with the ability to expand infinitely in theory might mean that we touched flexibility in a way. We think that giving users the chance to intervene in modules as they want and designing indefinite modules show signs of flexibility in the project.

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