Possibilities and Limitations in Shaping Customized Residential Interiors

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Abstract. Own, satisfying home is one of the things that having in a person's lifetime is extremely important because it ensures meeting basic needs. Nowadays, in the era of increasingly stronger privatization and individualization of social life, paying attention to the individual and not universalistic user is becoming an important planning task. The Polish multi-family housing stock mostly comes from the '70s and '80s, when the construction was based on a large-panel system – hostile, rigid and heavily standardized. At present, the buildings are erected in technologies based on modern materials and technologies, but the layout and size of the residential units are not much different from those erected 40 years ago. The paper is an attempt to draw attention to the issue of shaping residential interiors tailored to the individual user. An attempt to analyze the possibilities or lack thereof for the free creation of residential interiors, The aim of the research is to analyze the possibilities of spatial creation of individualized residential interior layouts, both in existing multi-family residential stock – a project in adapted space, and in a model space (cube 6 x 6 x 6 meters). The research material comes from both: the design classes conducted by the author of the article and the housing stock that has been inventoried by her. The research method is a comparison of existing flats and ideological systems, designed by the students of the Faculty of Architecture of the Silesian University of Technology, within the design classes based on the author's own didactic program. The interior utility program includes residential functions – daily rest, sleeping, personal hygiene, preparation and consumption of meals, storage and implementation of hobbies. In principle, the residential interior is intended for two users: two people, or a person plus a pet, taking into account the individual needs of each co-resident. The designed residential interiors, apart from utilitarian solutions, are characterized by aesthetic and functional solutions related to the selected interests (hobby) of the inhabitants. Basing on the analysis of selected conceptual designs and comparing them with existing residential layouts, conclusions will be drawn about the occurrence of possibilities and limitations in shaping individualized residential spaces. It is important to determine – what are the restrictions on adaptations, in connection with the existence of a specific structural and installation system, the arrangement of windows on the facade, etc., which lead to the impoverishment of the arrangement possibilities and adaptation of the interior for a defined user. The presented projects will also show a different view on the way housing is shaped, which breaks the patterns existing in public awareness. The main conclusions from the research may be useful in subsequent development projects. They can be a clue to discuss the existing restrictions on residential interiors located in multi-family buildings, whose shape is governed by: building regulations, rigid building structure and its equipment with technical installations and devices, as well as the development policy focused on maximum investment return.
1. Introduction
In Poland, for a total number of apartments equal to approximately 14.5 million, over 7.7 million are located in multi-family buildings, which accounts for almost 60% of all residential premises [1]. The housing stock in Poland comes mostly from the second half of the 20th century. Its approximate age, determined on the basis of the Polish Census 2011\(^1\) of existing flats, is as follows [2]:

- built before 1919 – over 1,000 thousand flats survived (8% of resources),
- 1919-1945 – 1,440 thousand flats survived (11.5% of resources),
- 1946-1960 – 1,124 thousand flats survived (8.9% of resources),
- 1961-1970 – 1,803 thousand flats survived (14.4% of resources),
- 1971-1980 – built and survived the biggest number of flats: 2,647 thousand (21.2% of resources),
- 1981-1990 – 1,161 thousand flats built and survived (9.3% of resources),
- 1991-2000 – 1,200 thousand flats built and survived (9.6% of resources),
- 2000-2011 – 1,473 thousand flats built and survived (11.8% of resources).

Over the past century, the idea of "housing" has evolved, along with a whole range of technical and technological issues, which – conditioned by an economic factor – introduced better or worse functional, construction and material solutions. Designers tried to adapt the habitation models to social needs as well as legal and economic conditions. After many attempts to search for appropriate building materials and technologies as well as technical equipment that both allow for the shortest possible construction time of the building and bring comfort and satisfaction to residents, currently in Polish multi-family housing dominates traditional, improved construction technology. The buildings, including those erected in the 20th century, nowadays present an increasingly better technical and aesthetic standard, with the help of modern finishing materials and numerous adaptations to contemporary legal requirements, and the needs of users. The average area of an apartment currently being built in a multi-family building is 53.1 m\(^2\) [1]. And yet the share of people living in flats in multi-family buildings is steadily decreasing. In 2016 it was 42.5%. In 2005 it was 50.2%, which means that over 12 years the share decreased by 7.7 percentage points. The question arises – what is the reason for Poles' reluctance to use flats in multi-family housing? What else, apart from the need to maintain privacy and easy access to their own green area, are the needs of residents that cannot meet the condo?

The aim of the study was to present the possibilities of shaping an individualized residential interior, designed for a defined user, in the existing building structure and in model space. Based on the comparative analysis of four projects selected for testing, the main problems were identified that hinder or prevent the free shaping of the interior.

