

THE FLEXIBLE LAYOUT IN CO-HOUSING PROJECT – POSSIBILITY FOR AFFORDABLE CUSTOMIZED HOME

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ABSTRACT

With the growth of metropolises, the time lag between the increasing population and the housing construction causes a shortage of affordable housing. Cohousing, a type of community consisting of independent households with collaborative management and shared spaces, appears to some extent against the rising housing price by real estate investment. The research started with the customized interior layout exercise for diverse household needs based on a floor plan survey of de Nieuwe Meent project, an undergoing co-housing project in Amsterdam. Comparing with the results from a studio, a loft, and a living group space shows that different spatial spans and indicative forms of the existing construction led to how dwellers would arrange the layouts. The possibilities for customized household demands are improved when there are more spaces to share, while private spaces are decreasing. This research aims to answer how to reserve potential space for a co-housing design that suits dwellers from diverse backgrounds in an international city such as Amsterdam through an oriental perspective.

KEYWORDS: *Affordability, Flexibility, Cohousing, Customization, Sharing Space*

I. INTRODUCTION

1.1. Housing Shortage and Affordability

The simple wish for the homeless to have a shelter could date back to the Tang dynasty. When the Chinese poet and politician Du. Fu was suffering from heavy wind and rain that destroyed his cottage for shelter, he argued:

安得广厦千万间，大庇天下寒士俱欢颜，风雨不动安如山。

Get tens of thousands of spacious houses. Generally shield the poor in the world and make them all happy. As stable as a mountain in the wind and rain.

To get everyone, no matter rich or poor, an affordable home was impossible in ancient times. Nowadays, the situation is not as cruel as the days back then, but many countries are still suffering from a potential housing crisis. The shortage of affordable housing has been a global phenomenon. What is the fundamental reason for the high price of housing?

The insufficient supply of houses would be the answer that is easy to conclude. There will be a potential housing shortage of up to around 370,000 in the Netherlands in 2022, and the shortage is mainly in the metropolitan municipalities. It seems like the problem will be solved if we build up enough houses. However, the Dutch residential sector is under enormous pressure from the slow development of new housing comparing to the increasing demand (2020). When there is a shortage in the supply comparing to the demand, the price increase, building more homes will solve the problem if this is the case. The fundamental reason for expensive housing prices lies in massive demand for houses as a financial asset (Ryan-Collins, 2018). Housing as a commodity becomes luxury with a significant profit margin when there is a scarcity. The investors profit from

the real estate with rents and selling after decades, and banks benefit from selling financial products without building more houses (Ryan-Collins, 2018). The ones who suffered from the increasing housing price are the people who need a home to live in, especially low incomes who has the least competitiveness in the market. However, housing is not a piece of dispensable luxury. Having a place to live is a basic human right (Hala and Farooq Hasan, 2020). The World Health Organization defined affordable housing as a "residential environment which includes, in addition to the physical structure that man uses for shelter, all necessary services, facilities, equipment and devices needed or desired for the physical and mental health and social well-being of the family".

1.2. Co-housing and Affordability

To against marketing influence on housing, austerity measures are conducted to reduce financial support to housing production. However, the restriction caused an increasing number of middle-class citizens facing a living standard decline and housing exclusion except for low incomes (Czischke Ljubetic, 2017). The financial policy was able to control the housing market as a commodity; however, the housing crisis is a social issue that requests efforts from multiple sources from all kinds of association to the dwellers. Co-housing is one of the collective self-organized housing initiatives and attempts that involve much dwellers' participation and cooperation from a bottom-up basis and the authorities' support in a top-down way (Czischke Ljubetic, 2017, Krokfors, 2012).

The concept of co-housing varies among academic fields. "In literature, the co-housing concept tends to be focused on the physical layout and the social aspects of this living form. An important feature of co-housing is the combination of single unit dwellings with shared facilities, balancing privacy and communality" (Beck, 2020). Financially, co-housing is defined by the ownership based on cultures and times, instead of a specific financing arrangement (McCamant and Durrett, 2011). For example, "(m)ost of the early communities in Denmark, and the large majority of communities in the United States, have used a condominium financing model with a homeowners' association. ... To date, most communities built in the North America have used private bank financing. Beginning in 1982, Danish communities have been able to take advantage of government-sponsored, guaranteed construction loans that structure the developments as limited equity cooperatives. Denmark has resulted from collaborations between nonprofits and resident groups to build rental units" (Beck, 2020). The flexible ownership offers the dwellers the advantage of a better neighbourhood without financing restriction. Consequently, affordable housing price for low and middle incomes is possible by getting rid of the housing market's control.

Except for the freedom of ownership that supports affordable housing, one reason the co-housing project is being argued and practised extensively in Europe is the diverse spatial demand. Accompanied by increasing immigration, European communities face integration from various aspect. It is considered that residential segregation limits individuals' social mobility and threatens cohesion (Blokland and van Eijk, 2010). Therefore, a livable neighbourhood for households with various jobs, education and social background in one community is essential to a metropolis such as Amsterdam. In a co-housing project, dwellers build together, sharing everyday life and serving a common ideal (Krokfors, 2012), making the integration possible. In general, a properly operated co-housing can provide affordable housing in a mixing ethnics and social classes groups.

1.2. Flexibility and Affordability

Although ownership and housing market is the fundamental factor influencing the housing price, many other factors influence the housing price except for community construction. There are macro and mesoeconomic factors such as income, costs, and supply through the economic aspect. Physical dwelling characteristics, physical environmental characteristics, social and functional environmental characteristics influence housing price in a microeconomic way (Ruttenberg, 2018). Although architecture is incapable of controlling the housing price ambitiously, the

building condition still influences the price. It is not hard to conclude that the price gets higher when the physical dwelling characteristics improve. However, when these characters are customized and handcrafted by the dwellers, the flexibility will enhance spatial efficiency, thereby saving the unnecessary cost.

1.3. Thematic Research Question

Among all the physical dwelling factors, interior flexibility is what the dwellers could control themselves. By leaving the customization flexibility of the layout, the dwellers could live in an ideal home with their own efforts and save the money they need to spend on housing. The thematic question is: how much flexibility is needed in a co-housing project on the customized layout?

II. METHOD

Since this is a qualitative research question on flexibility measurement, to identify flexibility is the first step. It is identified in two ways: the desire of functional space to become flexible and the potential of spatial division that would fit in various activities. The next question is how to measure it. The research focuses on de Nieuwe Meent Project, a co-housing project under process in the Oost Amsterdam. De Nieuwe Meent is a mix of social housing units and shared apartments for self-organized living groups sharing communal facilities and public spaces (de Nieuwe Meent, 2021). The project contains three different types of households: living group, studio, and loft.

1. The research's main body is to analyze the survey done by the architect, Roel van der Zeeuw Architects for the VO design in 17. May 2020 (Appendix 1). The survey asked the project members to fill in the floor plan with provided pieces of furniture including beds, closets and other options. The survey is similar to Ir. Frans van der Werf's infill workshop in Istanbul, 2018. The desire for functional space is explored by analyzing the layout tendency. The research on the potential of spatial division is divided into two parts. The first is the comparison of the spatial components between three types of layout. The second part is the analyze of the room division from the living group floorplans.
2. De Nieuwe Meent cooperative organizes regular zoom meetings on diverse working-group agendas, architectural design, and financial issues. Through the participation of the group and observation, the research gets access to the dwellers' view. "(architects) do this in close contact with future inhabitants through a participatory co-design process. This way members can create a home according to their own needs and desires. This co-design process also empowers future inhabitants by making diverse housing types possible, as well as offering innovative approaches to shared spaces and a strong sense of community" (de Nieuwe Meent, 2021). Participating in the process helps understand how architects and residents get the unanimous solution through communication and cooperation.

From the observation, the research focuses on how the residents would respond in reality. The measure of the floorplan area concretes the standard of spatial demand. However, the survey is operated on a small group of samples with 27 valid answers, which adds uncertainty and contingency. So, the last part of the research is to examine the universality of the result.

III. RESULT

2.1. Functional Space Desire

2.1.1. Household Type Differences

The shared apartments are for around 4-5 people who share a kitchen, two bathrooms, and a shared space that the dwellers themselves can define. The studios are for single or couple who live on their own. The lofts are for couples with kids. Three different types of housing units meet diverse household requirements.

The essential functional spaces for all three units are bathroom, kitchen, dining room, living room and bedroom (necessary especially for shared apartments). Through a rough calculation of the functional space per person, the spatial efficiency and diversity are easy to compare (Appendix 3).

1. The shared apartment bedrooms are much more significant than the other two types of units because of private space. There are study table or a sofa in the bedroom for individual activities.
2. People who live in a studio unit have the largest living room, but the price for a large living room is almost no space for other activities. The dwellers have the least passion for filling in other furniture except for the basic need.
3. Due to the staircase space, the valid space for the loft is less than the actual interior area. The lofts are designed for a couple with kids makes this type of unit the most crowded. These two factors lead to all the functional space for each person are less than the others. Also, the floorplans look quite similar because there is less space for a possible solution.
4. The space for entertainment and other functions in a shared apartment is the biggest comparing to others. First, the floor area for each person is the most in a shared apartment. The sharing of kitchen, dining room and living room enhance the spatial efficiency. Therefore, this type of unit can hold more activities.

		Household Size (people)	Bedroom Amount	Bedroom (m ² /person)	Living Room (m ² /person)	Dining Room (m ² /person)	Kitchen (m ² /person)	Other Entertainment (m ² /person)
Shared Apartment	Average	5.44	3.77	78.01	18.15	15.10	8.49	17.14
	Average/Person	-	0.69	14.33	3.33	2.77	1.56	3.15
Studio	Average	1.50	1.00	8.23	7.63	4.35	4.73	-
	Average/person	-	0.67	5.49	5.09	2.90	3.16	-
Loft	Average	3.00	1.71	13.04	6.18	2.15	4.03	6.50
	Average/person	-	0.57	4.35	2.06	0.72	1.34	2.17

Figure 1. Rough Calculation of Functional Spaces

2.1.2. Bathroom and Kitchen

In the exercise of the loft and the studio, the unsettled position of the kitchen is emphasized in the report. Compared to other functions, a kitchen requires extra space for gas, water, and ventilation, making it more challenging to customize the position. It is worth mentioning that the architects consider options where the bathroom is smaller for studio units because there will be more space for the living room. However, this is the change for architectural design in general, not for dwellers' flexible arrangement. Moreover, one of the proposals is to move the kitchen to a corner in the living group floorplan, but the architect declines it due to the natural lighting for the whole room. Even if there is no problem with lighting, it cannot easily switch the kitchen position.

