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The Concept of Changeability Depending on User Preferences in Gated Housing Sites: The Case of Trabzon

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Abstract

The concept of changeability is explained by the ability of the existing space to carry new functions, its continuity, its ability to grow and to meet different needs. The concept of changeability, which is important for all building groups, is especially important in residences, which are spaces where different needs of the user are met, as well as their shelter needs. Within this framework, the study aims to investigate the spatial characteristics of changeability in existing gated communities, using the Armada Residence housing project in Trabzon as a case study, and to contribute to discussions on design strategies for future residential developments. The research process commenced with a comprehensive literature review. This was followed by a three-stage methodological approach for data analysis and evaluation. In the first stage, the original residential units were systematically examined through field observations. In the second stage, architectural drawings were analyzed in order to identify and synthesize spatial similarities and differences among the plan typologies. In the final stage, changes made to the original plan types were identified and evaluated by comparing the initial residential layouts with the revised plans incorporating pre-occupancy interventions. The research emphasizes the concept of changeability in housing, reveals the necessity of incorporating this concept into new housing designs, and presents the analysis results regarding the types of changes made in the examined houses and which areas were frequently changed/transformed. Considering the data obtained from the analysis made as a result of the study, the changes were evaluated in terms of usability of the space and changeable design suggestions for the new houses were included.

Keywords: *Changeability, Flexibility, Housing, User requirements, User satisfaction*

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INTRODUCTION

A house is a physically large environment where people safely meet their basic needs such as nourishment, clothing and shelter (Özkan, 1981). It is a spatial and socio-economic phenomenon for society, and when considered within the social order, it refers to the smallest scale spatial unit (Erata, 1998). Housing is a building order where an individual's physical and visible functions take place, and where their behaviour and values are shaped by culture and social conditioning (Ersoy, 2002). A house, which meets people's needs of shelter as a type of building, includes many different activities inside. These activities depend on the user's characteristics, needs, lifestyles, and socio-economic characteristics. It changes and diversifies depending on many factors (Zorlu, 2004).

Lifestyle and income disparities within society are increasing day by day, which reduces interaction between different social groups and leads to physical segregation. Over time, social polarization becomes spatially manifested, resulting in the formation of divided urban structures within the city (Brenner and Theodore, 2002). In the second half of the 20th century, under the influence of the Industrial Revolution, closed residential settlements were formed as a spatial reflection of the rupture and separation that occurred in cities as a result of economic changes. Housing settlements closed to the outside, emerging with the need for security and the demand for prestigious housing, are defined as housing communities with social activities, where public space is privatized and separated from the environment by limiting elements (Ercan, 2021). Determining user preferences in these types of residences, which are generally considered more luxurious residences, is important for user satisfaction. Meeting the user needs of the house and residential area and meeting the wishes and expectations of the users are important factors affecting user satisfaction.

User requirements in housing are the features expected by the user, and these requirements are the factors that determine the space organization inside the house. According to Atasoy (1973), user requirements are the conditions that must be met so that users can carry out their activities effectively. According to Ünügür (1973), user requirements are the essential conditions that the environment must have so that the user or users can perform certain activities. User needs are considered as economic, physical and psycho-social based needs. While psycho-social needs include behavioural, privacy and aesthetic needs, physical needs include requirements related to security, health, spatial and physical environmental conditions (Uzel, 2001). Although various classifications have been made regarding user needs, the common aspect in these classifications is that user needs include physiological, social and psychological aspects (İslamoğlu, 2022). Requirements change through life and so do the expectations of house, and this leads to other changes. Housing must be able to meet these

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changing requirements. In addition to meeting users' expectations, lifestyles, social and psychological needs, meeting their wishes and expectations is an important indicator of user satisfaction in the residence (İslamoğlu, 2022). When the necessary harmony between human needs and the environment is not achieved, various disorders arise and people solve these problems by adapting to the environment, or adapting the environment to their needs, or they leave the environment (Altaş and Özsoy, 1998).

As the needs and wishes of the users vary, it does not seem possible for the houses built to appeal to the average user profile to fully meet the wishes and satisfaction of the users (Süvari and Çeliktepe, 2023). In order to prevent this problem, the concepts of flexibility must primarily be handled in housing. The concept of flexibility, which entered architectural terminology in the early 1950s, has increasingly been recognized as a quality criterion in urban design, architecture, and planning in Western contexts (İslamoğlu, 2014). Today, it is defined through the capacity of space to expand, the ability of existing spaces to accommodate new functions, continuity, and the adaptability of technical systems. Furthermore, this concept is elaborated through related sub-concepts such as variability, adaptation, compatibility, and adaptability (Halu, 2024). According to Schneider and Till (2005, 2007), flexibility is associated with a range of issues concerning both the present and future needs of users. First, it anticipates diversity in the spatial organization of units within architectural design; second, it includes the capacity of these units to change and adapt over time. Finally, it enables buildings to accommodate new functions as user requirements evolve.

As the user changes over time, the house must have a changeable and free design approach for use (Hasgül and Özsoy, 2016). Assuming that the residential space is the most personal place where people live their lives, it crucial that individuals tend to change that space in accordance with their own needs and lifestyles and that the home can meet this expectation by being flexible (Yakın, 2022). Houses that can adapt to changing needs, time and situation, and where multiple functions occur in the same space, are defined as flexible housing. Adaptibility in a house refers to its functional flexibility, where functions can change without altering the volume of the space. Flexible housing refers to sustainable and transformable space housing that can take shape according to the changing wishes and needs of users over time and can meet different functions in the same space. These residences allow the space to grow or shrink vertically or horizontally, to personalize the space depending on the user's wishes, and to change the spatial interior arrangements (Diker, 2021).