2. Research material
Analyzing the history of the development of design thought related to the apartment and the functional layouts of residential premises emerging en masse in the consecutive decades of the 20th and 21st centuries, one can notice the evolution of the concept of "apartment" – from a multifunctional, single room, which has been the type of accommodation of a larger part of society for centuries, through apartments of two, three rooms with a kitchen as the center of family life, to a regular flat, with full technical equipment [3]. Selected, representative examples of flats existing in Poland from different decades are presented in Table 1.

\(^1\) Another Census is planned to be held in 2021.
Table 1. Sample apartments with an area of approx. 50 m² from the chosen periods of the 20th and the beginning of the 21st century

| Period of creation | Layout of the premise | Share of % of rooms area | Features of the functional system and equipment |
|--------------------|-----------------------|--------------------------|-----------------------------------------------|
| 1913-1915          | ![Diagram](image1.png) | Σ 43,30 m²               | – a three-room enfilade system with an independent entrance from the staircase to the room, technical equipment: kitchen core, kitchen sink, stove in the room; installations (electricity, water and sewage), sanitary room accessible from the staircase landing |
| 1925-1927          | ![Diagram](image2.png) | Σ 43,20 m²               | – a three-room enfilade system technical equipment: kitchen core, kitchen sink, stove in the room; installations (electricity, water and sewage), sanitary room accessible from the balcony, a pantry with no window |
| 1955-1956          | ![Diagram](image3.png) | Σ 49,40 m²               | – separated rooms, accessible from the corridor, small bathroom, big rooms, kitchen and bathroom combined close to the installation shafts, in-built furniture – kitchen cabinets and wardrobe, technical equipment: kitchen core, kitchen sink, stove in the room; installations (electricity, gas, water and sewage). |
| 1984-1985          | ![Diagram](image4.png) | Σ 56,0 m²                | – separated rooms, accessible from the corridor, tiny bathroom, technical equipment: kitchen core, kitchen sink; installations (electricity, gas, water and sewage, central heating, central warm water supply). a balcony |
| 2010-2012          | ![Diagram](image5.png) | Σ 46,40 m²               | – enfilade access to the kitchen and sleeping-room, full technical and installation equipment, small balcony |

Own elaboration.
The above housing schemes were developed on the basis of residential premises located in buildings built with various technologies: traditional - using brick (wall structure) and wood (inter-story ceilings), industrialized – using concrete blocks (wall structure) and reinforced concrete (inter-story ceilings), industrial – walls and ceilings made of large reinforced concrete slabs. The material used for the construction of the building structure and its type are one of the most important factors affecting the possibility of conducting renovation and transformation works in a residential interior [4]. Especially when structural walls are located inside the apartment, dividing subsequent rooms, as is the case in each of the examples shown in Table 1. Another important feature is the presence of plumbing divisions, ventilation shafts or chimneys that determine the location of the bathroom and kitchen. Since the 1950s, in multi-family buildings, these rooms have been grouped to minimize the length of plumbing and reduce the number of installation risers. This way of connecting rooms is not compatible with the proper functioning of the zones in the apartment, where the bathroom should be combined with the bedroom, not the kitchen.

Nowadays, there is a growing desire for privatization and individualization in social life. This also applies to the living spaces, where users want to emphasize their status, independence and individuality through custom consumer choices. Characteristics of the apartment in terms of the possibility of adapting it to individual needs are a key factor increasing its market attractiveness. The possibilities of carrying out design works in existing residential buildings were tested during classes conducted with students at the Faculty of Architecture of the Silesian University of Technology. The works were compared with projects on the same subject carried out in the model space. The design task was to design the living space for a defined user who had specific needs arising from both: his physical condition and individual interests, which have been specially selected for theoretical solutions. A residential interior was supposed to be designed for two users - for the main tenant (taking into account his interests and hobbies - randomly selected by students) and potential roommate (spouse, child, parent, grandparent, siblings, friend/colleague, but also dog, cat, rabbit, birds, reptiles, etc.). The application program included residential functions – daily rest, sleeping, personal hygiene, preparation and consumption of meals, storage, work at home and hobby. Therefore, the theoretical resident must have been characterized by a selected hobby that should have been an inspiration for design solutions and should have affected the aesthetics of a residential interior. The student's task was to design the interior space taking into account the behavioral needs of both: the main user and the co-resident.

3. Analyzes of selected design works
The materials for comparison are for four selected student projects conducted by the author of the paper, based on the author's own didactic program. Two were implemented in the adapted space (Table 3) – residential interior designs in an existing building from the 1920s and in a building from the 1960s. Two further projects are residential interiors in a model, cubic space with dimensions of 6 x 6 x 6 meters (Table 4). During the design work, it was possible to notice the possibilities and limitations that exist in the built space and which in the model space.