2.2. Layout Tendency

2.2.1. Shared Space and Spatial Division

Comparing the layouts (Figure 2), what is going to be shared by the living group members are the living room with sofa and TV, dining room, and space for entertainment. What is not shared is the bedroom, and there is at least one extra functional piece of furniture put in the bedroom, such as a study table and couch. This gives light to the personal space that is required in a shared home. On the other hand, the possibilities of the studio layouts are more limited by the narrow space. What is missing compared to a living group is entertainment, playing corner for children, and possible separated study room.

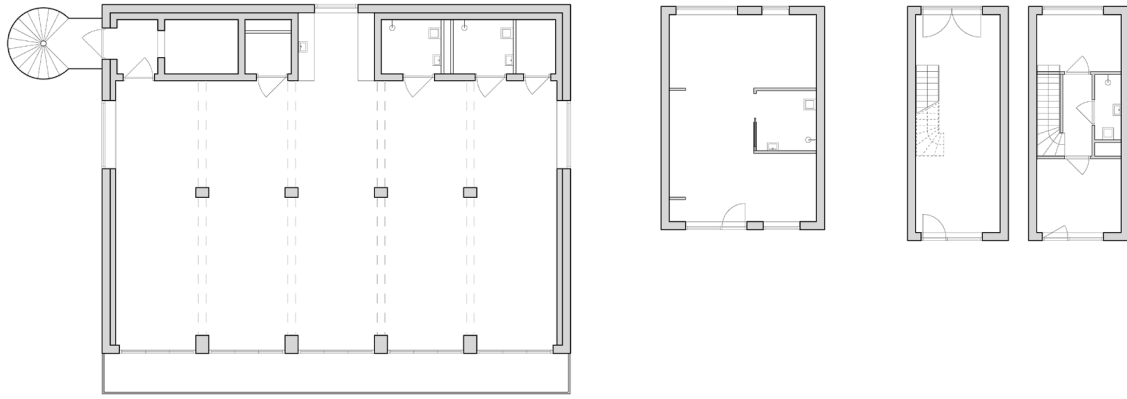


Figure 2. Floorplan of a shared apartment, studio and loft (ground floor and first floor)

For members choosing a living group, it is required to divide the rooms based on specific needs and place the furniture and facilities. However, the freedom to arrange the rooms for studios is not that much. The basic layout of the rooms is settled; what is needed for the layout is mainly furniture. It is only possible to add one or two separation walls (Figure 3). When it comes to the loft, the rooms are already settled clearly (Figure 4). The freedom to arrange the space is the least among the three, for it is more unlikely to further divide the room on a smaller scale. However, the privacy in a studio and loft is better guaranteed than a living group for all the indoor areas such as living rooms and kitchen owned based on a household unit without sharing the layout.

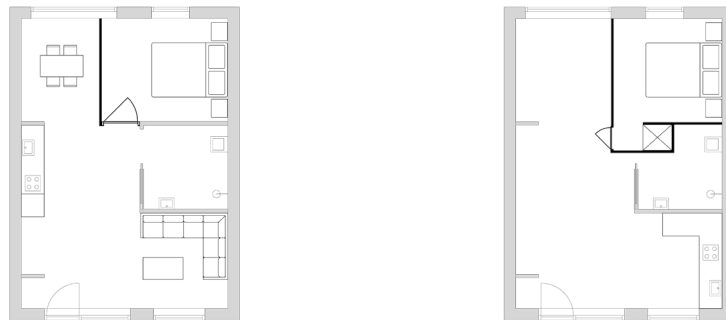


Figure 3. Studio layouts from the survey

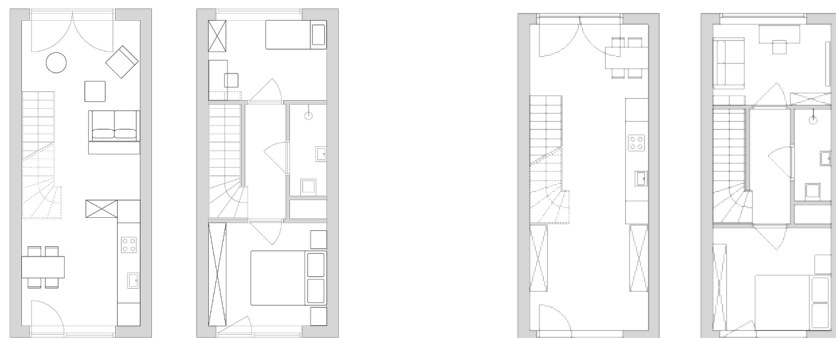


Figure 4. Studio layouts from the survey

2.2.2 Shared Apartment Division

This part of the research is the observation of the layout exercise of the living group. In the design, infrastructures, including a kitchen, two bathrooms, staircases, an elevator, an equipment room, and a storage room, are fixed with their position and layout. The rest is available for the future members to arrange with four columns in the middle with a span of around 3.3m from each other. The spans between the columns and the wall to the service rooms are 4.25m, and the span between the columns and the French windows is 5.75m. These measures are so necessary that in the exercise, people tend to separate the rooms based on half of the span in a horizontal way, whereas full span in a vertical way. The minimum measures of rooms that dwellers tend to separate is around 2.8m. It is not surprising that although the architect suggests that it is also possible to divide the rooms halfway between the columns in a row in the report, few divide the rooms vertically from the middle of the columns (Figure 5).

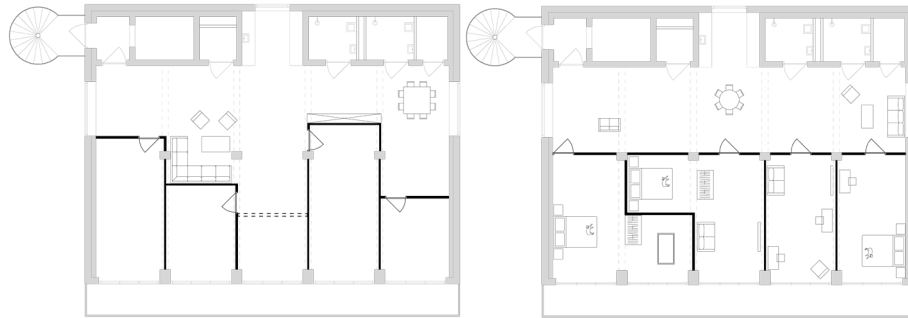


Figure 5. Shared apartment layouts from the survey

The division possibility lies in the spatial left by the structure and dimension. First, the form of the columns attached to the windows indicates the separation of the room. The proportion of the width and length is around 2:3. The long side is perpendicular to the window and protrudes the window frame for around 54cm from the inside. This put a hint of a continued separation based on the columns and from that direction. Second, as mentioned above, the span between the columns attached to the windows is around 3.3m. A divide between may cause a 1.65m span, which is too small to arrange a room. Even space is divided into two parts and added to the adjacent span, the space close to the window in those rooms with one and a half span will still be divided into two parts by the columns in between. The restriction by the limitation of such a small span still exists in some extent.

IV. CONCLUSIONS

Three different types of household indicate the diversity of functional need. The shared apartments are more welcomed by a single person, a couple or a young family with newborn babies. Studios are designed for a couple who want a more private life. It is more likely that a family with kids and parents would choose loft for their home.

Residents from the shared apartment sharing the bathroom, kitchen and dining room means these functions are more efficiently used and leave more space for personal hobbies. Some have extra private space, some have a playroom for kids, and some have a workshop. Comparatively, there is less space for a studio or loft to hold other functions based on residents' particular need. This indicates that a sharing space enhances the possible flexible place due to spatial efficiency.

Although there are some options for kitchen and bathroom adjustment, architects are unwilling to change the position of the kitchen and bathroom individually due to the technical restriction. This drives the conclusion that the bathroom and kitchen's flexibility is low because of refurbishment cost.

From the layouts analysis for the shared apartment, two main architectural factors influence how people divide rooms. The indicative forms of existing construction are most likely to conduct where to separate the space from. Furthermore, dimensions decide how much division could take place.

In conclusion, a sharing of space helps with the efficiency of the space and makes it possible for customized more inner space for entertainment or something else. The flexibility of the arrangement is influenced by the spatial guidance with construction but more importantly, by appropriate dimensions.

V. REFLECTIONS

The research results lead to a different direction from the initiative that households are contained in boxes inserted in the structure and pull out to fulfil the flexibility. Due to the practical need and affordability, the flexibility of the infrastructure part is not necessary, the essential demand of flexible rooms with multifunction and sharing living room in a limited area of space is more of demands.

VI. ACKNOWLEDGEMENTS

Special thanks to the generous support of architect Roel van der Zeeuw and team de Nieuwe Meent. It is Mr Zeeuw's passionate lecture and careful explanation that introduce me to this project. The members of de Nieuwe Meent also give me much welcome and kindness in the more profound understanding of the project.

REFERENCES

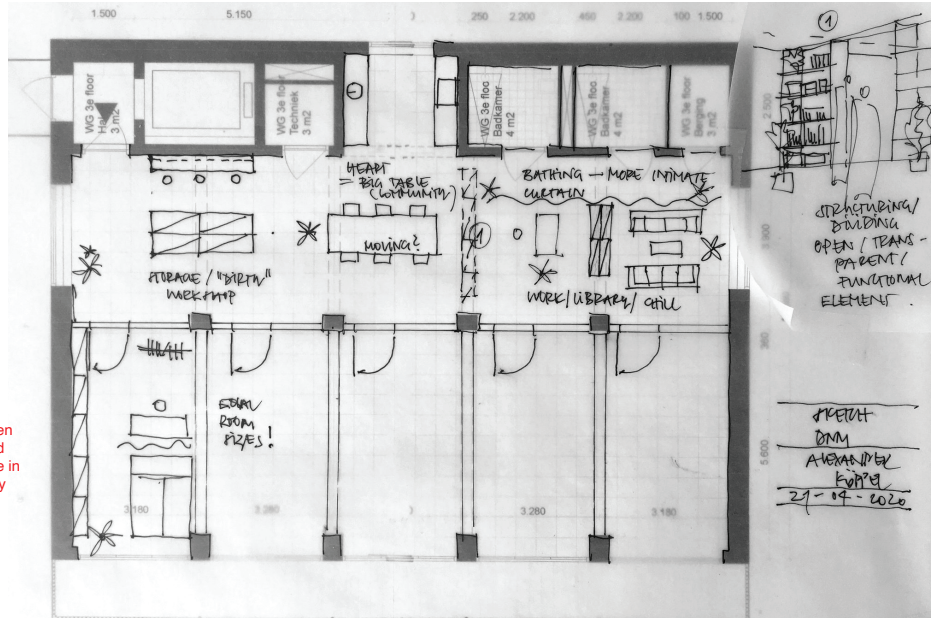
1. Frans van der Werf. 2021. *Workshop*. [ONLINE] Available at: <http://www.vdwerf.nl/workshops.html>. [Accessed 1 January 2021].
2. Nieuwemeent.nl. 2021. *Building – De Nieuwe Meent*. [online] Available at: <https://nieuwemeent.nl/en/gebouw/> [Accessed 1 January 2021].
3. 2020. *Housing and residential investment market in the Netherlands 2020*.
4. Beck, A. F. 2020. What Is Co-Housing? Developing a Conceptual Framework from the Studies of Danish Intergenerational Co-Housing. *Housing, Theory and Society*, 37, 40-64.
5. Blokland, T. & van Eijk, G. 2010. Do People Who Like Diversity Practice Diversity in Neighbourhood Life? Neighbourhood Use and the Social Networks of 'Diversity-Seekers' in a Mixed Neighbourhood in the Netherlands. *Journal of Ethnic and Migration Studies*, 36, 313-332.
6. Czischke Ljubetic, D. K. 2017. Collaborative housing and housing providers: towards an analytical framework of multi-stakeholder collaboration in housing co-production.
7. Hala, A. & Farooq Hasan, K. 2020. The right to adequate housing in international law and Human Rights. *الرافدين للحقوق* [Online], 22.
8. Krokfors, K. 2012. Co-Housing in the Making. *Built environment.*, 38, 309-314.
9. McCamant, K. & Durrett, C. 2011. *Creating co-housing: Building sustainable communities*, New Society Publishers.
10. Ruttenberg, J. 2018. *The fundamentals of the Amsterdam housing market*.
11. Ryan-Collins, J. 2018. *Why can't you afford a home?* Medford, MA: Polity.

