

EXPLORING FUNCTION ADAPTABILITY AND FLEXIBILITY IN ARCHITECTURE – CASE STUDY OF A HOUSING VERTICAL

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Abstract. *Adaptability and flexibility are popular and wide spread terms when discussing architecture, as well as desirable characteristics of a space. When it comes to housing, Modern Movement has particularly theorized, practiced and underlined the essential need of a space to be adaptable and flexible. However, how can we test if a space indeed possesses these qualities internally, and avoid the mistake of assigning these traits without any experimental confirmation? This paper revolves around a case study of a housing building in Novi Sad (Serbia) where seven apartments placed in the same vertical have been explored. The aim is to test whether the primary spatial layout (IMS system grid) had the possibility to evolve over time, having in mind the hypothesis that different dwellings include different users/family structures that have developed diverse habits, lifestyles and needs. The research method was both analysis and synthesis (firstly, analysis of selected units as examples, and then synthesis in form of intercomparison and conclusions). The case study method has been conducted through interviews with the tenants, current state documentation, and ultimately, graphically represented through diagrams. The analysis focused not only on the adaptability and flexibility of the room/function layout, but on the program openness/closedness, change in square footage and corridors (stiffness/fluidity of connecting spaces and door disposition changes). The results conclude that the original structure is adaptable and flexible, since all seven apartments tested differ from each other considerably. This means that through the exploitation, the users have used the flexibility and adaptability assets of the space to further develop the existing housing framework, and that, consequentially, apartment structures correspond to the family structure.*

Key words: *adaptability, flexibility, IMS, vertical, housing, Novi Sad*

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1. INTRODUCTION

Adaptability and flexibility represent terms that are often used in architectural discourse, sometimes mistakenly and automatically attributed to the spaces that are not essentially adaptable or flexible. What do internal and objective characteristics of adaptability and flexibility entail in the context of the given construction that allows only certain structure dispositions in a residential unit? In his essay 'An apartment is used and changed', Milan Lojanica writes about function compression and superposition, as well as about flexibility and adaptability, qualities that he considers to be "part of the determination and negation of rigid, hermetic structures that injure the naturally dynamic family units" (Lojanica, 1975). The arrangement flexibility allows the space to receive small, ongoing changes; whereas adaptability, on the other hand, allows residential and spatial changes to a great extent. Similarly, Groák defined the in-built opportunity for adaptability as 'capable of different social uses', and the opportunity for flexibility as 'capable of different physical arrangements' (Groák, 1992). These two features do not condition each other, and the optimum of the housing variability lies in their combination. Flexibility is achievable with the level of architectural treatment and skills, while adaptability is more dependent on the potential of constructive, structural and technical production that is prone to cultivation. Both properties imply the understanding that housing is not solely an arrangement of functions, but an organic whole – a living, ever-changing unit in constant motion. Thus, one housing type varies across a wide range of residents' needs or preferences. The users can strengthen their identity and remove themselves from the discriminating spatial anonymity, which usually is a feature of every residential unification, mostly of a prefabricated building with a standardized structure. The link between the user and the apartment is the **exploitation** of a space. As a variable, evolving measuring unit, exploitation helps users express their relationship to the apartment, and *vice versa*, helps the dwellings express their different potentials and values. This paper questions the *tabula rasa* aspect of a dwelling, structural circumstances that provide optimal use possibilities. This question is essentially considering user's lifestyle, which also concerns other aspects such as construction planning, design, economy, standardization and production (especially in large series) (Lojanica, 1975).

Milan Lojanica also underlines that 'the degree of residential space *utility value* corresponds to the number of the met users' needs'. Each apartment is made up of **dimensions** (invariable measure units, sizes) in which frequent **variable** actions take place. The number of variable properties is unlimited, so the units are prone to constant evolution and analysis (Lojanica, 1975). Should an apartment's *utility value* potentially be increased; the goal is to strengthen all three key elements in the 'apartment-exploitation-evolution' ratio (the apartment as a physical foundation should offer answers to questions of exploitation while anticipating evolution). On the topic of evolution, the crucial connection is 'time-space', the ongoing changeability of human needs. Ideally, an apartment needs to entail the ability to adapt, which among other things can be realized through the properties of flexibility and adaptability.