3.1. Adapted space
For adaptation, a fragment of an apartment located in a building from 1927, built in traditional technology, made of brick, with a longitudinal structure of load-bearing walls (external walls and a central wall along the building), with a story height of 3.2 m, was chosen. The second building chosen for adaptation was a block of flats erected with reinforced concrete skeleton technology on, a modular grid of 3 m x 3 m. The height of the story in this building is 2.5 m. Depending on the assumed number of inhabitants and type of roommate (human or animal), the size of the surface accepted for design work ranged from 45 m² to 60 m².
Table 2. List of apartments accepted for the adaptation projects

| Period of creation | Layout of the premise | View of the part of the facade | Additional information |
|--------------------|-----------------------|-------------------------------|-----------------------|
| 1927               |                       |                               | Building type - downtown tenement house; construction technology - traditional; original arrangement plan - flats with an area of over 100 m²; a fragment of the apartment with an area of approx. 50 m² was adapted to the project. |
| 1968               |                       |                               | Building type - a block of flats containing 275 premises; construction technology - skeletal, reinforced concrete system, filling with concrete blocks; all flats with an area of approx. 36 m²; two adjacent apartments were adapted for the project. |
|                    | Own elaboration.      |                               |                       |

During the design works, the following obstacles and opportunities were observed, provided by the physical and technical characteristics of each building –

- Type of construction technology they were erected with – buildings erected with the use of traditional technology (ceramic brick walls, wooden ceilings) have a fairly rigid arrangement of massive structural walls, which also appear inside the apartment space. Another element hindering the reconstruction of the interior are numerous ventilation and smoke chimneys. Partition walls in such buildings (also made of full brick) not always may be removed, as this may result in sliding the same walls from the upper floor. Wooden ceilings with large spans do not guarantee the maintenance of the additional structure of new partition walls. In terms of the possibility of connecting adjacent rooms and demolition of partition walls, the reinforced concrete frame building looked better. The modularity of the layout allowed for the selection of space from the side or from above, which was also allowed by a similar (symmetrical) arrangement of apartments in the building.

- The height of the story – a big advantage of apartments situated in pre-war buildings is the high height – 3.2 m, even up to 4.0 m – which gives the opportunity to form a mezzanine or platforms, which enriches the artistic expression of the interior. Such treatments allow for better marking of functional zones in a one-space interior. The high height of the rooms also allows the use of a technological floor or suspended ceiling, in which installation cables can be routed to newly designed rooms, including bathrooms or kitchens if they are located not directly next to the installation risers. In the building from the 1960s, the height of living quarters was shaped at the level of the necessary minimum (2.5 m), which does not allow additional rising of floor fragments or lowering the ceiling. Additional upward space can be sought by annexing the space on the upper floor.

- Arrangements of windows on the facade – facades in historic buildings have been designed as finished compositions and they cannot be freely interfered by adding additional openings or
changing their layout or size. It is much easier to design an interior with modular, wide glazed facades that characterize some of the apartment blocks built since the 1960s. Buildings with fully glazed facades provide the biggest possibility to shape the interior, where the layout of partition walls and the rooms they divide does not determine the composition of the facade, and lighting with natural light can be obtained anywhere. Thus, the designer can decide which zones will gain access to daylight and which will not – this can be seen in projects made in the model space (Table 4).

- Location of ventilation chimneys and installation risers – in buildings built in the traditional technology chimneys and installation shafts were usually built into the load-bearing walls. Previously, the apartments were heated with the help of coal stoves, so chimneys were located in every room. Their density on the building plan is a significant impediment to carry out transformation works. They cannot be demolished if it does not apply to the entire chimney riser. Similar problems apply to installation risers – sewage, gas and water supply. In the example building from the 1960s (Table 2), gas and one of the sewage divisions are located in the center of the apartment and constitute a certain problem in adaptation works. The ventilation and additional sewage shaft in this building create an integrated, large element, shapely adjacent to the wall of the collective corridor and this element could be much easier incorporated into the new interior layout.

- Location of the apartment entrance – another important issue is the possibility of changing the entrance opening to the apartment. In stairwell buildings, this is usually not possible, because the wall with the entrance door to the apartment is short. The corridor layout of the building seems to be a better solution, where along the long corridor the entrance openings to the apartments can be designed more freely. This affects the possibilities of shaping the interior of the apartment and its more interesting inner zoning.