APPENDIX 1

VALID FLOORPLAN OF DE NIEUWE MEENT SURVEY

Woongroep

Suggestion:
For bedrooms is better when
bed is on the back side and
desk space on window side in
connection with the balcony



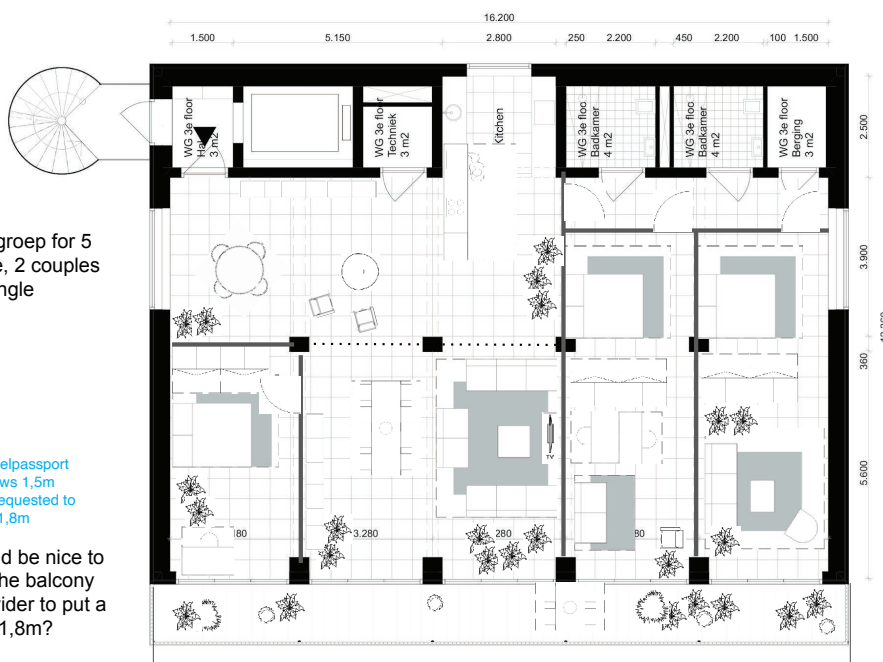
Woongroep for 5
people, 2 couples
one single

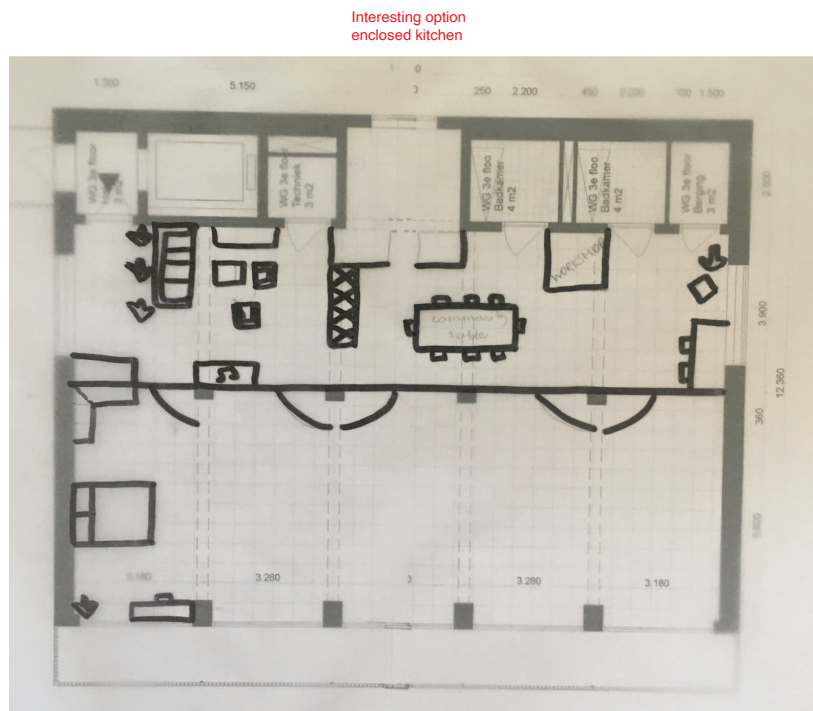
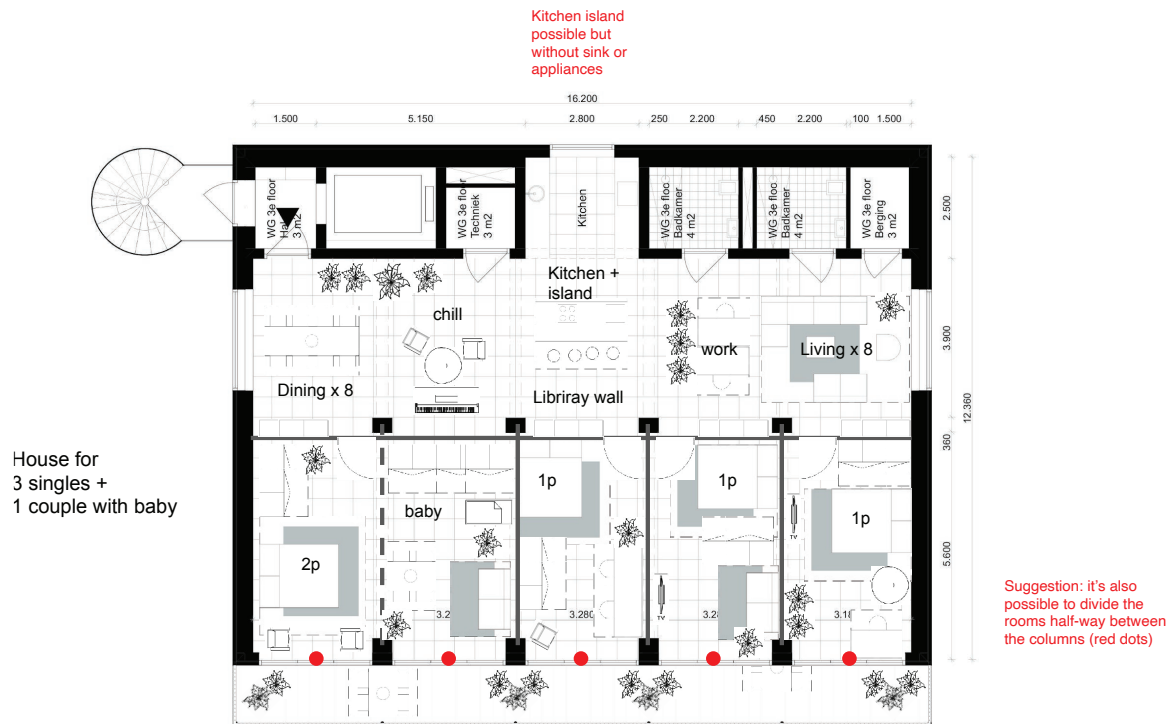
The Kavelpassport
only allows 1,5m
but we requested to
make it 1,8m

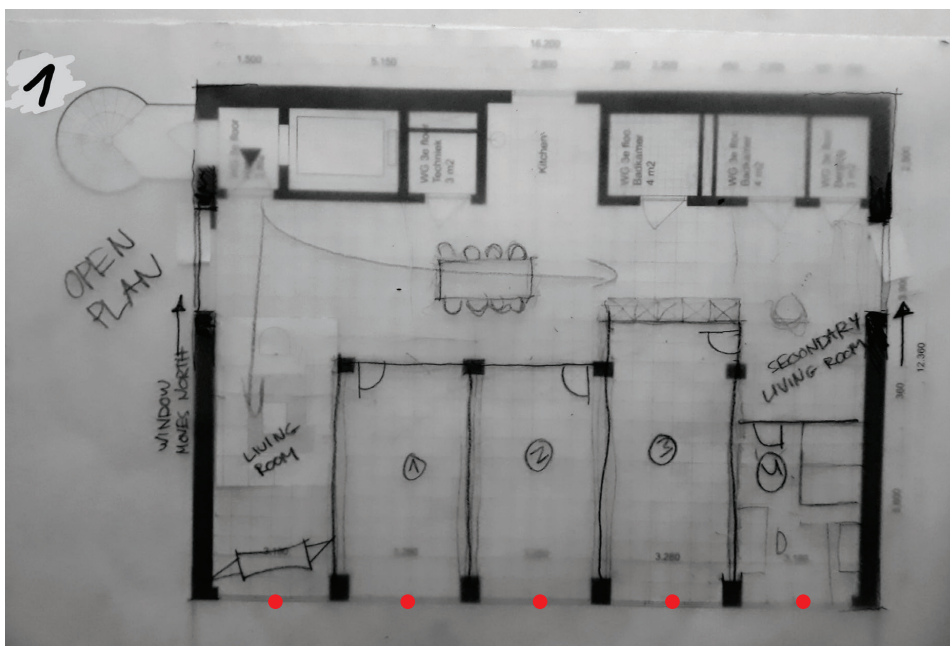
It would be nice to
have the balcony
a bit wider to put a
table! 1,8m?