The concepts of changeability and flexibility in space are provided by the ability of different users to shape the same space in accordance with their needs and make it a more useful space for themselves (Süvari and Çeliktepe, 2023). Thus, different users can produce many alternative

areas using the same volume according to their needs, without changing the building system (Zorlu, 2004). Particularly in residential areas, resolving living spaces in line with user demands is among the factors that increase the efficiency of its use. Efficient use of a building turns it into a building that addresses the comfort conditions of its user (Yüksel and Kariptaş, 2019). With its changeable and flexible design approach, the ability of the user to organize the space within the scope of their own needs and requirements ensures the useful life and efficient use of the building.

The term "changeability," often used in conjunction with flexibility in related definitions, can be conceptually derived from flexibility through its associated meanings and is commonly addressed under several subcategories. Changeability can be defined as the capacity to adapt to changing conditions within a given period, providing a response to evolving circumstances (Somer and Umur, 1978). A changeable product refers to the ability to accommodate change by reorganizing the existing space in response to content requirements or changing users, particularly through the availability of information before, during, and after production and use (Deniz, 1999). Changeability parameters include the capacity of space to respond to individual needs (Hesapçıoğlu, 2010), the system's ability to intervene in and modify conditions, and the potential to change elements, functions, and components within the built environment (Erata, 1998).

There are many factors which affect user satisfaction in housing design. These factors include adding users in house design, personalization, flexibility and multi-purpose areas of utilization. Therefore, the concept of changeability becomes prominent as a design factor. Thus, it is possible to increase user satisfaction with housing designs that can adapt to the changing needs of the user. Applying the user's ideas to the planning and design processes of the house by determining the principle of flexibility and changeability in design is the way to learn the needs and expectations of the users, and this increases user satisfaction (Estaji, 2017).

The concept of changeability has been accepted as one of the important features of satisfaction in housing use and multi-faceted studies have been conducted in this area. The studies have revealed that the concepts of changeability and flexibility increase the service life of residential buildings and the satisfaction of the user (Altaş and Özsoy, 1998; Üstün, 2000; Uzel, 2001; Gülaydın, 2004; Zorlu, 2004; İnal & Ünlü, 2009; Deniz, 2011; Buluklu, 2014; Gücesan, 2014; Çimşit Koş, 2015; Hasgül and Özsoy, 2016; Kızmaz and Çimşit Koş, 2015; Özçelik and Kaprol, 2017; Diker, 2021; Yakın, 2022; Süvari and Çeliktepe, 2023; Şuta and Akansel, 2023).

Housing study is important in terms of revealing the evaluations regarding the physical, social and psychological satisfaction of users in their living environments. The short-term benefit of these studies is to immediately solve the problems of the current project, the medium-

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term benefit is to provide information for the building cycle in future projects, and the long-term benefit is to provide forward-looking feedback to develop design criteria (Liu, 1999). Based on this, the study is based on the claim that the physical and psychosocial needs of the user in the house are different and their expectations from the house change accordingly. The main purpose of the study is to discuss changeable and flexible usage opportunities in existing gated housing sites and design strategies for new houses to be built. In this context, the study covers a research and analysis on changeability and flexibility opportunities in a sample area determined in Trabzon. In this project, which was built in 2014 and started to be resided in 2018, the plans of 40 houses were discussed before use and 12 house plans that were changed were analysed.

Within the scope of the study, the purpose is to reveal the changing needs of the users regarding their residences, to develop the usage possibilities of the residences depending on the new usage norms and to develop design suggestions for the new residences to be built. In accordance with this purpose, a literature review was first conducted on the concepts of housing, closed housing settlements, changeability and flexibility in housing. In the second stage, analyses were made to determine the changes made in the Armada Residence buildings in Trabzon. These analyses aimed to determine what kind of changes were made in the houses and which areas were frequently changed / transformed. In the last part of the study, based on the data obtained from the analysis, the changes were evaluated in terms of the usability of the space, and finally changeable design suggestions were provided for new houses to be built.

RESEARCH AND METHOD

Sampling Area Selection

Armada Residence is a housing project consisting of 14 blocks and 317 apartments, located in the Yıldızlı District of Akçaabat in Trabzon (Figure 1). The project area is distributed across two separate parcels, with 11 blocks located on the upper parcel and 3 blocks on the lower parcel. The project includes various social facilities such as outdoor and indoor swimming pools, a fitness center, Turkish baths for men and women, a sauna and steam room, animal shelters, a tennis court, a cafeteria, and extensive landscaped areas. Construction of the project began in 2014, and the 11 blocks on the upper parcel have been inhabited since 2018.

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Figure 1. Armada Residence Housing Project

Since its introduction, Armada Residence has emerged as one of the most prominent residential projects in Trabzon, attracting considerable attention. The project stands out due to its social facilities, diverse apartment layouts, exclusive services, dual-kitchen configurations in many units, and the quality of materials used (Figure 2).