2. THEORETICAL FRAMEWORK

Many authors have discussed the terms of flexibility and adaptability, both in theory and as conclusions of practical experience. However, some claim that flexibility has been attacked as propagating a 'false neutrality' (Forty, 2000). Flexibility in housing design has never been fully accepted. The tendency to design buildings that only correspond to a specific type of household at a specific point in time reflects a way of thinking that is predicated on short term economics (Schneider & Til, 2005). Inflexibility means that once the users' needs change, as inevitably they do, the occupants have no choice but to move. This keeps the housing market in a state of permanent demand. If flexibility were built in, occupants would be able to adapt their houses and so stay longer in them; this would depress the housing market and limit the continuing sales on which developers depend (Schneider & Til, 2005). Their main objective is to get the housing sold as quickly as possible and in this the future needs of the users hardly registers as a factor. Second, because the number of rooms is seen to be more important than the size of rooms, private housing tends to be designed down to minimum space standards and designated room types. This results in what Andrew Rabeneck calls 'tight-fit functionalism', the idea that rooms can only be used in one predetermined way because of the size and shapes of the rooms (Rabeneck *et al.*, 1973). While it has been argued that flexibility costs money, Henz states that if any upfront additional investment is needed (which is not always the case) it can be set off against long-term economic calculations such as a higher appreciation of the dwelling on the part of the user, less occupant fluctuation, and the ability to react quickly to changing needs or wants of the existing or potential inhabitants and the market (Henz, 1997).

If flexibility in housing is to achieve its full potential, it has to mean more than endless change without fixed determinants. This wider intent is examined by considering flexibility under issues of Modernism, finance, participation, sustainability and technology (Schneider & Til, 2005). First, it elides with a technically determined agenda of industrial prefabrication. As John McKean stated 'Standardisation in itself I have tried to do all my working life. But in building it is only significant if you do not standardise but that you use standardised things' (McKean, 1989). Second, Modernism's interest in new models of habitation, together with at least lip-service to the empowerment of the user, was well served by the notion of flexibility (Schneider & Til, 2005). Herman Hertzberger, for example, regards an architect as someone who can 'contribute to creating an environment which offers far more opportunities for people to make their personal markings and identifications, in such a way that it can be appropriated and annexed by all as a place that truly "belongs" to them' (Hertzberger, 1991). Arsène-Henri states that flexible housing provides 'a private domain that will fulfil each occupant's expectations'; it is not about designing allegedly 'good' or 'correct' layouts but aims to provide a space which can accommodate the vicissitudes of everyday use over the long term (Rabeneck *et al.*, 1973). 'One has to turn to the argument of user satisfaction, which, as studies in other countries have shown, can be increased by implementing spatial adaptability and flexibility (Uhl, 1981). Mies van der Rohe, acknowledging that buildings generally last longer than the functions for which they were initially designed, went to great lengths in developing, in conjunction with other architects and interior architects, a large number of possible layouts for his apartment block at the Weissenhofsiedlung (Schneider & Til, 2005). A certain logic of construction and provision of services allows flexibility of configuration, which in turn enables flexible use and occupation. Many of the more emphatic

examples of intentionally flexible housing have a formal clarity, distinguishing between those elements that are fixed and those that are open to change and variation (Schneider & Til, 2005). 'I would be able to subdivide these spaces according to the needs of the occupant. This would also have advantages insofar as it would provide the possibility to change the layout of a unit according to changes within a family, without large modification costs. Any joiner or any down-to-earth laymen would be in the position to shift walls' (Kirsch, 1927). The most extreme expression of flexibility can probably be found in Yona Friedman's demand for structures that are 'transformable at will by the individual'. This notion of empowerment is also a central feature of participatory design processes. Flexible housing not only allows users to take control of their environments post-occupation, but also during the design stage (Schneider & Til, 2005). Therefore, architects such as Walter Stamm, the architect of a participatory scheme in Wasterkingen, Switzerland, developed structural and design principles made for the 'second tenant' (typically unknown) or multi-usability (Kuhnert *et al.*, 1989).

3. THE VERTICAL AS THE BACKBONE OF A FUNCTIONAL SCHEME

'The basis of a *typical floor plan* is not a horizontal model. Floor plans build vertical neighborhoods without collective space. "Vertical" apartments do not share a common space, but they share common everyday problems. "The vertical" is a place of conflict and negotiation, a place of public space much more than private. The basis of a *typical floor plan* is the antithesis of private and individual. The spatial framework of everyday life is the same for everyone. Tolerance to changes is minimal, individualization is cosmetic, activity patterns and the use of space are accessible to everyone.' (Maraš *et al.*). Oftentimes, architects are prone to viewing architecture through horizontal plans, which is rather an asset belonging to the Modern Movement's heritage. However, the previously underlined thesis about vertical neighborhoods proposes an idea about exploring architecture through sections (Figure 1). Especially when discussing the characteristics of adaptability and flexibility, it would make sense that in order to make an adequate comparison of the level of structural change in specific apartments during a long-term exploitation period, the core of the analysis should be the observation of apartments that are positioned in the same vertical. What the dwellings in the same vertical share is the same spatial framework (construction type and spans, installations positioning – horizontal and vertical services), which represents the starting point of this research. The given spatial framework are the **dimensions** (invariable measure units, sizes), as mentioned beforehand. The spatial framework investigated in this paper is the IMS prefabrication system, a model of economic mass construction which contains standardized elements. The 'level and potential of constructive and technical production and the possibility of its cultivation' (Lojanica, 1975), which Milan Lojanica points out as very important, is tested in this paper through the level of structural and functional change caused by the **variable** measures (actions, habits). The assumption is that through exploitation, the users further develop the existing housing framework which is caused by a wide range of needs or preferences.