**Table 3.** Adaptation projects of multi-family buildings’ fragments.
A fragment of the building from the 1920s; apartment arrangement plan and cross-section; project: M. Wiktorowicz.
The apartment has been designed for the bibliophile breeding lizards – a large, glazed terrarium was designed at the window; a fragment of the existing apartment was annexed to the project so that the rest of the living space was available for other adaptations; with adequate security, part of the structural wall in the center of the apartment was removed; the very high height of the flat (ground floor location) has allowed the creation of a mezzanine above the kitchen area; on the mezzanine, there is a further part of library shelves and a place to read books.

A fragment of the building from the 1960s; apartment arrangement plan and inner space views; project: J. Spyrka.
The apartment has been designed for two people engaged in rock climbing; two flats located above each other, with the same area and the same partition walls were chosen for the project; for the purposes of creating a high space, fragments of ceilings within two structural modules of the building were removed, which was allowed by the skeletal structural system of the entire building.

Own elaboration. Projects supervised by B. Kucharczyk-Brus.

3.2. Model space
A cubic space with internal dimensions of 6.0 x 6.0 x 6.0 meters was adopted for design works. The upper floor or mezzanine must be created in this space. There are no specific installation and ventilation divisions or demands in the project – with modern construction technologies, free maneuvering with elements of internal installations makes no problem. We assume that only one of the external walls can be glazed, and the entrance to the apartment must be on a wall other than the window. Such open space gives the possibility of dividing it at different heights, depending on the designed room function. Adolf Loos' famous Raumplan can be used here, where the height varies depending on the size of the room and its importance in relation to the entire living space [5]. The idea of a residential cube defined in such a way is to connect it into larger housing units, and the glass one wall of the cube is like a fragment of the glass facade of a large multi-family building.

During the design works, the following opportunities offered by the model space were observed –

- No installation restrictions – the possibility of freely shaping "wet" rooms and installing devices such as washbasins, bathtubs, sinks, etc. gave new, avant-garde solutions that are created for the individual user, according to his needs.
- Lack of existing divisions in the interior – the lack of partition walls, structural elements and installation risers allow for free shaping of the interior structure and its artistic expression, both horizontally and vertically, which make the entirety of the apartment's aesthetics complementary.
- The assumed height made it possible to introduce stairs, landings, depressions of floor fragments and other attractive elements of the structure that are not possible to enter in traditional residential buildings (e.g. climbing walls, ramps, slides for children).
- The premise is that the entrance to the apartment can be on any of the walls, except for the window wall – free movement of the entrance area gives another opportunity to create countless, interesting functional solutions.
Table 4. Projects of residential modules in the model space.

Top floor arrangement plan and inner space view; project: Z. Zakrzewska.
The apartment has been designed for a traveler breeding aquarium fish. The space is divided with two floor platforms.

Entrance floor arrangement plan and inner space view; project: M. Wcisło.
The apartment has been designed for a pianist living with a cat. The piano is the most important element in the flat.

Own elaboration. Projects supervised by B. Kucharczyk-Brus.

4. Conclusions
Determinants shaping the contemporary market of residential premises located in multi-family buildings in Poland generate a product that does not quite match the current way of life of people or real social needs, which means that residents prefer to invest in a detached house than in an apartment in a block of flats. The design process has always been limited by the current political and economic conditions and a set of legal provisions, which often limit the possibilities of erecting buildings more susceptible to later transformation works. In apartments from subsequent decades, one can observe a decrease in the total usable area with a similar number of living rooms, a decrease in the share of the kitchen room area in the overall balance, in favor of other rooms – a separate communication zone and a small bathroom that previously did not exist at all [6].

The disadvantage of modern, multi-family housing development is that there has not been a fundamental change in the approach to forming the functional layout of the apartment, dictated by current social needs, especially the need for pluralization and diversification of solutions. Most of the used construction and technological solutions are characterized by a lack of flexibility, which does not
allow free formation of the apartment space, separating and connecting rooms depending on the needs of users. Such actions would be possible with skeletal structural systems of a residential building, multiplied windows or fully glazed facades, numerous ventilation and installation risers (but put outside the floor plan of the flat), as well as story heights allowing running installations in the space of a suspended ceiling or raised floor.

Today, economic issues play a great role in housing construction, including technologies, installations and elements of technical equipment aimed at reducing maintenance costs. But equally important should be the technological solutions enabling an easy transformation of interior spaces, which will allow for a better personalization of residential space, easy renovation and adaptation, which bring greater user satisfaction and increase the attractiveness of the building on the housing market. Thus, a conflict arises between the need for modern solutions, generating perhaps higher initial costs, and the goal of developers – to obtain the lowest implementation costs and the goal of potential customers – the lowest prices of residential premises.

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