Figure 2. Sample Interior Views of Residential Units

The residential units within the project are designed as duplexes and in 1+1, 2+1, 3+1, 4+1, and 5+1 typologies, exhibiting a differentiated distribution across residential blocks. In addition to this variation in housing layouts, significant differences are also observed among the residential blocks themselves. The blocks vary in terms of spatial scale, plan typologies, number of floors, social amenities, total number of dwelling units, and additional functional spaces (Table 1). Accordingly, the selection of the residential block to be examined in this study is of particular importance. In this selection process, criteria such as the number and characteristics of dwelling units, spatial size, location, and diversity of plan typologies were taken into consideration. This approach aims to enable a more comprehensive comparison and a more in-depth analysis of variations in plan typologies.

Table 1. General Features of Armada Residence Housing Project Blocks.

A Block	B1 Block	**B Block** (B2-B3)	**C Block** (C1-C2)	**D Block** (D1-D2)	**E Block** (E1-E2)	**F Block**	**G Block**	**H Block** (H1-H2)
23 flats	**22 flats**	**48 flats**	**50 flats**	**49 flats**	**45 flats**	**22 flats**	**21 flats**	**37 flats**
1+1 4+1 5+1	3+1 4+1	1+1 2+1 3+1 4+1 Dublex	1+1 2+1 3+1 4+1 Dublex	1+1 2+1 3+1 4+1 Dublex	1+1 3+1 4+1	3+1 4+1	3+1 4+1	1+1 2+1 3+1 4+1

This study aims to generate data for new approaches to residential design by examining the potential modifications that can be implemented within the units of the selected housing blocks and by revealing these modifications through spatial analysis methods. In this

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context, the primary objective is to identify the housing block to be studied and to obtain a wide range of different plan typologies for comparative analysis. We focused on Block C, which is a block that has diversity in terms of its plan type and will therefore allow more comparison and analysis. Block C was also included in the study because it is located in the center of the project and houses the project's social facilities and sample apartment. Block C has 13 floors and consists of 50 apartments, including 1+1,2+1,3+1,4+1 and duplex.

Method

The research process initially involved the development of a conceptual framework. Within this scope, a comprehensive literature review was conducted based on theses, journal articles, conference papers, and books addressing housing, gated residential communities, user requirements, user satisfaction, flexibility, and changeability, as well as changeability in housing. Subsequently, data related to the study area were collected. The Armada Residence housing project, selected as the case study, provided data regarding its project characteristics, housing typologies, user profile, construction materials, original floor plans, and modified floor plans. All collected data were supported through interviews with the contractor and residents, as well as on-site inspections and field observations.

After the data collection process, the sampled residential units were subjected to spatial analysis from an interior architecture perspective. A three-stage methodological approach was employed to analyse and evaluate the implemented modifications. In the first stage, examinations were conducted at the residential block level, and the plan typologies within the block were identified. It was determined that the residential block comprised a total of six different plan typologies (Table 2). During the research process, the basement floor units were excluded from the scope of the study, as their sales transactions had not been completed. The findings derived from the spatial analyses are presented in the findings section; These data are further interpreted and discussed in the subsequent sections of the study and constitute the basis for the proposed design recommendations.

Table 2. C Block Plan Types

Type-1 Original Plan Ground Floor	Type-2 Original Plan 1.2. and 3. Floor	Type-3 Original Plan 4. and 5. Floor
		
Type-4 Original Plan 6.Floor	**Type-5 Original Plan 7. and 8. Floor**	**Type-6 Original Plan 9. Floor**
		

1. Corridor, **2.** G. Bedroom, **3.** S. Facing Balcony-1, **4.** Living Room, **5.** Cold Kitchen, **6.** Hot Kitchen, **7.** N. Faced Balcony, **8.** Children's Room-1, **9.** M. Bedroom, **10.** En-Suite Bathroom, **11.** General Bathroom, **12.** WC, **13.** Laundry Room, **14.** Study Room, **15.** S. Balcony-2, **16.** Floor Garden, **17.** Dressing Room, **18.** Guest Bathroom, **19.** Children's Room-2.

After the study on the grouping of plan types, architectural projects were examined in the second stage and spatial differences and similarities within the plan types were determined. As a result of the examinations, it was seen that the living room, cold kitchen, hot kitchen, children's room-1, master bedroom, guest room, general bathroom, en-suite bathroom, north side balcony, south side balcony areas were included in all plan types. The differentiating areas in the apartments are those such as children's room-2, study room, dressing room, WC, laundry room, guest bathroom, floor garden and a second balcony facing the south side. Of these areas, children's room-2 is located in type-4 and type-5, WC is located in type-1 and type-2, and the study room is located only in type-3. It is seen that the dressing room and guest bathroom are located in type-4, type-5 and type-6, and the laundry room is also located in type-3 in addition to these types. The second balcony setup facing the south facade is seen in type-3 and type-4 housing plans. Floor garden areas are also located in type-1, type-5 and type-6, and are located in only one apartment (east or west apartment) on the floors of these types (Table3).