Fig. 1 The analyzed housing vertical photographed bearing in mind the same vertical axis
(Source: authors)

4. THE HISTORICAL AND SOCIAL CONTEXT

In this research, a multi-family building in the Liman neighborhood in Novi Sad (Serbia) designed by Dušan Krstić (Neimar Construction Company) is observed. This project belongs to a building complex that was constructed in phases, during the years 1982-1987. In that period, the agenda of zoning housing near the Danube banks was taking place, in a terrain that used to be a marshland and had previously been sanitized. Similar buildings were multiplied in Resavska, Ravanička and Fruškogorska streets. The analyzed building contains 8 floors, ground floor occupying shops and communal rooms, while housing units are placed on upper floors (apartment sizes of 54, 64, 94 and 110 square meters). As already mentioned, the buildings were built by using the standardized IMS prefabrication system. The spans of these prestressed concrete elements range from 3.60 m; 4.20 m and 5.40 meters when implemented in housing programs, while spans of 7.20 meters were mastered over time. Specifically in this building, the column spans are 3.60 and 4.20 meters. All abovementioned spans were determined by the basic module of 60 cm, an anthropomorphic dimension established by the Modern Movement (Mecanov, 2016).

In order to assess the 'apartment-exploitation-evolution' ratio, social context needs to be addressed. When it comes to the original (first) users of the allocated social housing, they were mainly 'vetted personnel' of provincial and city institutions, as well as professors of the University of Novi Sad (Vujović *et al.*, 1971). A number of apartments could be bought at a certain market price. Data by the Yugoslav Institute for Urban Planning and Housing (1971) confirm that Liman I and Liman II represented 'elite' settlements. Family structures, the number of household members, their qualifications and professions, distance from work, schools and kindergartens, ways of spending leisure time, square footage and rooms of apartments etc. were all relevant assessment factors in the mentioned publication. It was concluded that Liman I and Liman II have the highest percentage of employees with higher education, as well as households with the highest monthly income. Also, Liman I and Liman II have the largest square footage per household member ratio (Vujović *et al.*, 1971). Although the mentioned buildings did not exist in 1971 when the publication was published, it is concluded that Liman II enjoys a constant high status. The housing quality is determined by the urban and environmental features, and still to this day, there is a high demand for these apartments on the real estate market. Given the demand is high and that the supply is limited, it is expected that the high purchasing power of future tenants would increase the *utility value* of the apartments, which is achieved by adapting the structure or renovating.

Dušan Krstić advocated for receiving feedback from (future) residents. Every piece of information he received was systematized and recorded in order to collect the input as a starting point when designing. 'Give them exactly what they want. [...] Observing people carefully and analyzing how they live their everyday lives needs to be central to the design process' (Design Council, 2002). Krstić insisted on detecting tenants' needs, habits, preferences etc. and considered it important to determine different factors such as: family structure, the number of family members, their age, gender etc. Krstić underlined that the family structure has to correspond to the apartment structure, and *vice versa*. This balance he had explored many times, and some useful properties he often implemented in housing design are the following: communication that accesses to all rooms (without a passable living room), loggias as an extension of the interior and a connection to the exterior space that generates a sense of depth, as well as the addition of a half-room or the possibility of adding a half-room. These specific practices were all under the umbrella of

adaptability and flexibility in accordance with the family changes. Vladimir Mitrović had concluded that ‘the imposing series of residential buildings (by Krstić) had a common denominator – Krstić’s great work ethic and humanistic approach to modern housing, both from the practical and the theoretical side’ (Mitrović, 2015).

