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THE MOTIVES FOR APPLICATION OF THE FLEXIBLE ELEMENTS IN THE HOUSING INTERIOR

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Abstract. *In the era of progressive technological and social development, housing environment should respond to actual demands of modern society, with the idea of flexibility and adaptability as the key parameters of sustainable living. Application of the flexible elements in the interior provides a variety of spatial interpretations of the residential unit that can be determined by an architect or by users, depending on the applied design concept. The degree of achieved spatial flexibility will depend on the degree of independence of moveable elements within the unchanging structure of the apartment. Appropriate selection and analysis of the certain number of projects and realizations in the field of flexible housing, points to the diversity of motives of flexible elements application and considers the impact of applied design approach on the interpretation of residential environment. Different social, political and economic circumstances in which the individual examples emerged are also taken into consideration.*

Key words: *housing interior, flexible elements, open plan*

1. INTRODUCTION

Modern building technologies support the construction of flexible structures, which in turn provide a flexible use and exploitation of housing environment. Flexibility, as an aspect of the apartment use-value, requires the development of new design concepts that meet the unpredictable changes in the housing program. These changes require the definition of plan characteristics in terms of their spatial determination, in other words, the identification of fixed and variable factors of architectural space [10]. Representative examples with integrated flexibility make a clear distinction between those elements that are fixed and those that are open to change and variation. The use of flexible elements such as sliding and folding partitions and movable pieces of furniture can be defined as the key or additional tool of internal flat flexibility. The applied method of flexible

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elements implementation determines the degree of personalized interpretation i.e. the degree of user's identification with his immediate environment.

The flexible elements are a part of a more complex spatial structure that represents the product of diversity of collective and individual models of living. Depending on the structural characteristics and furnishing concept the method of interpretation and usage of a living space varies. Usage of the foldable and moveable wall partitions and flexible pieces of furniture can transform the flat within different usage modes, in accordance to the intended living functions. This approach is typical for mass housing development, with residential units of the minimal area. In this case, the method of space usage is precisely determined and the flat flexibility is reduced to the possibilities offered by the architect. The opposite approach would be to start with undefined, functionally neutral space, giving inhabitants a meaningful participative role in the design process, in accordance with their own wishes and needs. The study examined both architectural models, following their historical development, socio-cultural and economic background of their application.

2. The Flexible Elements in the Apartment Interior

The flexible elements in the flat interior include sliding, folding and removable items of equipment such as lightweight wall partitions and flexible pieces of furniture whose different positioning in space enables various spatial and functional configurations. In the cases when the position and purpose of flexible elements is determined in the initial phase of design by the architect, the obtained solution mainly corresponds to the generally accepted model of living. In the case of architectural predestination of usage mode, a flexible but also to some extent deterministic model of housing is provided to the users. The implementation of flexible elements is determined by the functional and spatial organization of the residential unit and, in most cases, operates at the level of day-night regime, according to the functional predictions in a certain spatial structure. On the other hand, the concept of "open and closed plan" is designed with the goal of alternative formation of single-space unit or redistribution of housing units to several spatial and functional structures.

John Habraken, Dutch architect, theorist and educator, in the 1960s proposed the concept of design and manufacturing of prefabricated elements, movable and foldable equipment, defining two basic sub-systems of apartment structure, "support" and "infill" [3]. Consideration of a flexible approach in the interior design includes designing moveable architectural elements of "infill" that stand in a certain spatial relation inside the architectural setting. Flexibility within a predefined, fixed flat structure is achieved through the use of architectural elements, among which removable, sliding and foldable wall partitions and removable and foldable parts of furniture and equipment are commonly used (Fig. 1). Flexible elements support the fluid nature of space that can be divided, separated, integrated or opened, depending on customer needs and preferences and lifestyle. Usage of these elements neutralizes predefined social structuring and general attitudes derived from the conventional design approach instead of this, "the topography of movement" is defined as a guiding tool in the spatial arrangement and usage of the apartment [7].