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Table 3. Spatial Distribution of Residential Block C by Typology

	Type-1	Type-2	Type-3	Type-4	Type-5	Type-6
Living Room	+	+	+	+	+	+
Cold Kitchen	+	+	+	+	+	+
Hot Kitchen	+	+	+	+	+	+
Children's Room-1	+	+	+	+	+	+
Children's Room-2	-	-	-	+	+	-
Master Bedroom	+	+	+	+	+	+
Guest Bedroom	+	+	+	+	+	+
Study Room	-	-	+	-	-	-
Dressing Room	-	-	-	+	+	+
Laundry Room	-	-	+	+	+	+
WC	+	+	+	-	-	-
General Bathroom	+	+	+	+	+	+
En-Suite Bathroom	+	+	+	+	+	+
Guest Bathroom	-	-	-	+	+	+
Floor Garden	+	-	-	+	+	-
N. Faced Balcony	+	+	+	+	+	+
S. Facing Balcony-1	+	+	+	+	+	+
S. Facing Balcony-2	-	-	+	+	-	-
Corridor	+	+	+	+	+	+

In the final phase of the study, the spatial adaptations made to the housing plan typologies in response to users' needs and preferences were identified. The alterations implemented within the residences were incorporated into the plans based on data obtained through on-site observations and interviews conducted with the residents. In light of the data derived from the analyses, the study sought to determine the areas in which users most frequently implemented spatial adaptations, the types of interventions most commonly carried out, whether users exhibited general tendencies regarding these interventions, and how the Armada Residence housing units responded to such spatial adaptations. Based on the findings, the spatial requirements most needed by users within their residences were identified, and design recommendations for future housing projects were proposed.

ANALYSIS AND FINDINGS

Within the scope of the research, 40 apartments in Block C of the Armada Residence housing project in Trabzon were examined within the scope of changeability. The changes identified in the residential units examined within the scope of the study encompass the modifications made during both the design and implementation phases of the project. The results of the analysis, interviews and evaluations revealed that only functional changes were made in some apartments, while in some apartments additions, deletions, combinations etc. were made. While no change was detected in 2 types (Type-1 and Type-6) among the 6 plan types, it was determined that changes were made in 12 houses in the other plan types.

These changes made by the users in the original plan type in line with their wishes and requirements before use are expressed in detail in the

figures by analyzing the architectural plans, on-site determinations and interviews (Figure 3-8). The tables prepared for the analysis of the spatial adaptations within the residential units include both the original floor plans and the revised plans illustrating the implemented spatial adaptations. In the sample of the C residential block, the spatial adaptations made to the plans were indicated by marking the adapted areas in red on the drawings.

There are a total of 4 Type-1 plan type apartments in C block. The original housing features of this type are given in Figure 3. The apartments are planned as 3+1 apartments. These apartments include a living room, kitchen (cold and hot kitchen), guest room, children's room, parent bedroom, and 3 wet areas: a general bathroom, an en-suite bathroom and a WC. There are also balconies and floor gardens facing the north and south facades. No changes have been made by the users in the apartments of this plan type.

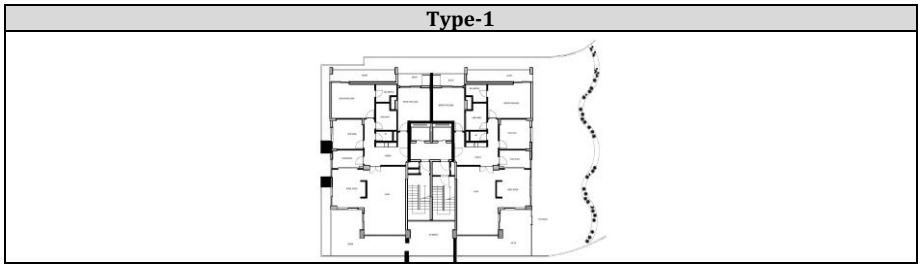

Figure 3. Type-1 original floor plan

Type-2' original housing features and the changes made are shown in Figure 4. There are a total of 12 apartments of this plan type in C block. The apartments are planned as 3+1 apartments. These apartments include a living room, a kitchen (2 cold and hot kitchens), a guest room, a children's room, a parent bedroom, and 3 wet areas: a general bathroom, an en-suite bathroom and a WC. While there is a balcony facing the north and south facades, there is no floor garden of this type. In this plan type, changes were made to a total of 3 apartments in block C.

The changes made: The hall was changed only in the residence belonging to plan 2. The common wall of the hall with the corridor was moved towards the hall, making the hall smaller and the corridor larger. The purpose of doing this is that the area allocated for the cloakroom in the original plan disappeared as a result of the change made in the WC and a new area for the cloakroom was wanted to be created. In the two residences, no enlargement or reduction was made in the original areas, only functional changes were made. As stated in plan 1, the change was to cancel the parent bathroom in one of the residences and use it as a dressing room. In the other house, the WC mentioned in plan 3 was cancelled and this area was used as a laundry room. In a residence, the master bedroom was enlarged and the children's room-1 was reduced. This change, mentioned in Plan 2, was realized by shifting the common wall of the two areas towards children's room-1. With the enlargement of the master bedroom, a new space was obtained for the user's

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wardrobe. The bathroom and corridor areas were narrowed and the WC area was expanded. The resulting new WC area was divided into two vertical areas, considering the minimum space requirements. A new WC has been designed in one of these two areas, and a laundry room in the other. These narrowing and expanding operations were carried out in Plan 2. These narrowing and widening operations in Plan 2 were made by shifting the common wall of the WC and corridor towards the corridor and the common wall of the bathroom and WC towards the general bathroom.