Interesting option
to extend the kitchen

To check
wall in window
and fire escape with
corridor







[illegible]

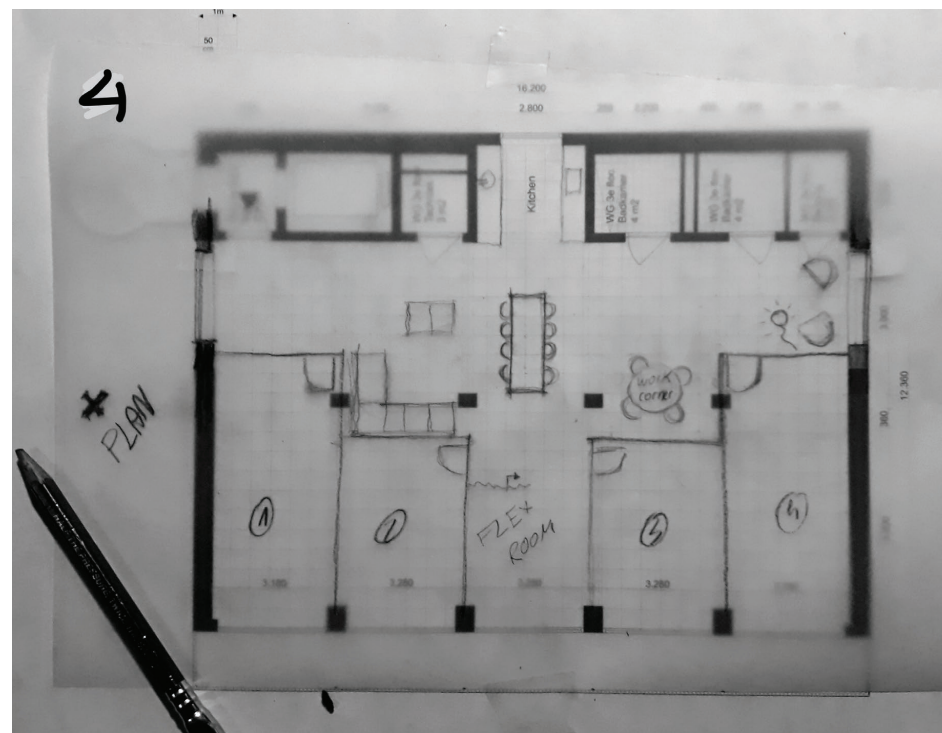
12

3.2



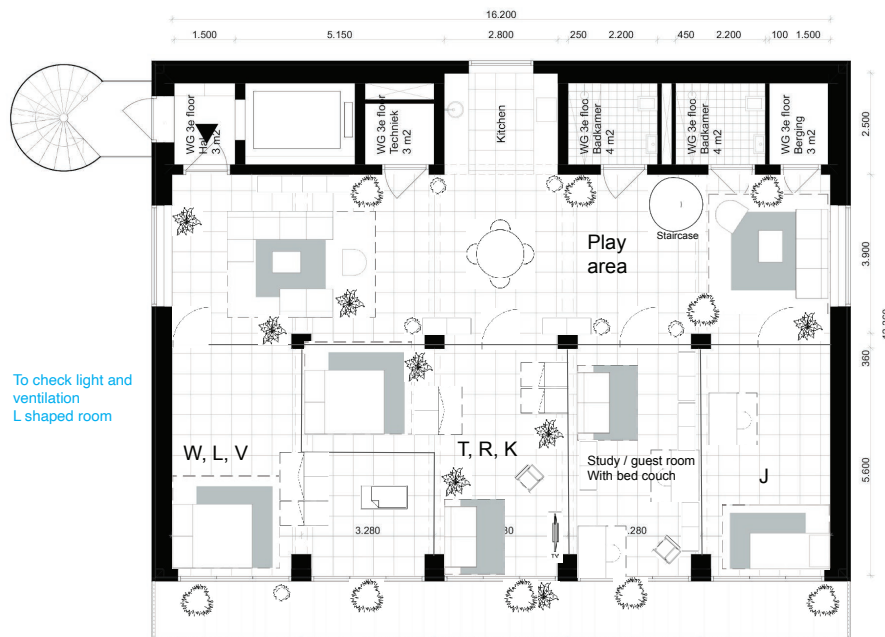
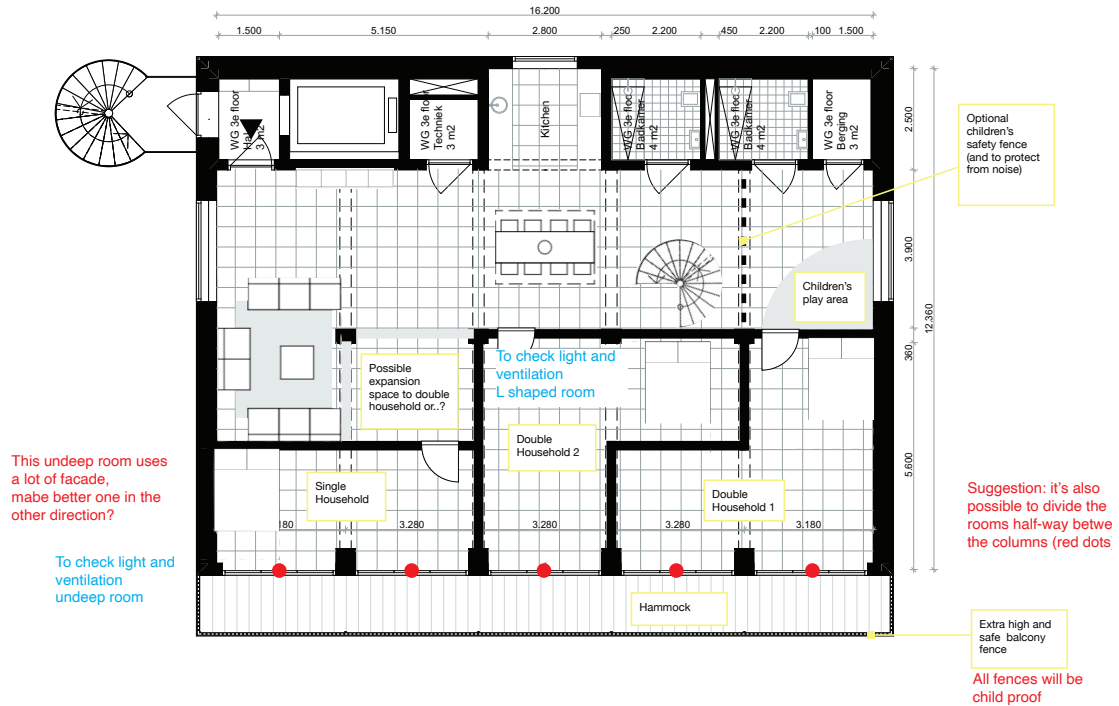
Kitchen cannot be in different position, it's in the center because we need the window to give light to the middle of the room