5. RESEARCH METHODOLOGY

The research methodology includes the analysis method of selected examples (a case study) and the synthesis process for obtaining results, intercomparison and conclusions (which was presented through diagrams). The case study was conducted on seven 64.16 square meters apartments. Originally, the dwelling is one-and-a-half-bedroom apartment (Figure 2). This square footage is the closest to the average size of an apartment in Serbia (the average apartment size is 68.9 square meters in urban areas according to the data of the Republic Institute of Statistics and the Census of Population, Households and Apartments from 2011), and that is why it is chosen for this research. Even though new census data (published as of May, 2023) conclude that the average apartment size is 74.7 square meters, this result was unknown at the time of carrying out this case study. Another reason for the selection of this particular dwelling is the fact that, potentially, in a medium-sized apartment there is a largest range of household members number (single person to a family of more members). This paper assumes that the apartment structures and layouts indeed correspond (or would potentially correspond if flexible and adaptable changes were introduced) to the family structure. The building has seven housing floors. The last floor differs from others but is included in the paper due to the identical construction grid and the same function layout (the top apartment has slightly higher ceilings and the differences in the square footage are minimal).

The study was carried out through the following mediums:

- a) Interview with the tenants,
- b) Current state documentation (photo documentation and floor plans),
- c) On-site recording and analysis,
- d) Diagrams.

The interview with the tenants was inspired by the work of Krstić. It contained a set of 12 questions regarding the family structure and possible adaptations made. The residents were also asked to state their opinions on the level of the unit’s suitability for the family structure.

Current state documentation was achieved through photo documentation and obtaining original floor plans. Photographs were taken in the same spots in each dwelling (next to the bearing pillars), so that the apartments could be comparable (Figure 1).

On-site recording and analysis included additional measuring and *in situ* comparisons between the original floor plan and current floor plans (analysis of changes made to the apartment).

Diagrams represented a conclusive tool in order to test and confirm observations made on-site, since they simplify problem research and the interrelationships display. They are a combined result of all three mediums previously mentioned. The applied space rationalization tool studies architectural functions and their correlations, communication between the functions, and their disposition. Communication is presented linearly in cases where certain functions are rigidly divided (by doors). If a straight line does not exist, then the connection between the two programs is fluid or flexible. The circumference line of the rectangle explains

the openness of the functions to each other. The solid line represents the closedness and rigidity of the program. Having in mind that the primary apartment state is the key to reading the scheme, in the case study that follows, other types of lines that imply the latter adaptations will appear: dashed (the connection between two functions is flexible, most often in the form of a visual partition), and no line, a colored rectangle without contour (absolute openness to neighboring function). Spaces that belong to the night zone only are marked in dark gray, in order to easily notice the separation of daytime functions from the night zone. Superficial, non-essential changes were not observed, but only functional and structural changes/elements such as: areas of spatial communication (stiffness/fluidity of spatial connection and change of door disposition), room layout (function), change of square footage of functions and openness/closedness of functions.

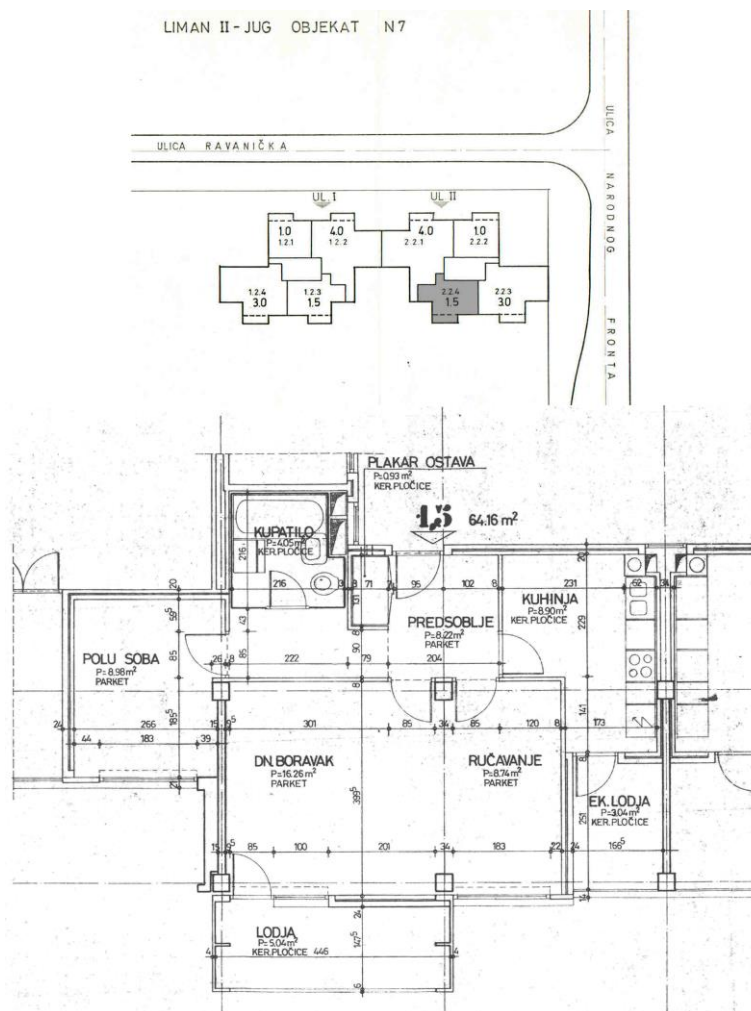


Fig. 2 The original building scheme with the original floor plan of the analyzed dwelling
(Source: Neimar Construction Company, edited by authors)

6. THE RESULTS

As already mentioned, the study was carried out through three mediums: Interview with the tenants, Photo documentation of the current state of the dwellings and Diagrams. In this *Chapter*, all results combined will be disclosed.