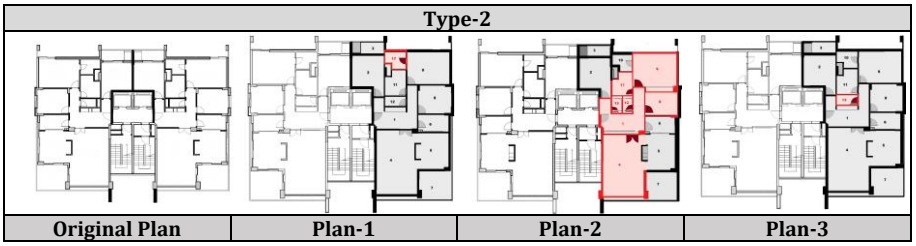

Figure 4. Changes made in Type-2 floor plans

Type-3' original housing features and the changes made are shown in Figure 5. There are a total of 8 apartments of this plan type in C block. The apartments are planned as 4+1 apartments. These apartments include a living room, a kitchen (2 cold and hot kitchens), a guest room, a children's room, a study room, a parent bedroom, and 4 wet areas: a general bathroom, an en-suite bathroom, a WC, and a laundry room. While there are a total of 3 balconies, 1 facing the north and 2 facing the south, there is no floor garden in this plan type. In this plan type, changes were made to a total of 3 apartments in block C.

The changes made are as follows: In three apartments, the laundry room was cancelled and the washing machine was placed in the general bathroom. WC was cancelled in all three modified apartments. In one of the apartments, the WC was combined with the laundry room as indicated in plan 1 and turned into an en-suite bathroom. The entrance to the new en-suite bathroom was given from the corridor where the guest room was in the original plan. In the other apartments, the WC was combined with the laundry room and the general bathroom. This area was transformed into a general bathroom and dressing room as shown in plan 2 and plan 3. During this transformation, the wall of the master bedroom, which was common with the corridor, continued horizontally and divided the new space into two different areas. While the area inside the bedroom was transformed into a dressing room by opening a door from the room, the area in the corridor was functionalized as a general bathroom. The cold-hot kitchen setup was changed to a single kitchen in one of the houses. While making this change shown in Plan 2, the common wall of the hot kitchen with the children's room-1 was kept constant. The sliding door between the warm kitchen and the cold kitchen was eliminated and these two areas were combined. The opening between this space and the living room was closed by extending the wall with the kitchen door towards the

balcony door. Thus, the living room and kitchen are designed independently from each other. The en-suite bathroom in one of the houses was combined with the master bedroom by eliminating the common wall as shown in plan 1. This new space has been functionalized as a library. With the conversion of the master bedroom in Plan 1 into a library, the guest room in the original plan was re-functionalized as a master bedroom.

Figure 5. Changes made in Type-3 floor plans

Type-4's original housing features and changes made are shown in Figure 6. There are a total of 4 units of this plan type in Block C. The apartments are planned as 4+1 apartments. These apartments include a living room, a kitchen (2 cold and 2 hot kitchens), a guest room, 2 children's rooms, a master bedroom, a dressing room, and 4 wet areas. The 4 wet areas consist of a general bathroom, en-suite bathroom, guest bathroom, and laundry room. There are three balconies in total, one facing north and two facing south. Only two of the apartments have a floor garden. This plan type has been modified in all four apartments in Block C.

The changes made in Type-4 are as follows: In 2 apartments, the double kitchen setup was changed and the kitchen area was designed as a single kitchen. While making these changes shown in plan 2 and plan 4; the common wall between the hot kitchen and the children's room-1 was kept constant, and the sliding door between the cold kitchen and the hot kitchen was cancelled. A part of the cold kitchen area was combined with the hot kitchen to create a new kitchen. Thus, the connection of the new kitchen with the living room was eliminated. The other area remaining from the cold kitchen was combined with the living room and the living room in these apartments was enlarged. In the houses belonging to plan 2, plan 3 and plan 4, the original en-suite bathroom was combined with the dressing room and the new space obtained was transformed into a larger dressing room. In 3 apartments, the overall bathroom area has been reduced. In plan 2, plan 3 and plan 4, the common wall between the general bathroom and the guest bathroom in the original plan was moved towards the general bathroom. As a result of this change, the guest bathroom, whose area expanded as a result of this change, was divided into two areas in the vertical direction considering the minimum space requirements. One of these areas was again designed as a guest bathroom and the other area was designed as a laundry room. In the houses belonging to plan 2, plan 3 and plan 4, the en-suite bathroom, which was cancelled by being included in the dressing room, was built in the place of the laundry

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room in the original plan. In the houses belonging to plan 2, plan 3 and plan 4, the door of the master bedroom was pulled towards the corridor and this area was widened and the corridor was narrowed. Only in the dwelling belonging to plan 1, the entrance to the en-suite bathroom was cancelled from the original plan and given from the dressing room. As a result of this change, a change in surface areas was detected. This change was in the form of an increase in the wall surface in the master bedroom and a decrease in the dressing room.

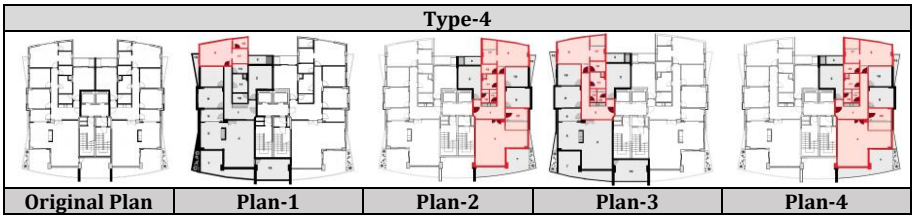

Figure 6. Changes made in Type-4 floor plans

Type-5's original housing features and changes made are shown in Figure 7. There are a total of 8 units of this plan type in Block C. The apartments are planned as 4+1 apartments. These apartments include a living room, a kitchen (It consists of 2 parts: cold and hot kitchen.), a guest room, 2 children's rooms, a master bedroom, a dressing room, and 4 wet areas. The 4 wet areas consist of a general bathroom, en-suite bathroom, guest bathroom, and laundry room. Each apartment has a balcony facing north and south. Only 4 of the apartments have a floor garden. In this plan type, a total of 2 apartments in Block C have been modified.