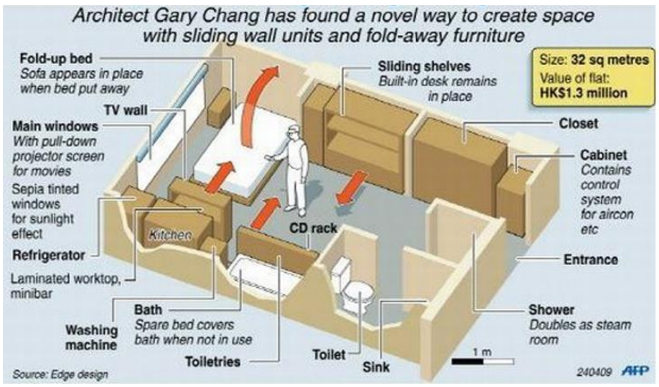

Fig. 1 Gary Chang's apartment with sliding walls and foldable furniture, 2006.

Different political, economical, social, demographical and technological conditions greatly influence the housing design as well as the motives for implementing the flexible solutions. Further study presents some of the key motives for implementation of flexible elements through history of housing development.

2.1. The forerunner of the modern application of the flexible elements in the interior design

The use of movable panels and light partitions was presented for the first time in the examples of traditional Japanese house whose architecture is characterized by flexibility, openness and brightness of the interior. "Traditional Japanese House" designed in 1850's by the Kazuhiko and Kaoru Obayashi architectural team, is a representative example of a traditional Japanese architecture with the interior that contains the elements of flexibility. This house is organized as a series of interconnected spaces that can be joined or divided by means of sliding partition walls (Fig. 2).

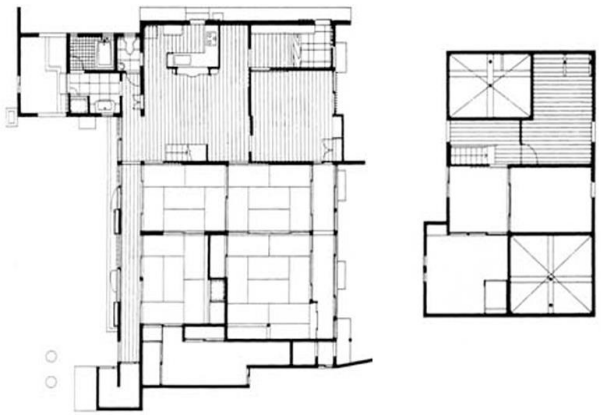

Fig. 2 The layout of ground and first floor, "A Traditional Japanese house," Kazuhiko and Kaoru Obayashi, 1850.

The openness of the plan and the construction suggests the spatial adaptability to functional and social changes that occur within the family, made at the level of daily, periodical or long term use. Individual rooms are separated by the light walls enriched by traditional Japanese motives and symbols. Connections between rooms can be opened or closed by the use of sliding partitions, which determines the size and function of certain spatial units: two single rooms can be combined into a single space by simply opening two large partition elements, so the resulting space can be used for maintenance or special celebration or family assembly (Fig. 3). The flexibility and adaptability of the house therefore entirely dependent on the active participation of the users and the application of certain types of furniture: beds pull out of the closet, a room that served as a living room can be transformed into a bedroom, etc.

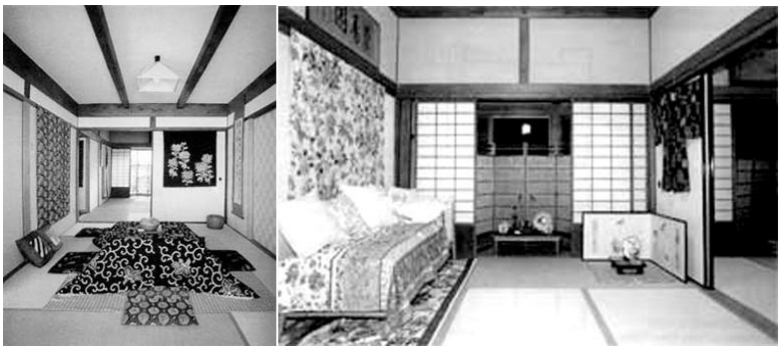

Fig. 3 Interior view, "A Traditional Japanese house", Kazuhiko and Kaoru Obayashi, 1850.