6.1. Apartment number 214

The tenants are the first owners of the apartment, and therefore have been living in the apartment since 1987. By profession, the owner of the apartment is a retired veterinarian. The number of household members varied from four members (parents with two children) to three members (offspring departure). During the construction phase, the owners participated in adapting the structure of the apartment by adding a partition wall between the living room and the kitchen (in the original plan, between the 'dining room' and 'living room'), in order to convert the dining area into a half-room needed for children's room (Figure 3). The need of this particular adaptation has already been mentioned in the paper, and this spatial possibility is something that Dušan Krstić strongly advocated for. The dwelling structure has not been changed since 1987, and none of the rooms have been renovated in the meantime, which means that the flooring, tiling, sanitary equipment, windows and doors are completely original. The owners pointed out that they see improvements happening in the future and that they are willing to renovate the bathroom first. Also, they concluded that the apartment was capable of adapting its structure resulting from changes in family composition over the years.

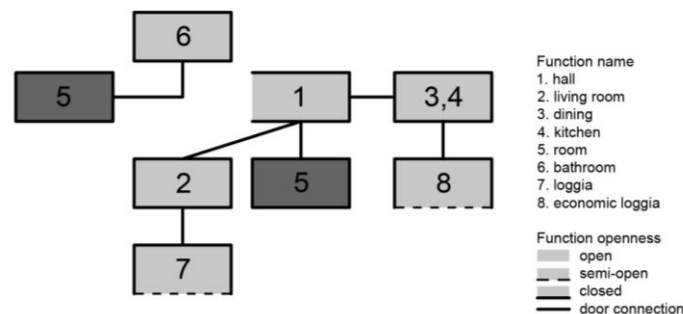


Fig. 3 Apartment number 214 diagram (Source: authors)

6.2. Apartment number 224

The resident is the third in line to live in this dwelling, and the apartment was bought in 2012. The interesting thing is that these owners have another apartment in the same building entrance, while their son (a student) lives in the analyzed apartment. The number of household members did not change (one member). Structural changes in relation to the original condition were made by the first or second owners. Adaptation includes achieving space openness, which was realized by eliminating partition walls (between the hall and the kitchen, the hall and the living room with dining), as well as the expansion of the kitchen towards the economic loggia (the loggia is enclosed from the facade). The dining room has been moved to the area next to the hall, and the living room is a spacious space that also contains a study area (Figure 4). There are no original materials and elements (tiles, parquet, carpentry and sanitary equipment) in the apartment, and the replacement was partially carried out by the previous owners (tiles and sanitary equipment), while the current owners replaced the windows and

parquet. Special qualities of the apartment that the owners emphasized are the openness and airiness of the space, and the user concluded that the layout is suitable for him and his needs.

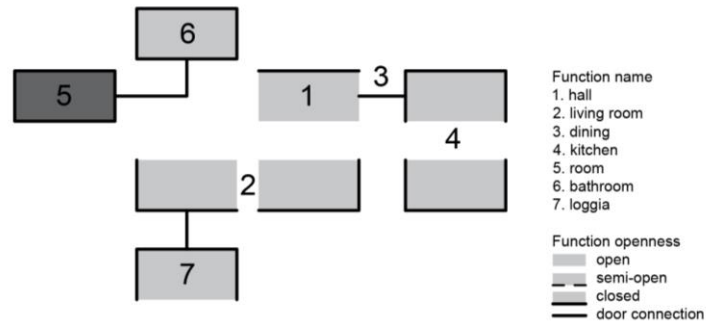


Fig. 4 Apartment number 224 diagram (Source: authors)

6.3. Apartment number 234

The current tenants are second owners and have been living in the apartment since 2003. The apartment owner is an economist by profession. The current household members number is three and the structure of the family has not changed in the meantime. When the residents moved in, they encountered the original dwelling structure and all materials presented in the apartment were renovated, as well as the layout which was adapted to their own needs. The wall between the hall and the living room was eliminated, while the kitchen and dining room were relocated (Figure 5). From the spacious area of the living room in its original condition, a room which the family needed as a children's room was partitioned. The materials are partially original: part of the carpentry that was crucial for the redistribution of functions was replaced with PVC windows and PVC balcony doors, while the other part of the carpentry is original. The parquet is completely original, while the ceramics and sanitary equipment have been completely replaced. The owner wanted to underline that the skeleton of the apartment is highly adaptable due to the fact that the redistribution of functions led to creating another, much needed room (children's room), while still maintaining the value of openness and fluidity.