The changes made in Type-5 are that the dressing room and laundry room were combined in both apartments. In this case, the laundry room was cancelled, and the new space obtained was functionalized as a dressing room. As a result of this merger, a new laundry room was not designed instead of the cancelled laundry room and the washing machine was placed inside the general bathroom.

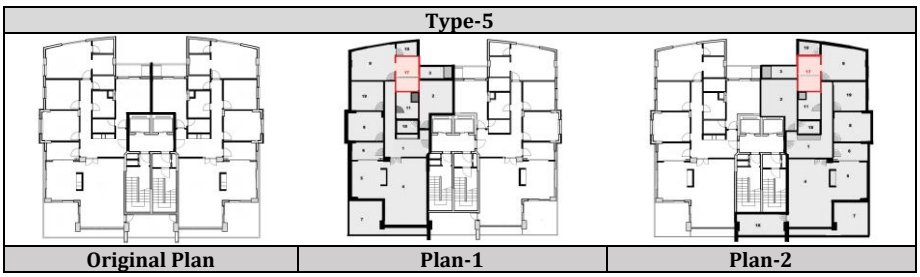

Figure 7. Changes made in Type-5 floor plans

There are a total of 4 units of Type-6 apartments in Block C. The original housing characteristics of this type are given in Figure 8. The apartments are planned as 3+1 apartments. These apartments include a living room, kitchen (2 cold and 2 hot kitchens), guest room, children's room, master bedroom, dressing room, and 4 wet rooms. The 4 wet areas consist of a general bathroom, en-suite bathroom, guest bathroom, and laundry room. Each apartment has a balcony facing the north and

south facades, but there is no floor garden. No changes have been made by the users in this plan type.

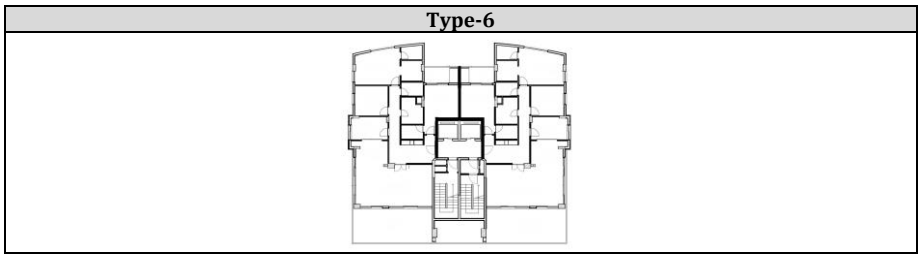

Figure 8. Type-6 original floor plan

In addition to all these changes, it has been determined that type-5 and type-6 are the same in terms of mass, but they are analysed differently in terms of planning. When type-5 is analysed, it is an apartment with a 4+1 plan type, while type-6, which has the same area, is analysed in a 3+1 plan type. While the master bedroom, dressing room, en-suite bathroom, laundry room, general bathroom, balcony facing the south facade, guest room and bathroom and children's room-2 are common solutions for both types, children's room-1 is cancelled in type-6. In addition, the living room, warm kitchen-cold kitchen and balconies facing the north facade are designed differently for these two types (Figure 9).

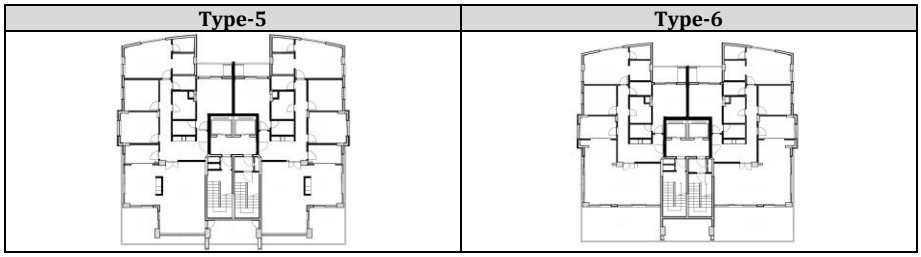

Figure 9. Type-5 and Type-6 original floor plans

When the spatial adaptations are examined, it is observed that some areas remained unchanged, while others were frequently subjected to modification. The findings regarding in which areas and in what manner these adaptations were implemented, which spaces were obtained as a result of these changes, and how they varied according to housing typologies are presented below:

•The findings indicate that the most frequently adapted spaces within the residential units are laundry rooms and dressing rooms, whereas the least frequently adapted spaces are children's room-1 and guest rooms. Additionally, no adaptations were observed in children's room-2 and study rooms across the examined floor plans.

•In laundry rooms, identified as the most frequently adapted spaces, spatial adaptations were observed in 10 out of 12 dwelling units. The interventions carried out in these areas include spatial addition, spatial reduction, and spatial removal.

•Following laundry rooms, dressing rooms constitute the second most frequently adapted spaces. Changes were observed in 9 out of 12 dwelling units, with interventions primarily involving spatial

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enlargement and the incorporation of dressing rooms into typologies where they were not originally included. This space was reduced in size in only one dwelling unit.

•Children's room-1 and guest rooms underwent adaptations in only one dwelling unit each. As a result of these interventions, the area of the children's room was reduced, while the guest room was removed.