Flexibility is also enabled through the modular design approach. The size of the rooms is based on the standard measures of tatami mats, with rooms made up of a set of these mats i.e. 6 or 8. These and other building components are thus interchangeable.

In this and similar examples, the movable elements are active factors of everyday life shaping residential environment. The movable elements are essential flexible tool, with variable pattern of use that achieves the privacy and social integration, redistribution of certain functions and reintegration of certain spatial areas. Modification of housing units through the use of flexible elements can be made in two levels. On a daily basis, it is possible to transform the space in accordance to the activities that take place in different daily regimes. On the second, long term basis, the transformation of the area is performed in accordance with the changing needs and lifestyles of the user.

2.2. The “moving scenery” as a symbol of social and economical progress

The progressive development of modern manufacturing technology allows easy production of moveable and foldable partitions, unlike the conventional architectural approach that treated them as the fixed segments of space design. This attitude is derived from the aspirations of modernism that "perceptual dynamics of today reflects the dynamic expression in architecture" [3].

One of the early examples of contemporary applications of flexible elements in the housing interior is Schroder house project, by architect Gerrit Rietveld, built in Utrecht, in

1924. This small family house, with its interior that enables flexible spatial arrangement, and the visual and formal qualities, was a manifesto of the ideals of the De Stijl group of artists and architects in the Netherlands in the 1920s. Since then it had been considered as one of the icons of the Modern Movement in architecture. The quality of the "Rietveld-Schröderhuis" is in the expressed design concept of modern architecture at a certain moment in time. Part of the house quality lies in the flexibility of its spatial arrangement, which allows gradual changes over time, in accordance to changes in functions. As in the traditional Japanese house, the flexibility of the "Schröder Huis" relies on the participation of the user, who is constantly involved in creating residential environment. At the same time the building has also many artistic merits, and its visual image has strongly influenced building design in the second half of the 20th century. Unlike earlier, traditional Dutch house, where rooms were accessible through corridors, this house was conceived by Rietveld in a flexible manner. There is no hierarchical arrangement of rooms in the floor plan. The upper floor is one open space and can be divided into three bedrooms and a sitting room by sliding panels. Flexibility, mobility, multi-functionality and adaptability become the leading aspects of a conceptual approach with the main goal of finding acceptable living solution in the modern age. Sliding and folding panels are the key elements of the building and they determine its architecture. The design of sliding and folding elements allows easy transformation of the space from completely open plan to a number of physically separated rooms (Fig. 4).

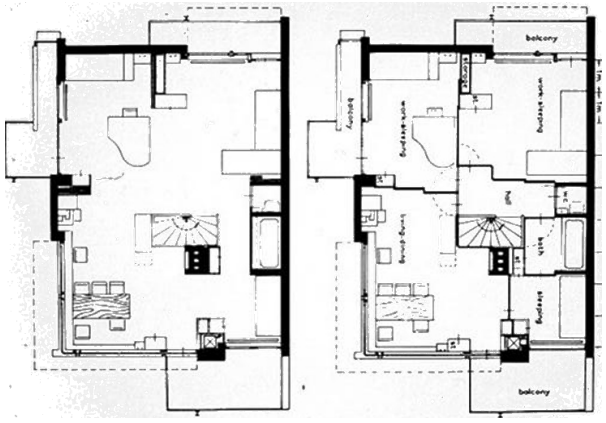

Fig. 4 Ground floor and first floor plan, "Schröder Huis", Gerrtit Rietveld, 1924.

This design approach has introduced significant innovations in the way of interpretation of residential environment. Rietveld-Schroder house has caused a revolution viewed from two aspects. First, the interior is designed to operate in two modes: as an open plan with the characteristics of single-space units as well as a closed plan with a physically separated rooms on the ground floor. Second, Shroder house contains elements of "built-in" furniture as an integral part of the design. Built-in furniture provides a clear indication of room using mode inside the unit. Design and installation of movable and foldable furniture leads to the conclusion that "one of the most modern houses of the century is essentially a piece of furniture" [1] (Fig. 5).