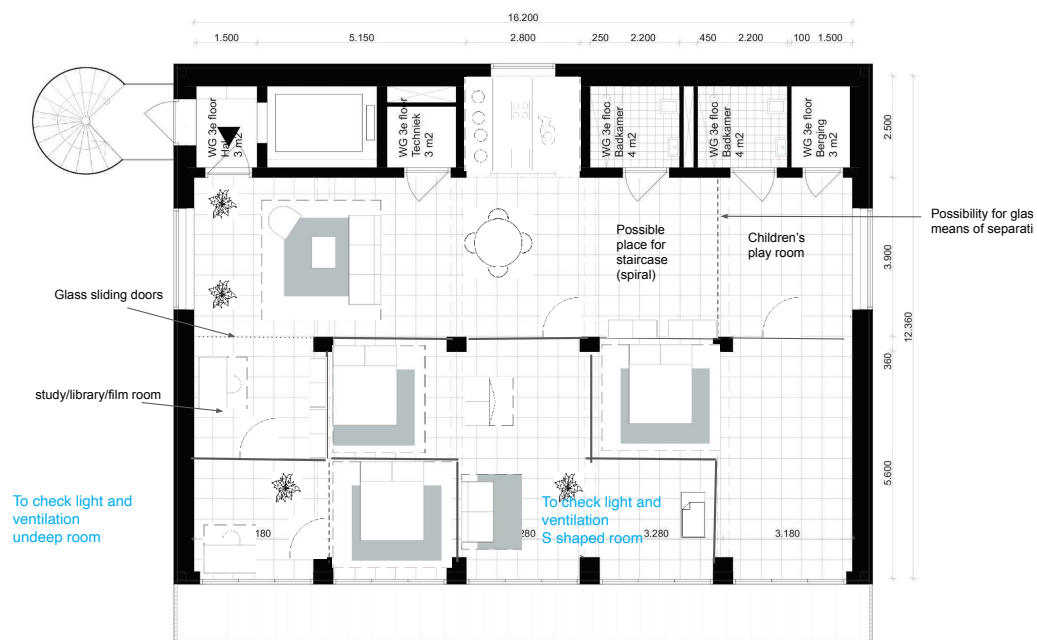
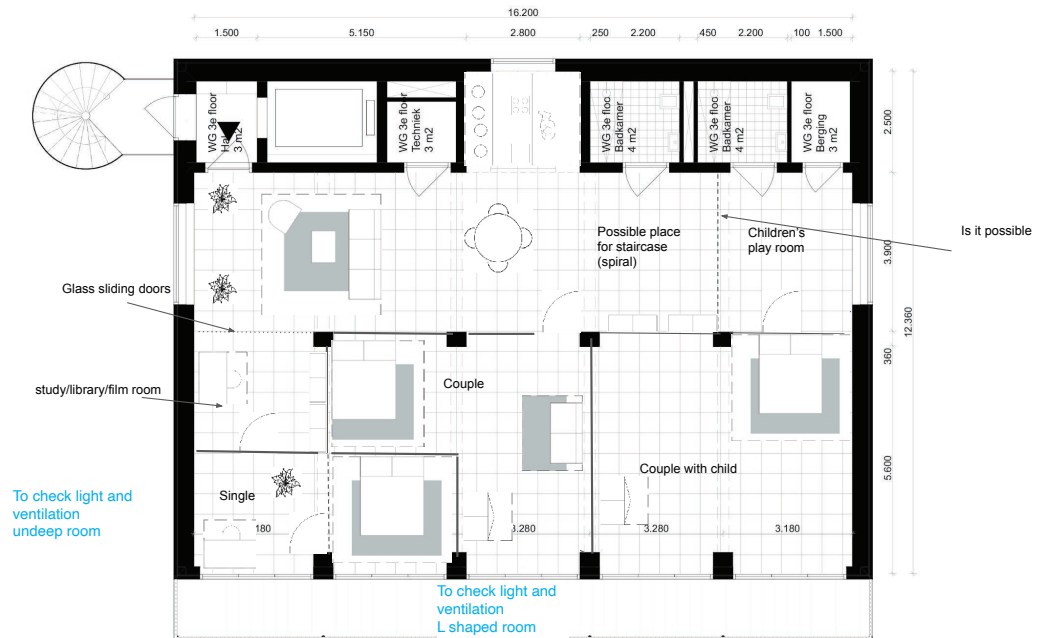
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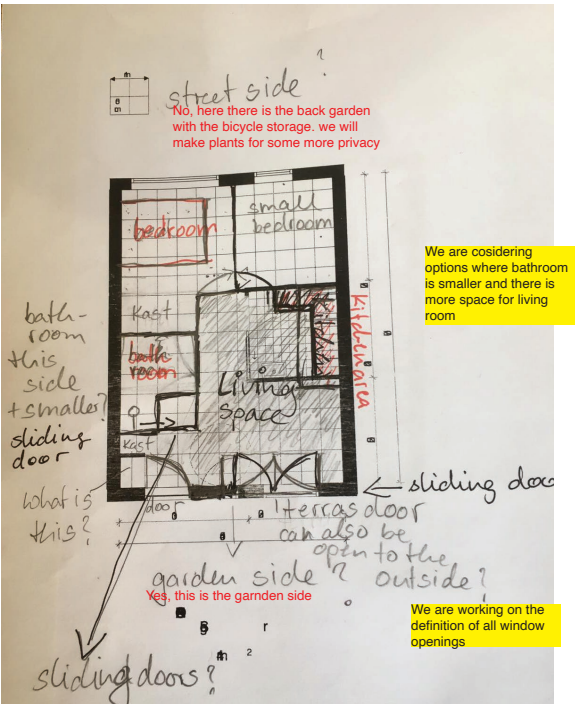
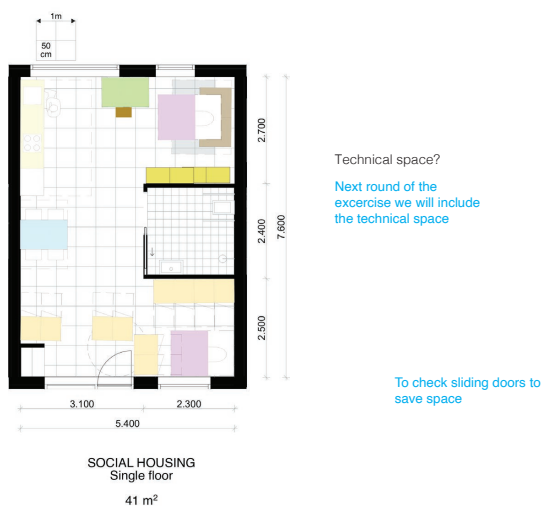
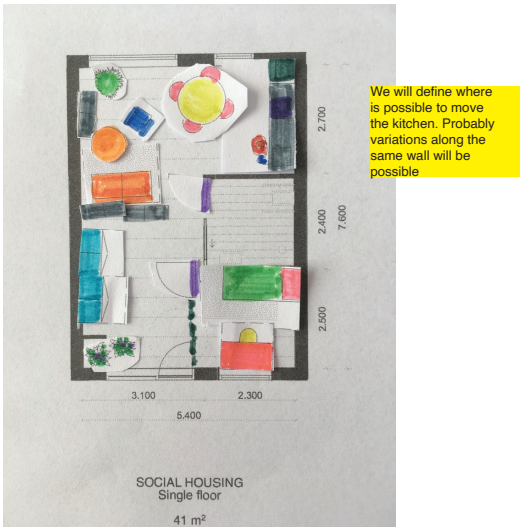
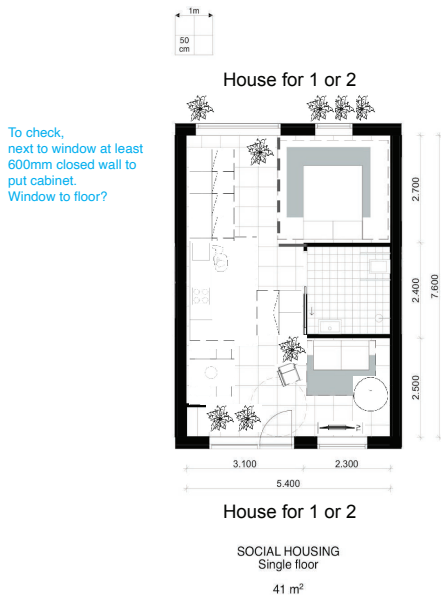
1 and half floor not possible, see
explanation page 24-25.

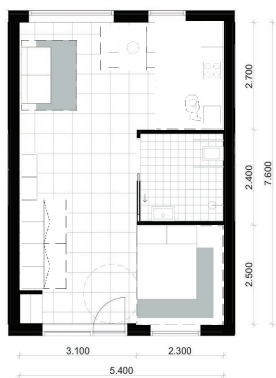
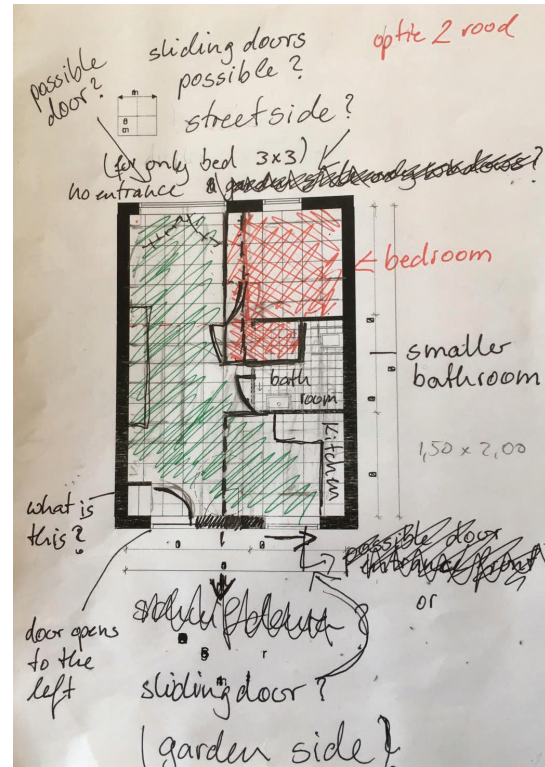
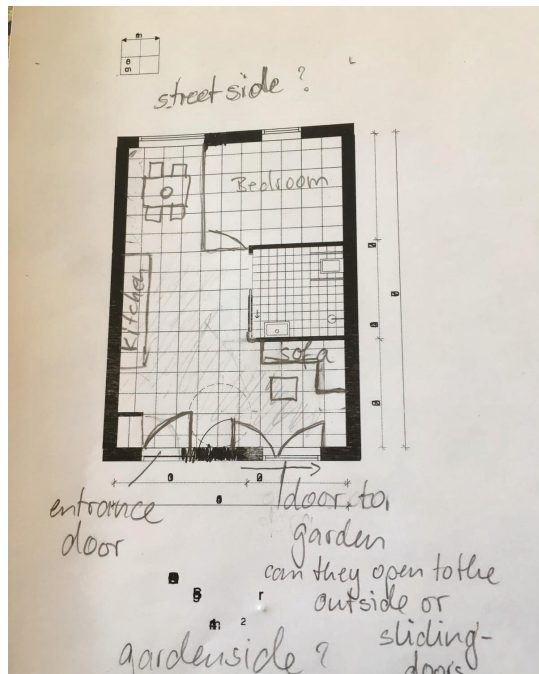
Let's assume this option links together 2
full floors with an internal staircase





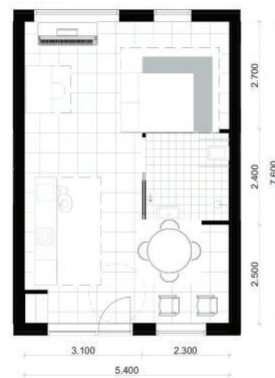
Single floor social housing





SOCIAL HOUSING
Single floor
41 m²

We will define where is possible to move the kitchen. Probably variations along the same wall will be possible

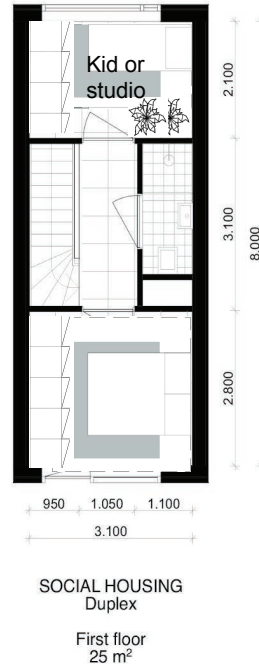
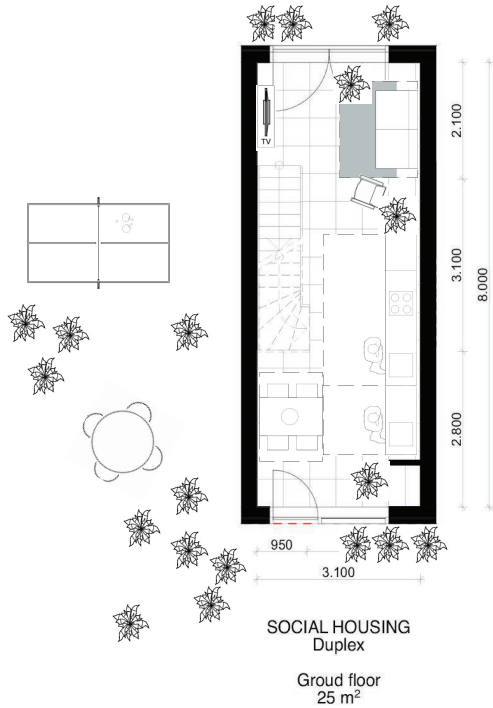


SOCIAL HOUSING
Single floor
41 m²

50
cm

House for 2 + kid

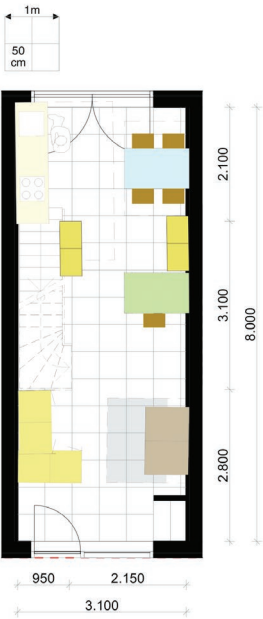
Andrea
Verdecchia
19.04.2020



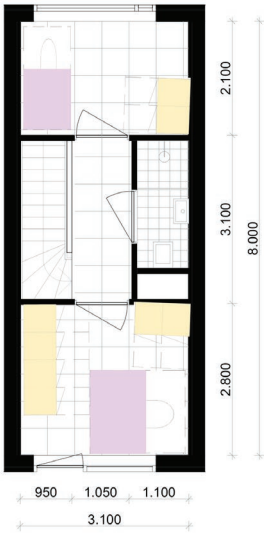
We will define where is possible to move the kitchen. Probably variations along the same wall will be possible