•Adaptations related to WC areas were identified in 5 dwelling units. In 4 of these cases, the WC was removed and the space was repurposed to accommodate different spatial requirements. The remaining intervention involved the redesign of the space to meet minimum spatial requirements.

•Adaptations in kitchen areas were observed in only 3 dwelling units. In all plan types, kitchens were originally designed as two separate spaces: a hot kitchen and a cold kitchen. However, in these 3 units, this separation was removed and replaced with a single combined kitchen.

•Adaptations related to en-suite bathrooms were observed in 6 dwelling units. Among these, the space was completely removed in only one unit. In another unit, the bathroom entrance was relocated from the master bedroom to the dressing room. In the remaining 4 units, the original location of the en-suite bathroom was changed and the space was enlarged.

•Adaptations related to guest bathrooms were observed in 3 dwelling units. The changes indicate that these spaces were reduced in size in accordance with minimum spatial requirements.

•Adaptations related to general bathrooms were observed in 7 dwelling units. These changes involved a reduction in area in 5 units and an enlargement of the space in 2 units.

•Adaptations in the master bedroom were observed in 8 dwelling units. These changes involved both spatial reduction in some typologies and spatial enlargement in others.

•Adaptations in corridor spaces were observed in 4 dwelling units. These changes involved both spatial reduction in some typologies and spatial enlargement in others.

•Adaptations related to living rooms were identified in 4 dwelling units. In 2 of these units, the space was enlarged, while in 1 unit it was reduced. In the remaining case, the connection between the living room and the cold kitchen was eliminated by constructing a partition wall, which resulted in an increase in usable wall surface area.

Table 4 presents the data on spatial changes in the dwellings of Residential Block C. It shows which spaces were changed, which spaces were removed from the dwellings, which new spaces were added, and which areas were enlarged or reduced. It also indicates how many dwellings were affected by these changes according to each typology.

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Table 4. Analysis of Spatial Adaptations in Residential Block C According to Typologies

Plan Type	Spatial Adaptations	Spatial Units within the Residential Space										
		1	2	3	4	5	6	7	8	9	10	
TYPE-2	*Addition*											
	Removal										*	
	Expansion	*								*		
	Reduction				*				*			
		11	12	13	14	15	16	17	18	19	20	21
	Addition			**				*				
	Removal		*									
	Expansion											
	Reduction	*	*									
TYPE-3		1	2	3	4	5	6	7	8	9	10	
	Addition											
	Removal		*			*	*					
	Expansion				*							
	Reduction									***	*	
		11	12	13	14	15	16	17	18	19	20	21
	Addition							**			*	*
	Removal		***	***								
	Expansion	**										
	Reduction	*										
TYPE-4		1	2	3	4	5	6	7	8	9	10	
	Addition											
	Removal					**	**					
	Expansion				**					****	***	
	Reduction	***										
		11	12	13	14	15	16	17	18	19	20	21
	Addition										**	
	Removal											
	Expansion							***				
	Reduction	***		***				*	***			
TYPE-5		1	2	3	4	5	6	7	8	9	10	
	Addition											
	Removal											
	Expansion											
	Reduction											
		11	12	13	14	15	16	17	18	19	20	21
	Addition											
	Removal			**								
	Expansion							**				
	Reduction											

1. Corridor, **2.** G. Bedroom, **3.** S. Facing Balcony-1, **4.** Living Room, **5.** Cold Kitchen, **6.** Hot Kitchen, **7.** N. Faced Balcony, **8.** Children's Room-1, **9.** M. Bedroom, **10.** En-Suite Bathroom, **11.** General Bathroom, **12.** WC, **13.** Laundry Room, **14.** Study Room, **15.** S. Balcony-2, **16.** Floor Garden, 17. Dressing Room, **18.** Guest Bathroom, **19.** Children's Room-2, **20.** Kitchen **21.** Library

CONCLUSIONS AND RECOMMENDATIONS

There are some important approaches to ensure changeability in housing design. Within the scope of this study, according to the data obtained from the research conducted on 40 houses in Trabzon, it was found that in 12 houses during the planning and implementation process, users made various changes to their houses depending on their profile, wishes and needs. As a result of the research, the determinations and suggestions for housing design are given below, considering the changes made in these residences.

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•The findings indicate that laundry rooms are considered a significant spatial component in achieving flexibility within residential interior design, functioning primarily as auxiliary spaces. It is essential that such service areas, including laundry rooms, can be transformed in accordance with different user profiles, changing needs, habits, and everyday living practices. In this context, incorporating laundry rooms into housing floor planning in a flexible manner facilitates the adaptation of dwellings over time in response to users' evolving requirements.

•These findings clearly demonstrate users' need for dressing rooms. The spatial interventions observed in the examined sample indicate that the changes made to dressing rooms mainly result from the inadequacy of these spaces or from their exclusion during the initial planning stage of the housing design. In this context, dressing rooms should be regarded as an important component of the residential design process and should be incorporated into future housing projects through a flexible and user-oriented planning approach.