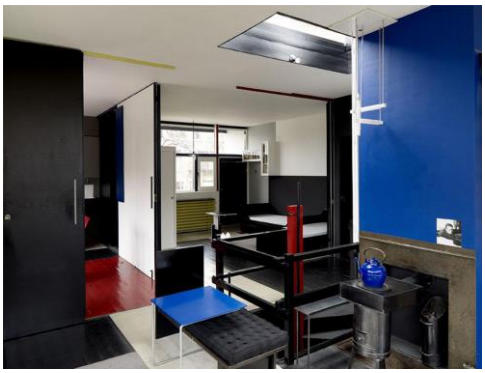

Fig. 5 Interior view, "Schröder Huis", Gerrtit Rietveld, 1924.

In this case the most interesting fact is that the radical and flexible design stemmed from the radical, flexible social program with the aim of creating a living environment for an unconventional family. Moving elements in this case take the social function that goes beyond the symbolic spirit of progress and technological advances indicated by the modernists.

2.3. Flexible elements and housing industrialization

If the previous approach to flexible housing was motivated by social and economic factors, this one is driven by technical influences, and in particular the adoption of industrialized solutions to housing provision [10]. Expanding technical capacity together with a rising demands for housing led to increased interest in standardization in housing production at the start of the twentieth century. The relationship of flexibility and prefabrication in mass housing production is based on the principle of the components that can potentially be arranged in an infinite number of ways. The main goal of mass construction was to minimize the flat size through the efficient organization, including the installation of sliding walls and folding equipment, taking into account the comfort and the quality of life.

From 1914, Le Corbusier, one of the most fervent advocates of factory production, developed projects that could potentially be produced on an assembly line: Maison Dom-ino (1914), Maison Voisin (1920), Maison Citrohan (1922) and later Maison Loucher (1928), all of them reflecting this belief.

Minimum standard and maximum adaptability are the basic characteristics of Le Corbusier's project for detached house La Maison Loucheur, with indicative elements of transformable equipment of couchette car in a day-night configurations (Fig. 6). In the individual residential unit the removable dividers serve as an internal modifiers of space with the dynamic transformations taking place in the day-night mode. Le Cobursier made a plan for Maison Loucher with the mobility of individual equipment elements brought to the extreme. Applying the complex system of movable walls and foldable beds and other pieces of furniture enables the multifunctional and efficient use of space. Features inside the home are organized around central sanitary facilities and include a large dining room and other daily activities, a kitchen that can be closed with sliding panels, rooms with beds disappearing beneath the built-in wardrobe elements, which during the day forms a space for work.

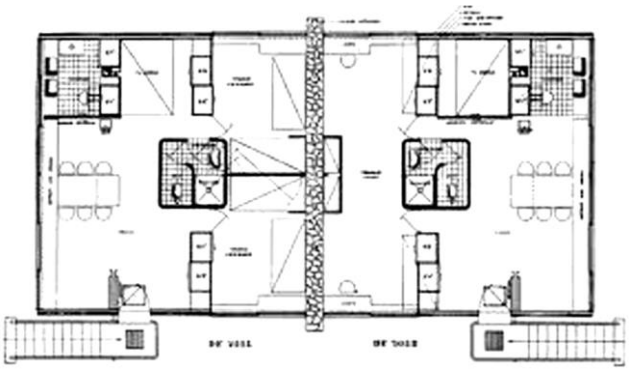

Fig. 6 Layout plan, "La Maison Loucheur", Le Corbusier, 1928.

The "Transformable Apartment" of 1996, by the Mark Guard Group Architects, is a contemporary exploration of the theme of foldable beds and sliding doors in order to maximize available space through flexibility and multi-functionality. Project title symbolically announces the progressive spirit of technological progress and a high degree of transformability of this simple and almost sterile contemporary designed space. Throughout the long side of housing unit the wardrobes are built in, accommodating the kitchen furniture, kitchen storage, space for drying and storage closet. Three independent modules to the left of the entrance contain elements of furniture and equipment that enable the transformation of the space from open-plan room with the living/working functions to the unit with one or two bedrooms (Fig. 7). Position of installation, sanitary, structural elements and moveable pieces of furniture and equipment enables a variety of spatial configurations, visual and functional interpretation of space. Whiteness, brightness and uniformity of the interior design further emphasizes neutrality and multifunctionality of the space.