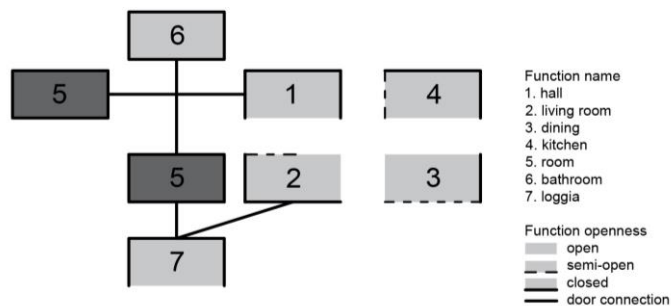


Fig. 5 Apartment number 234 diagram (Source: authors)

6.4. Apartment number 244

The tenant is the first owner and has lived in the apartment since 1987. He is a lawyer by profession. The number of household members and the structure of the family changed during

the years (departure of members). The structure of the apartment is original and has not been adapted in the meantime (Figure 6). This resident provided basic information, but declined to be interviewed.

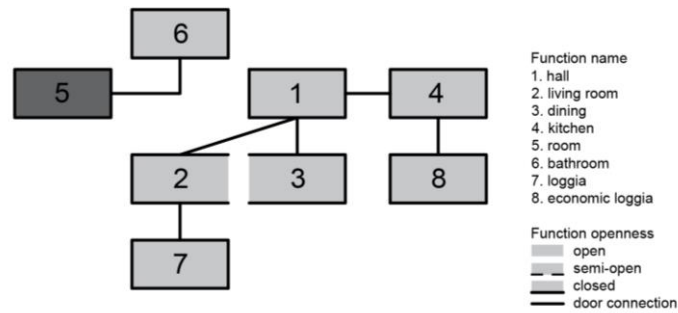


Fig. 6 Apartment number 244 diagram (Source: authors)

6.5. Apartment number 254

The users are the first owners and have lived in the unit since 1987. They are lawyers by profession. The household consists of two members, and the family composition has never been changed. Moreover, the owners participated in the dwelling design, both in the pre-construction and construction phases, as well as adapted certain elements (demolition of walls, redistribution of walls, functions and space). The biggest changes in relation to the original space disposition are: the elimination of the wall between the hall and the living room with dining, the partial elimination of the wall between the kitchen and the living room (dining in the original function placement), the expansion of the kitchen to the loggia, and then, the formation of a room from partitioning a part of the living room. The divided part of the living room was converted into a bedroom, while the originally predetermined half-room is used as a study. This way, the original one-and-a-half-bedroom apartment has evolved into two-and-a-half-bedroom unit (Figure 7). All incorporated materials include original floor coverings, ceramics, as well as original carpentry and sanitary equipment. As a specific feature of the apartment, the tenants singled out the forming of another terrace entrance from the living room. The users have stated that the apartment is highly suitable for them.

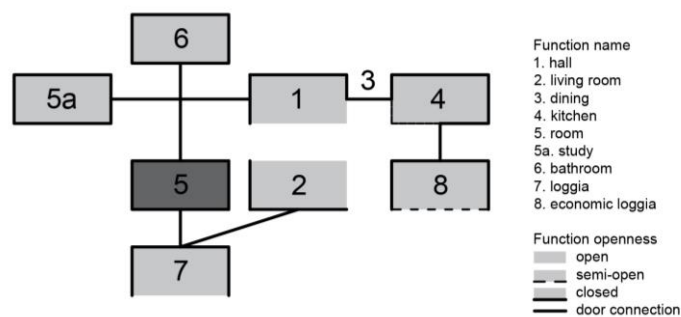


Fig. 7 Apartment number 254 diagram (Source: authors)

6.6. Apartment number 264

The present apartment owners were preceded by the first owners who lived in the apartment generationally. The primary owner was a city official. The current, second owners found the apartment in its original condition and completely adapted it, changing the structure completely. Therefore, the owners have modernized the assembly and renovated the surfaces in terms of material replacement. They neutralized the wall between the hall and the living room with dining room, and the wall between the hall and the kitchen. Part of the living room was used to create an additional room (Figure 8). By doing this, like in the previous case, the unit became two-and-a-half-bedroom apartment. However, the unit 264 is much airier and more open, with an impression of a studio-type apartment, which is appropriate given it is an Airbnb apartment at the moment.