•Although living rooms are generally perceived by users as sufficiently large, the findings indicate that users tend to modify these spaces by adding extra volumes to expand them. This suggests a perceived need for larger living areas and highlights that living rooms should be considered not merely as seating areas, but as multifunctional environments that accommodate rest, social interaction, and guest reception. Furthermore, the observed modifications reveal that the connection between the living room and the cold kitchen is often eliminated, resulting in the separation of these two spaces. This indicates that integrating living rooms with cold kitchen areas is not considered functionally appropriate by users. Such interventions suggest that maintaining a rigid spatial connection between these areas is not always necessary, and, in some cases, may negatively affect spatial integrity. In this context, living rooms should be regarded as central and socially significant spaces within residential design in future housing projects. Their design should allow for flexibility in terms of expansion and integration with adjacent spaces, in accordance with users' needs and preferences. Moreover, spaces related to living rooms should be planned with sufficient flexibility to accommodate different usage scenarios based on evolving user requirements.

•The kitchens were designed as dual-function spaces (hot and cold kitchens), and in all observed interventions, these layouts were converted into single-kitchen configurations. In this regard, it is evident that some users do not prefer a dual-kitchen arrangement and instead favor a single, sufficiently sized and functional kitchen space over two separate units. Moreover, the absence of any intervention in certain cases suggests that some users either prefer or are willing to experience the dual-kitchen configuration and are open to alternative spatial design approaches. In this context, it is essential that kitchen areas in future housing designs offer flexible design strategies in accordance with users'

needs and preferences. Secondary spaces (such as cold kitchens), depending on user requirements, may either retain their original function or be reassigned to alternative uses, thereby contributing to spatial flexibility within the dwelling by providing users with alternative usage scenarios.

•Master bedrooms are planned differently across housing typologies; in some units they are accompanied by an en-suite bathroom, while in others they are designed in conjunction with both a bathroom and a dressing room. The findings indicate that these spaces have undergone change, particularly as a result of interventions in dressing rooms and en-suite bathrooms. In this regard, master bedrooms appear to adequately meet user requirements, and the auxiliary spaces designed in association with them play a significant role in the spatial organization of the unit. Accordingly, in future housing projects, master bedrooms should not be designed solely as individual rooms, but rather in integration with bathroom and dressing room units.

•The change observed in the children's room indicates that this space is reshaped in accordance with changing user needs and demonstrates a degree of spatial flexibility. The intervention involving spatial reduction are particularly associated with the transformability of the adjacent space. In this context, in future housing designs, children's rooms should be planned by taking into account their relationship with adjacent spaces and should be conceived as areas capable of accommodating spatial transformations when necessary.

•The changes observed in guest bedrooms demonstrate that these spaces can be integrated into different functional uses. Based on the findings, guest bedrooms in future housing designs should not be considered solely as spaces intended for guest accommodation, but should instead be planned in a manner that allows for alternative functional arrangements when required.

•The changes observed in general bathrooms primarily result from interventions carried out in adjacent spatial units where they are directly connected, such as guest bathrooms, dressing rooms, and laundry rooms. This situation clearly demonstrates that general bathroom areas exhibit flexibility and adaptability in relation to user needs. In this context, in future housing designs, general bathrooms should be planned in a way that allows for spatial enlargement or reduction when necessary. Additionally, their design should be based on a user-centered and flexible approach, taking into account wall positioning and infrastructural systems such as plumbing.

•The high rate of elimination observed in WC areas indicates that these spaces are not frequently utilized within residential units. In this context, the flexible planning of WC spaces in future housing designs, together with their capacity to accommodate different functional requirements, can contribute to increased spatial efficiency. This approach enables users to make appropriate spatial arrangements within the dwelling in response to alternative needs and highlights the

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importance of allowing these spaces to be utilized in accordance with changing user requirements and preferences.

•The observed adaptations demonstrate the necessity of incorporating en-suite bathrooms into residential planning and design processes. In this context, the dimensions of en-suite bathrooms in future housing projects should be designed with flexibility in order to accommodate diverse user needs. Furthermore, these spaces should allow for adaptable use, enabling spatial enlargement, subdivision, or reconfiguration when required.

•The changes observed in guest bathrooms indicate that users require access to these spaces even within limited spatial conditions. This finding highlights the necessity of integrating guest bathrooms into residential design while considering minimum spatial requirements. Accordingly, guest bathrooms should be included in future housing projects even at a minimal spatial scale and should be designed to allow functional flexibility, enabling adaptation to changing user needs and alternative spatial solutions when required.

•The changes observed in corridor spaces appear to be closely associated with interventions carried out in other spatial units. In this context, corridors should be considered not only as circulation areas, but also as functional transition spaces that enable spatial modifications within the dwelling. It is evident that corridors contribute to planning flexibility by facilitating interventions in adjacent spaces. Accordingly, in future housing designs, corridors should be conceived not only as elements ensuring spatial circulation, but also as flexible and transformable areas that support the reorganization of other spaces when necessary.

The analysis reveals several recurring patterns in the observed spatial interventions. In particular, the adjacency of functionally related spaces suggests that interventions in one unit often influence or facilitate changes in the adjacent one. In this regard, grouping spaces such as laundry rooms, WCs, dressing rooms, en-suite bathrooms, general bathrooms, and guest bathrooms within close proximity may enhance the flexibility and ease of spatial reconfiguration in future housing designs. Another notable finding is that, in some cases, the original spatial unit remains physically unchanged while only its function is redefined. This indicates that these spaces possess a high degree of functional adaptability without requiring any dimensional alteration, demonstrating their capacity for purely functional transformation. In this context, it is recommended that future housing designs ensure not only functional compatibility but also dimensional coherence among spatial units, allowing for more efficient and flexible spatial reorganization.

In the process of reshaping user requirements in housing, it is believed that the present study can contribute to both new projects or existing housing plans by evaluating the obtained data.

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