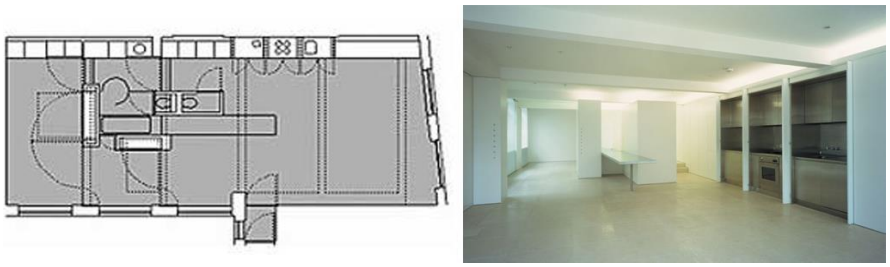

Fig. 7 The layout and interior view, "Transformable apartment", Mark Guard Group Architects, 1996.

Generally this approach is to some extent deterministic because the moving elements are defined as the key parameters of a flexible approach. Their disposition in space is pre-determined so the customers are aware of their existence and the performance of daily/night activities is directly related to their application. It can be concluded that in the examples of mass construction projects, "the user's life is shaped by the position of partition wall rather than vice versa" [8]. The use of the flexible elements is a necessity rather than an option for potential tenants.

In order to design a living environment with the flexibility left to future users, it is necessary to start from a different approach in which the flexible elements are defined as the part of "infill" with a high degree of user's independency in decision-making. In this way, the high level of individualization of the living environment is achieved, which is an important aspect of human adaptation to immediate environment.

2.4. Use of the flexible elements in the "Open building" concept

In the 1960's flexibility became an issue pursued by architects as well as sociologists who believed that every occupant should have the right of choice in terms of location and orientation, as well as a choice of personalization with regard to the layout of a dwelling unit.

John Habraken, the Dutch architect who has researched mass housing and strategies for the participation of users and residents in the building process, published the book "Supports: an alternative to mass housing" in 1961. Habraken argues that "support" or base building should be clearly separated from "infill" or interior fit-out in residential structure. The originality of Habraken's interpretation of a building lies in the fact that the system of support/infill was not simply technical solution but the empowerment of the user in the design and inhabitation of their dwelling [9]. The supporting construction, presented as technical and social framework, "enables furnishing of the apartments that can be built, modified and demolished independently of each other [2].

Like chess, the furniture arrangement game needs a stable, unchanging higher-level form to play in. The building provides context, space within which furniture may be deployed [4]. Live configurations of furniture can be rearranged: existing pieces can be modified or removed, and others can be introduced. The theory of "support" later developed into a global approach known as "Open building" design. This term is used to define the numerous concepts that consider the architecture and the surrounding living environment as "a number of different levels of intervention and processes under general precondition of constant transformation and change of built environment" [5].

Residential building Neuwil in Switzerland, by the Metron Group Architects, is one of the early projects that actively engaged the users in the design and construction process. The basic idea was that to create the flexible residential structure with the open plan adaptable to the changing needs of a family group, or the changing lifestyle of future generations. External dimensions of the apartment and the size and location of stairways, kitchens and toilets are predetermined. Spaces on the east and west side of the apartment are identical in size and have a balcony. The quality, size, and orientation of the space on the east and west sides are almost identical, so it is possible to organize this space in various modes. Spatial organization of the flat can be defined by the tenants, with the predetermined possible disposition of the partitions in a modular grid of 30 cm (Fig. 8).

In order to encourage the future users to use the flexible potential of the housing units, the architects have prepared a users' manual entitled "Meine Wohnung ist mein Schloß" (My apartment is my castle) prepared to assist tenants in organization process. This manual depicted life-cycle scenarios and their spatial implications, together with instructions to wall panels assembly. Submitted plans indicate the elements that are fixed and cannot be moved or modified as well as the possible disposition of moveable elements (dashed lines) that tenants can independently determine.

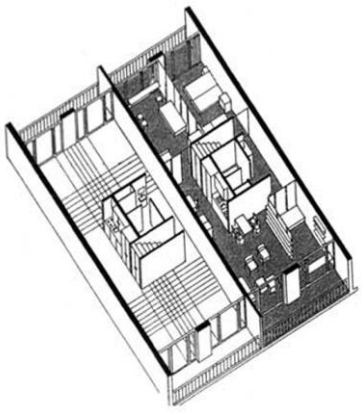

Fig. 8 Perspective view of interior, "Neuwil", Mark Group Architects, 1996.