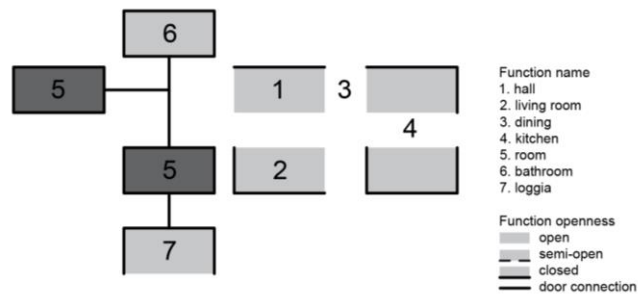


Fig. 8 Apartment number 264 diagram (Source: authors)

6.7. Apartment number 274

The current owner grew up in the apartment mentioned – his family had been living in the apartment for generations, since 1989. The present owners are second generation tenants and the number of household members now consists of three (parents with a child). When discussing any family structure changes that played out during many exploitation years, it is confirmed that the apartment served as a spatial framework in many iterations: arrivals and departures of members, subtenants (temporary tenants). The owners work in the IT sector and have structurally adapted the apartment in 2017. These changes include redistribution of the walls and the removal of the closet niche in order to increase the bedroom square footage (Figure 9). The only original elements that are present in the

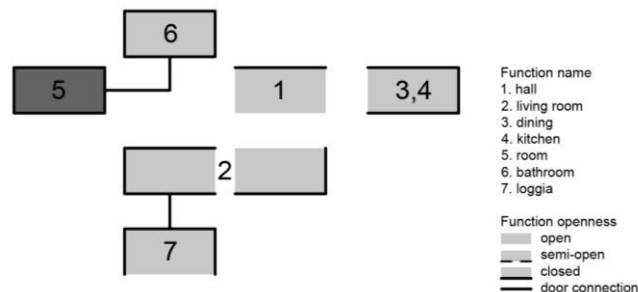


Fig. 9 Apartment number 274 diagram (Source: authors)

apartment are the radiators. What sets this apartment apart from the others in the same vertical are the higher ceilings, larger bathroom and the absence of the economic loggia. However, these differences do not have any significant impact on the structure. The only difference worth mentioning for the *Discussion and Synthesis* is the absence of the 'Function 8' (economic loggia), due to which the kitchen expansion is disabled.

7. DISCUSSION AND SYNTHESIS

If we were to call the analyzed apartments 'models', the original apartment could be named as the *prototype*. It can be concluded that the apartment **244** completely followed in the *prototype* model. Apartment **214** could be described as the next variation of the *prototype*, since the structure developed into two-and-a-half-bedroom apartment with the relocation of the dining room. Apartments **234** and **254** are structurally and functionally very similar to one another, with exceptions of the dining room layout, and the existence of an economic loggia. Another biased impression is that the difference lies in the sense of openness – apartment 234 is more fluid and airier. Apartment **224** entails the matrix of the original one-and-a-half-room apartment with significant differences – the first one being the level of fluidity of the space, the second one closing off the loggia on the façade and connecting it to the kitchen, and the final one being the relocation of the dining room. Apartment **264** represents a mix between models **234** and **254** with model **224**, considering the fact that an additional room exists in the apartment 264 (two-and-a-half-room apartment), but still remains a quality, open space. From the very beginning, the layout of the apartment **274** differs from the others, and it can be determined that it represents a *heterotopic prototype* possibly most similar to the model of the apartment 224. The numerical data and the answers from two key questions that were asked during the interviews with the residents can be found in the summary table (Table 1).

Table 1 Synthesis and comparison of the results

Unit number	Room number	Square footage per family member [m ²]	Adjectives that the residents used to describe their unit	According to the residents, does the unit structure match the family structure?
214	2,5	21,33	decent, satisfactory	yes
224	1,5	64,16	functional, open, airy	yes
234	2,5	21,33	modern	yes
244	1,5	64,16	functional	yes
254	2,5	32	/	/
264	2,5	64,16	modern, comfortable	yes
274	1,5	20,66	airy	yes

The interviews that Krstić conducted as a result of his proactivity and cooperation are valued by the residents considering that some of the first apartment owners/tenants participated in the process of redesign and adaptation during construction. The residents emphasized that they appreciate the urban, environmental and ambient context of the building. The dominant (re)appearance of positive adjectives (functional, open, airy etc.) in the survey suggest that the dwelling structure is suitable for different family structures,

as well as their needs, habits and expectations. As Vladimir Mitrović stated, ‘housing buildings (by Krstić) are characterized by real, internal flexibility of housing units’ (Mitrović, 2015).