Like this there is no space to access te stairs

We already checked divverent stairs shapes and we concluded that this is the most space saving option



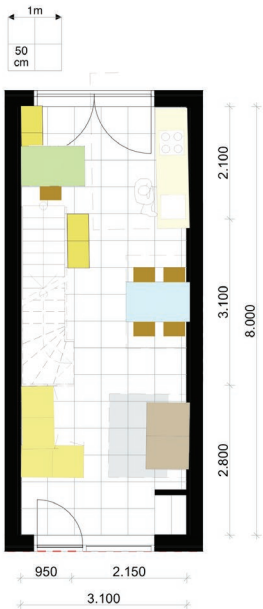
SOCIAL HOUSING
Duplex
Ground floor
25 m²



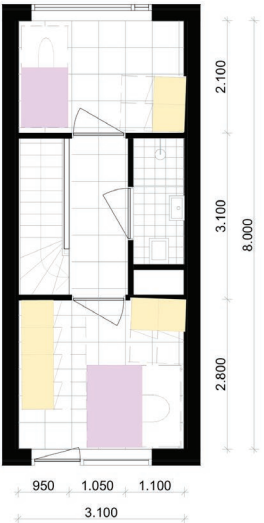
SOCIAL HOUSING
Duplex
First floor
25 m²

We will define where is possible to move the kitchen. Probably variations along the same wall will be possible

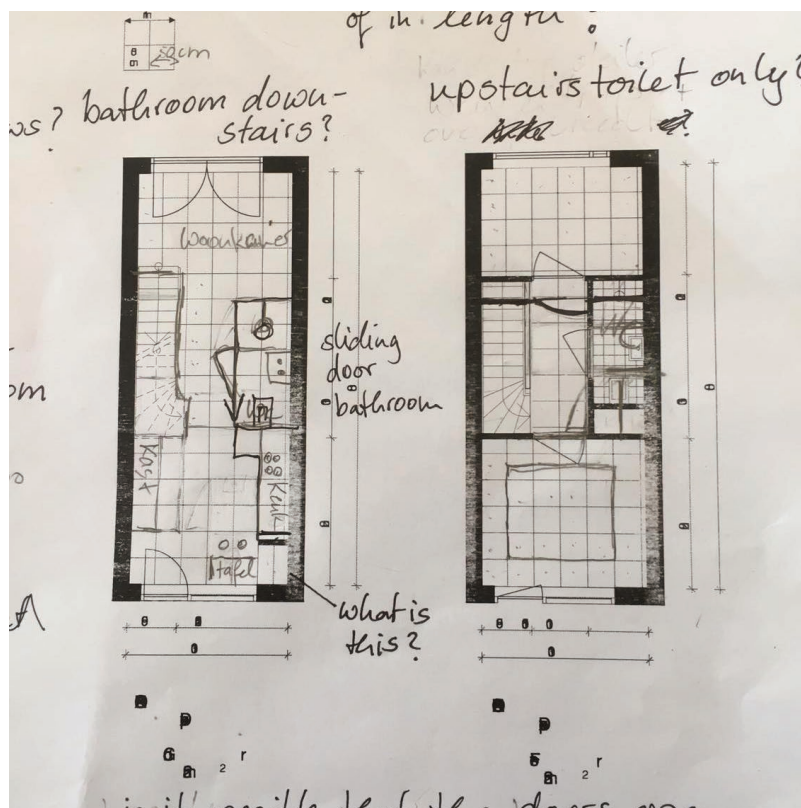
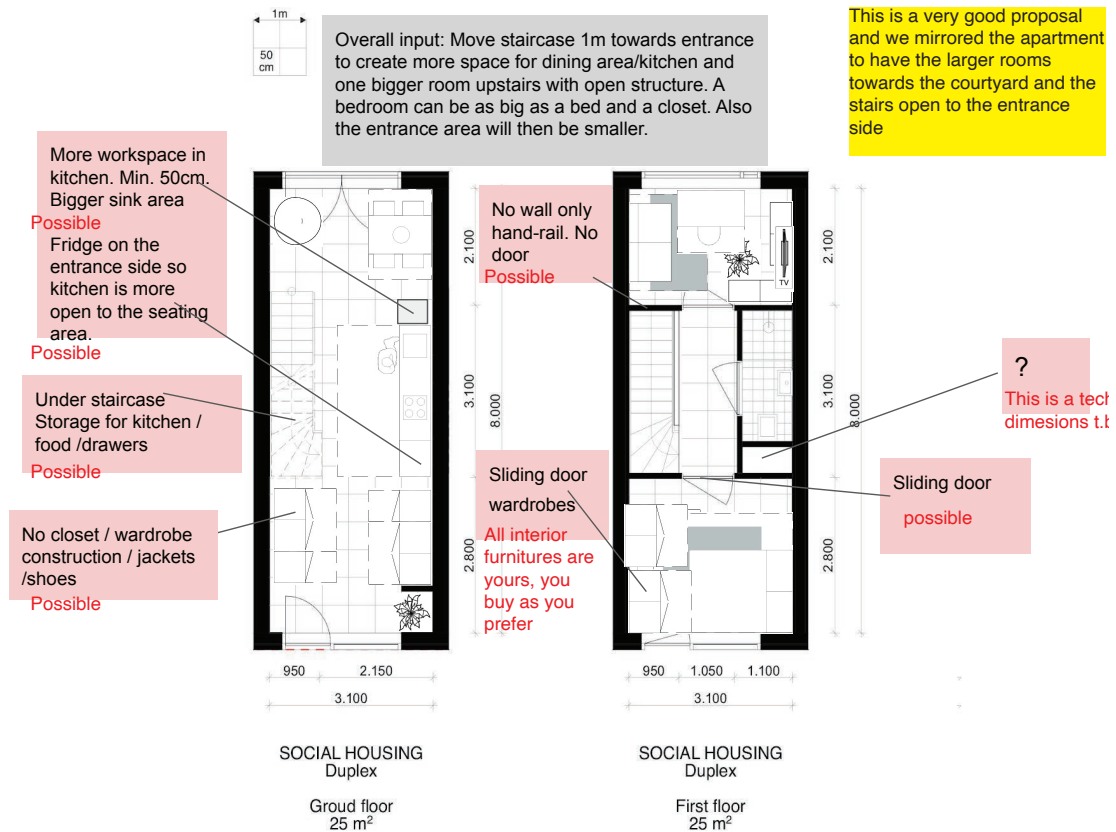
Like this there is no space to access te stairs



SOCIAL HOUSING
Duplex
Ground floor
25 m²



SOCIAL HOUSING
Duplex
First floor
25 m²

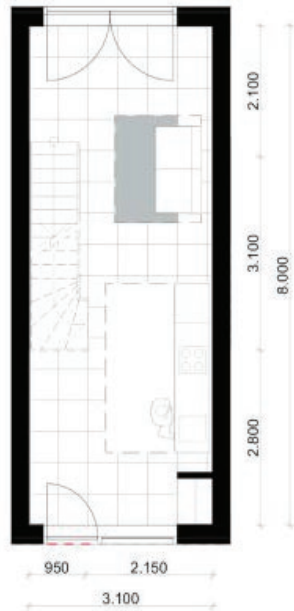


We will define where is possible to move the kitchen. Probably variations along the same wall will be possible



When there are 2 beds, better to make a bunk bed, so you have space for the wardrobe on the other wall

Here there is also space for a dining table



SOCIAL HOUSING
Duplex

Groud floor
25 m²

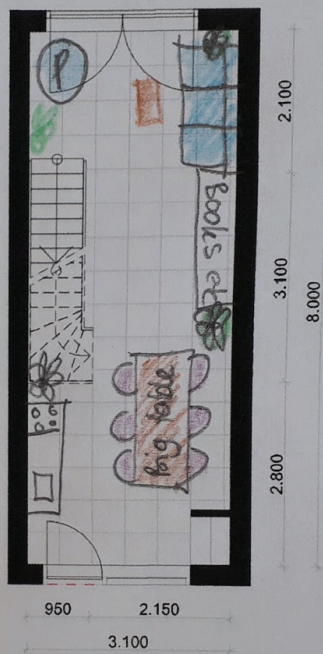


SOCIAL HOUSING
Duplex

First floor
25 m²

With bed in the other direction is perfect

We will define where is possible to move the kitchen. Probably variations along the same wall will be possible