The use of flexible elements in the open plan allows much freer and more diverse interpretation of residential environment because it is not conditioned by the spatial organization of various activities that are performed in the same area. Unlike the examples of mass construction in which the application of the flexible elements is a key aspect of flexibility, in the open plan concept, the flexible elements are "additional tools", whose application improves the existing flexible potential of initial plan. Application of the flexible elements, in this case, is a matter of occupant's choice, and dependent on the affinities, needs and structure of the tenants. In this way, the achieved "secondary flexibility" of the plan allows better user's identification with the housing environment, without architectural predetermination of modes and styles of living. In addition, an education of future users, which would raise the level of selectivity of the market could have a significant impact on the quality of housing [6].

3. CONCLUSION

The flexible elements of housing interior are the part of a complex spatial structure that reflects different collective and individual models of living, different historical, social and technological framework in which they were incurred. The flexible elements in the interior, usually classified as slide and assembling wall panels, removable and foldable parts of equipment and furniture, can be considered as primary or secondary tools of flexible design concept. In the first case, their use is an essential tool and a key aspect of flexibility. In the second case, these elements are additional tool that upgrades the existing flexible resources of the spatial structure.

Depending on the historical, social and technological framework in which this approach has developed, different motives of flexible elements application were identified. In the early years of the twentieth century architects advocate a radical approach to flexible design arising from the radical, flexible social programs and progressive technological progress. During the period of mass social housing the main motive that led the architect was to minimize flat size through the efficient organization and rational space utilization. In this case, the flexible elements are defined by the architect in the initial phase of design. This can be considered as the architectural predestination of the application method, where users get a

flexible but to some extent deterministic housing model, and are forced to adjust their activity to the space characteristics. Sliding and assembling parts of equipment and furniture are, in this case, the key aspect of flexibility with the use influenced by spatial and functional organization of residential environment. The most extreme approach to flexible design defines the residential environment as part of a complex of equipment in which the housing unit is treated as a piece of furniture, "a machine for living" with some functions reduced to an ergonomic point.

In contrast to the concept in which the flexible elements are predefined by the architect, stands the concept of the "open plan" with the flexibility achieved through the neutrality and vagueness of the space and spatial organization left to the users. The advantage of this approach compared to previous approach is that the performance of certain activities is not conditioned by the predetermined position of the flexible elements. Movable elements are part of the composition improving existing flexible concept that can work with or without these elements. Environmental entities resulting from these conceptual solutions include flexible elements whose existence in the plan encourages users to make free and expressive perception of formative potential of residential environment. This way the flexible elements application is a matter of choice and not a necessary requirement for the performance of certain functions in the housing interior.

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MOTIVI PRIMENE FLEKSIBILNIH ELEMENATA U ENTERIJERU STANA

U doba progresivnog tehnološkog i društvenog razvoja, stambena sredina treba da odgovori na aktuelne zahteve modernog društva, sa idejom o fleksibilnosti i adaptibilnosti kao ključnim parametrima održivog stanovanja. Primena fleksibilnih elemenata u enterijeru pruža raznovrsnost u načinu interpretacije stambene jedinice, koji može biti određen od strane arhitekte ili od strane korisnika, u zavisnosti od primenjenog koncepta u projektovanju. Stepen ostvarene prostorne fleksibilnosti zavisiće od stepena nezavisnosti fleksibilnih elemenata unutar nepromenljive strukture stana. Odgovarajućom odabirom i analizom određenog broja projekata i realizacija na polju fleksibilnog stanovanja ukazuje se na različitost motiva u primeni fleksibilnih elemenata i razmatra uticaj primenjenog projektantskog koncepta na način interpretacije stambene sredine. Različite društveve, političke i ekonomske okolnosti u kojima su pojedinačni primeri nastajali su takođe uzeti u razmatranje.

Ključne reči: *stambeni enterijer, fleksibilni elementi, otvoreni plan*