8. CONCLUSION AND FUTURE RESEARCH

This study carried out through analysis of the vertical brings us to conclusion that these seven apartments, originally of the same functional zones and structural assembly, indeed are seven different apartments. The users developed and adapted the existing structural framework to their needs or preferences, all while maintaining an adequate unit-family structure balance. If we were to define the originally designed apartment as a *prototype*, the other apartments would be variations of the prototype – *models* and *hybrids* (models obtained by mixed characteristics). In this way and in this particular case, it can be concluded that the prefabricated IMS construction provides a spatial polygon where layers of different layouts and functional zones occur. This cancels the function as such, offering a *tabula rasa*, which means that the attributes of adaptability and flexibility can be applied more easily. To avoid residential unification that is omnipresent, variation has to dominate over multiplication. In different moments and periods of life, human needs differ accordingly, so the apartment must contain flexible and adaptable characteristics to satisfy the user’s requirements (Krstić, 2013). Client-architect ratio should be dynamic, and an architect’s insight should be reflected in the apartment layout design, however hard it is to achieve this in a multi-family building design process where this ratio is non-existent in most real-life scenarios. On the other hand, if an architect is not to anticipate scenarios of use (Koolhaas *et al.*, 2006), then it is fair to underline that some construction systems such as IMS already provide a level of space modalities. This would be an ethical and rightful solution which does not dictate a certain lifestyle in any way, but leaves the residents the right to choose, again underlining the *tabula rasa* concept.

Further research in this domain could include exploring other housing verticals in Novi Sad built in the IMS prefabrication system, testing if they offer spatial adaptability and flexibility as well. Another future study could involve trying to find a certain ‘architectural key’ to these units and grouping them. This in fact would be defining different unit types that share the same structural logic as a spatial outline for function dispositioning, which means that we could better understand the way adaptability and flexibility is achieved (both these assets as internal traits a certain space entails, and the architectural treatment that manifests them). Another step further would be implementing Artificial intelligence (AI) in order to test layouts and unit types. Cellular automaton or any other more suitable AI system could not only examine the hypothesis, but as a result, generate floor plans of units containing a certain ‘architectural key’.

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ISTRAŽIVANJE PRILAGODLJIVOSTI I FLEKSIBILNOSTI FUNKCIJE U ARHITEKTURI: STUDIJA SLUČAJA STAMBENE VERTIKALE

Prilagodljivost i fleksibilnost su popularni i široko rasprostranjeni termini u arhitektonskom diskursu, kao i veoma poželjne karakteristike prostora. Kada je reč o stanovanju, modernistički pokret je posebno teoretisao, praktikovao i podvukao suštinsku potrebu za prilagodljivim i fleksibilnim prostorima. Međutim, na koji način možemo da testiramo da li prostor zaista suštinski, iznutra poseduje ove kvalitete, to jest kako da izbegnemo grešku pripisivanja ovih osobina bez ikakve eksperimentalne potvrde? Ovaj rad se bazira na studiji slučaja stambene zgrade u Novom Sadu (Srbija) gde je istraženo sedam stanova koji su smešteni u istoj vertikali. Cilj je da se ispita da li je primarni prostorni raspored (raster IMS konstruktivnog sistema) nudio mogućnost razvijanja prostora tokom vremena, imajući u vidu hipotezu da različiti stanovi imaju različite korisnike/strukture porodica koje, opet, imaju različite navike, stilove života i potrebe. Metod istraživanja je bio analiza i sinteza (najpre analiza odabranih jedinica kao primera, a zatim sinteza u vidu međusobnog poređenja i donošenja zaključaka). Metoda studije slučaja je sprovedena kroz intervju sa stanarima, dokumentaciju postojećeg stanja, i na kraju, grafički predstavljena kroz dijagrame. Analiza se fokusirala ne samo na prilagodljivost i fleksibilnost rasporeda prostorija/funkcija, već i na otvorenost/zatvorenost programa, promenu kvadrature i hodnika (krutost/fluidnost prostora i promene u dispoziciji vrata). Rezultati zaključuju da je originalna struktura suštinski prilagodljiva i fleksibilna, budući da se svih sedam testiranih stanova međusobno znatno razlikuju. To znači da su korisnici kroz eksploataciju iskoristili interna svojstva prilagodljivosti i fleksibilnosti prostora za dalji razvoj postojećeg stambenog okvira, te da, posledično, svaka struktura stana zaista odgovara strukturi porodice.

Ključne reči: *prilagodljivost, fleksibilnost, IMS, vertikala, stanovanje, Novi Sad*