SOCIAL HOUSING
Duplex

Groud floor
25 m²

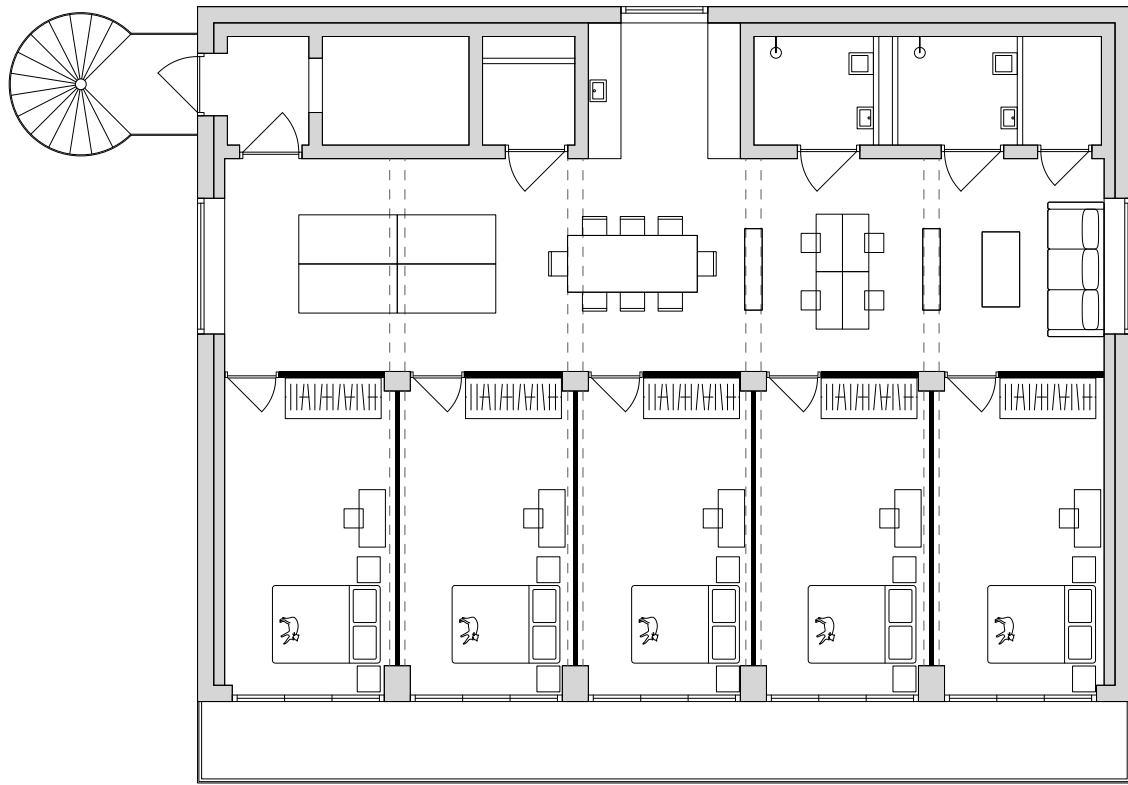


SOCIAL HOUSING
Duplex

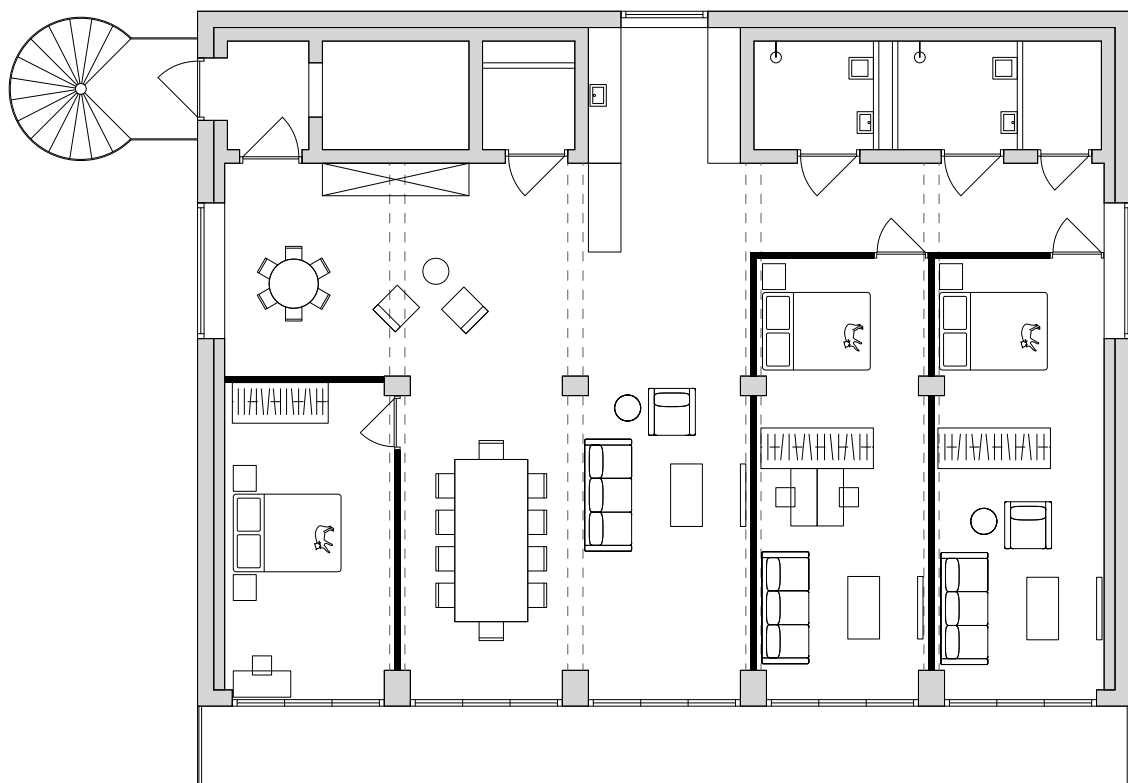
First floor
25 m²

APPENDIX 2

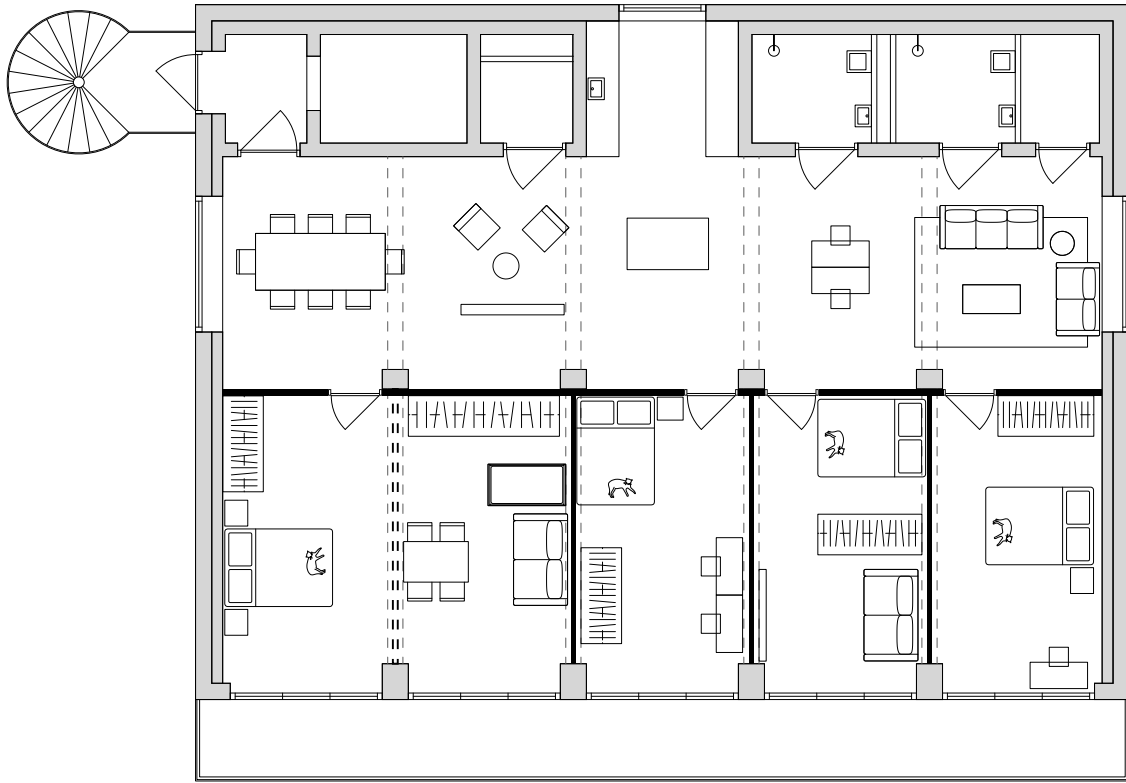
FLOOR PLAN REDRAW



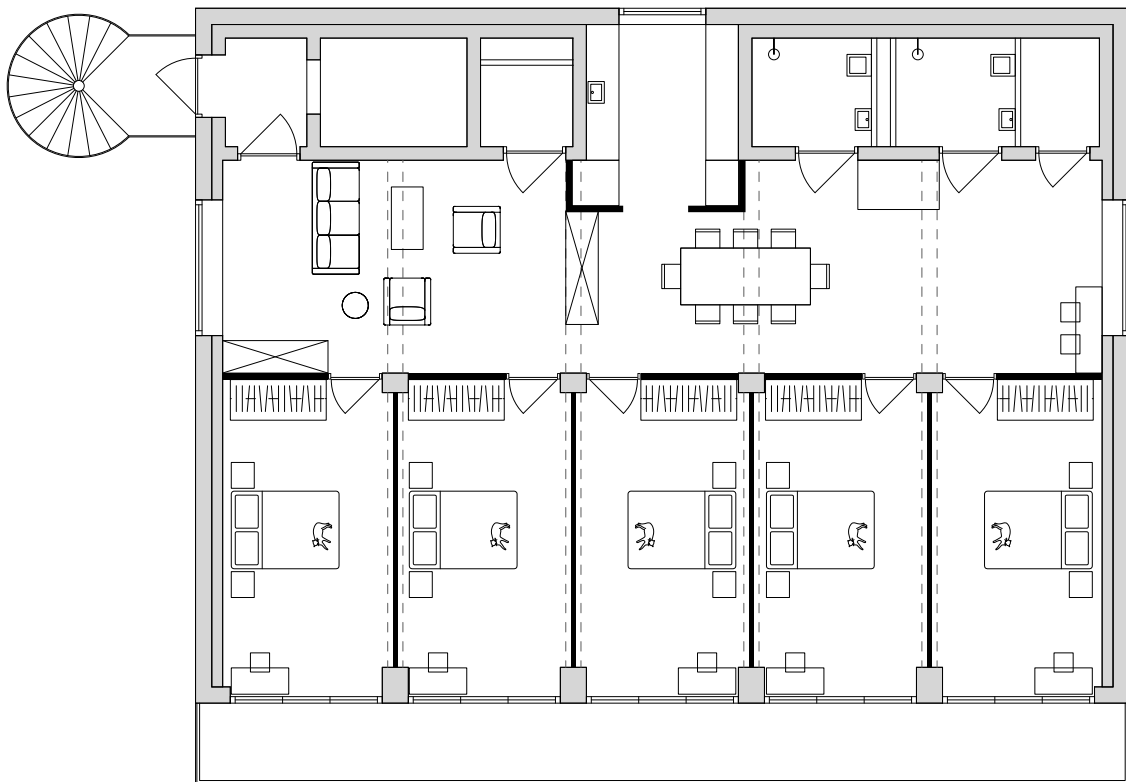
Sharing Apartment 1



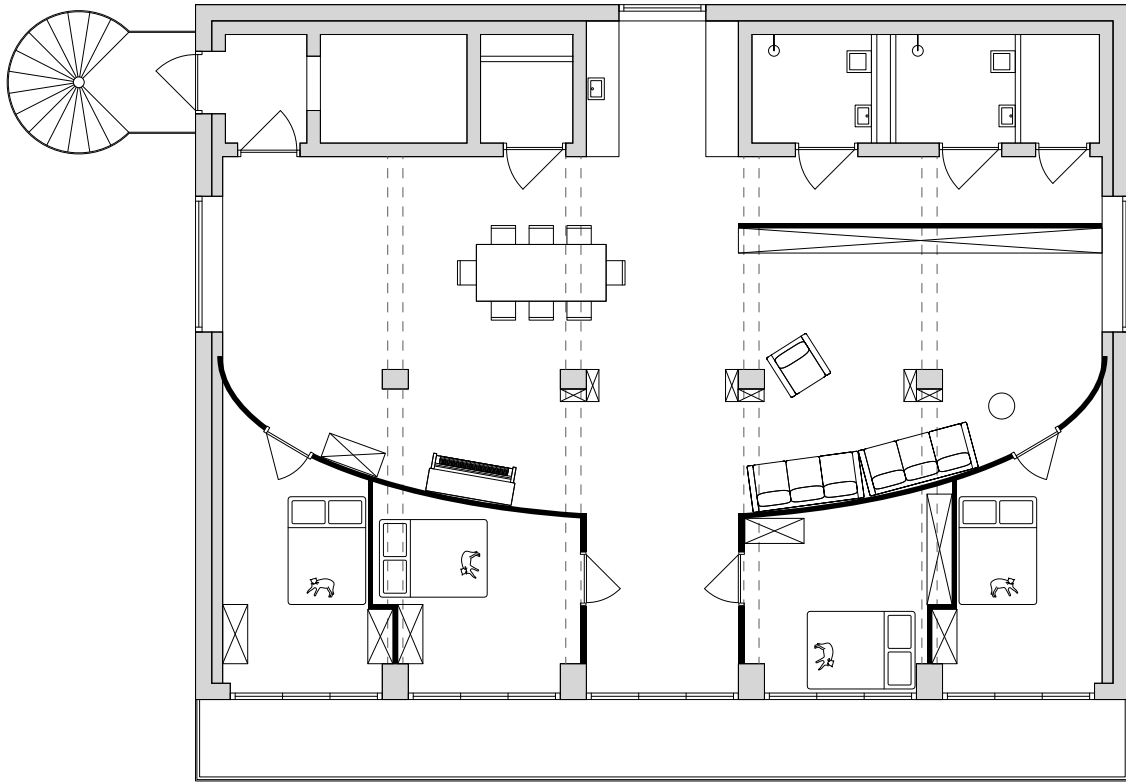
Sharing Apartment 2



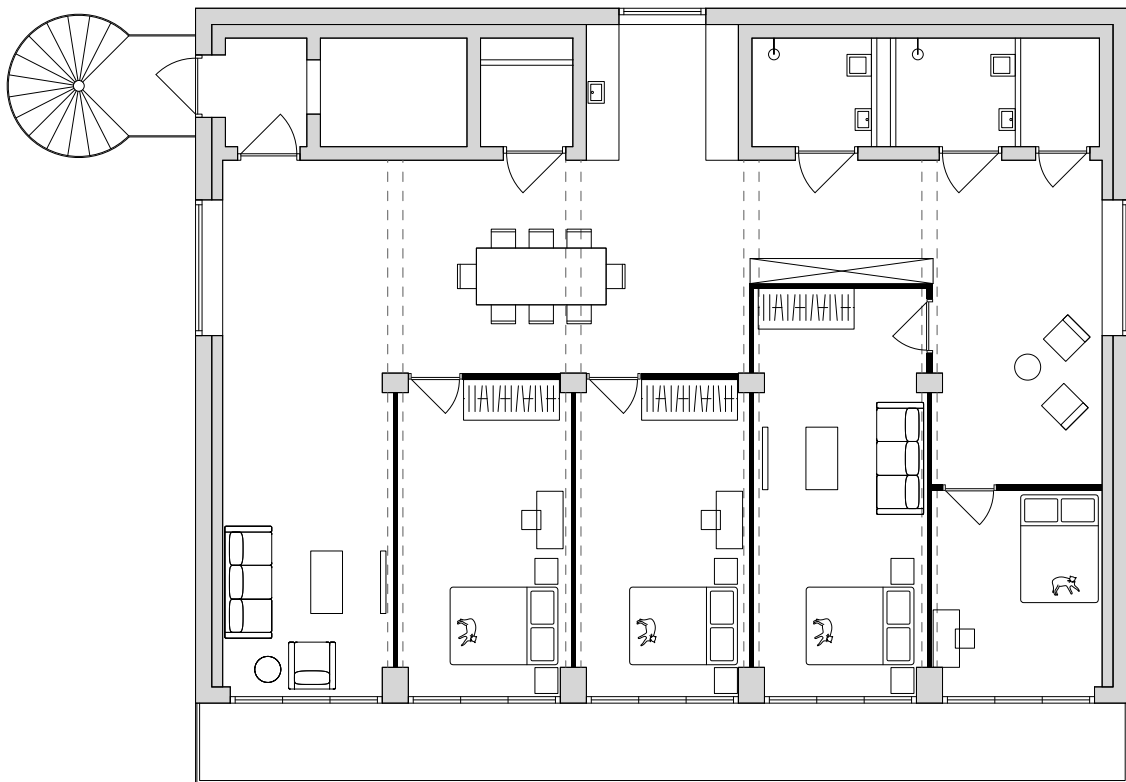
Sharing Apartment 3



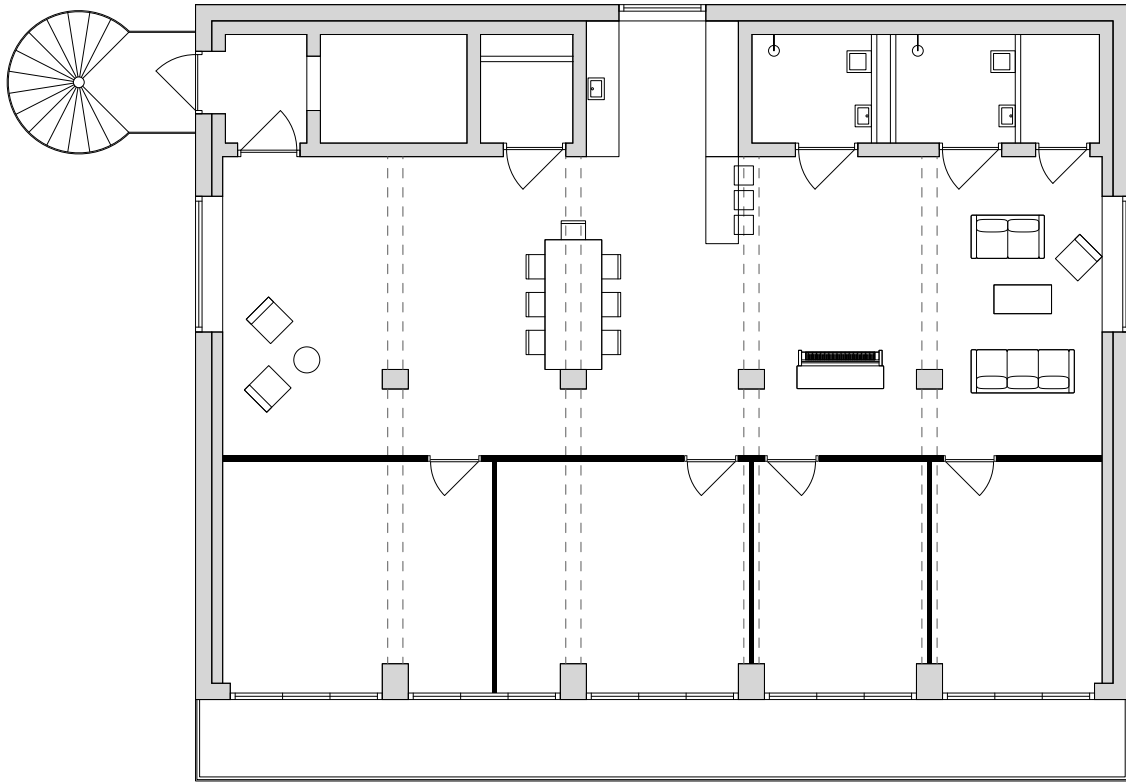
Sharing Apartment 4



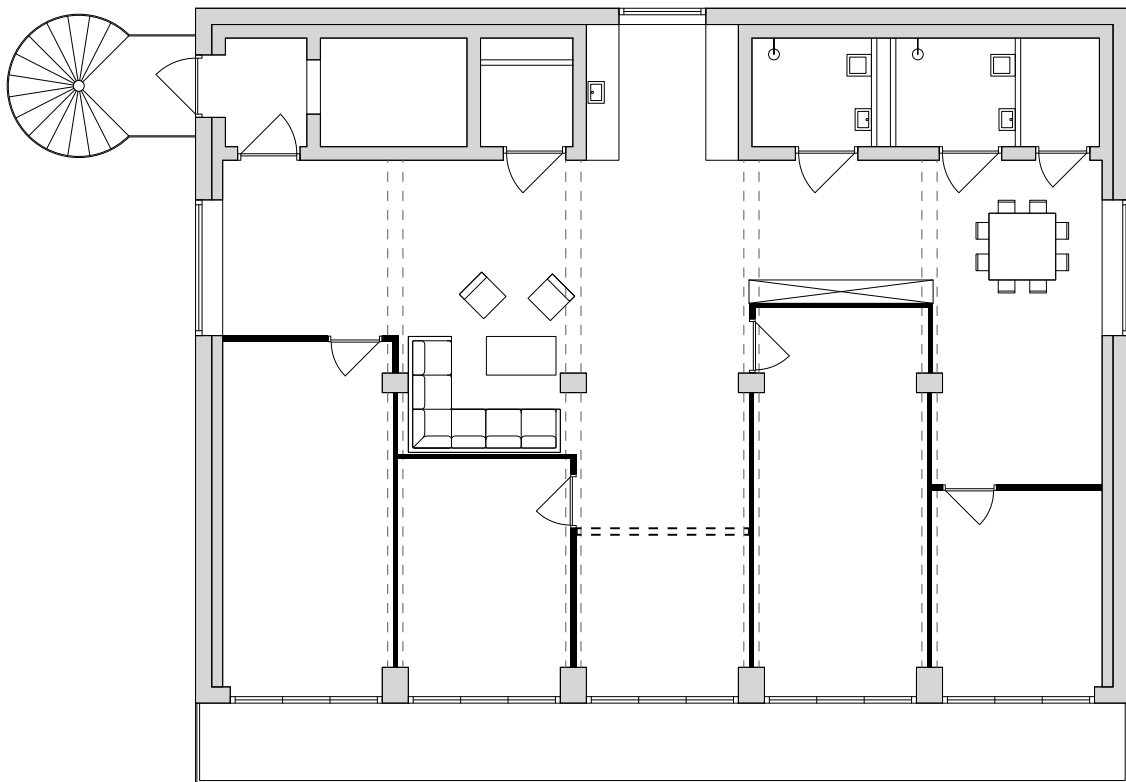
Sharing Apartment 5



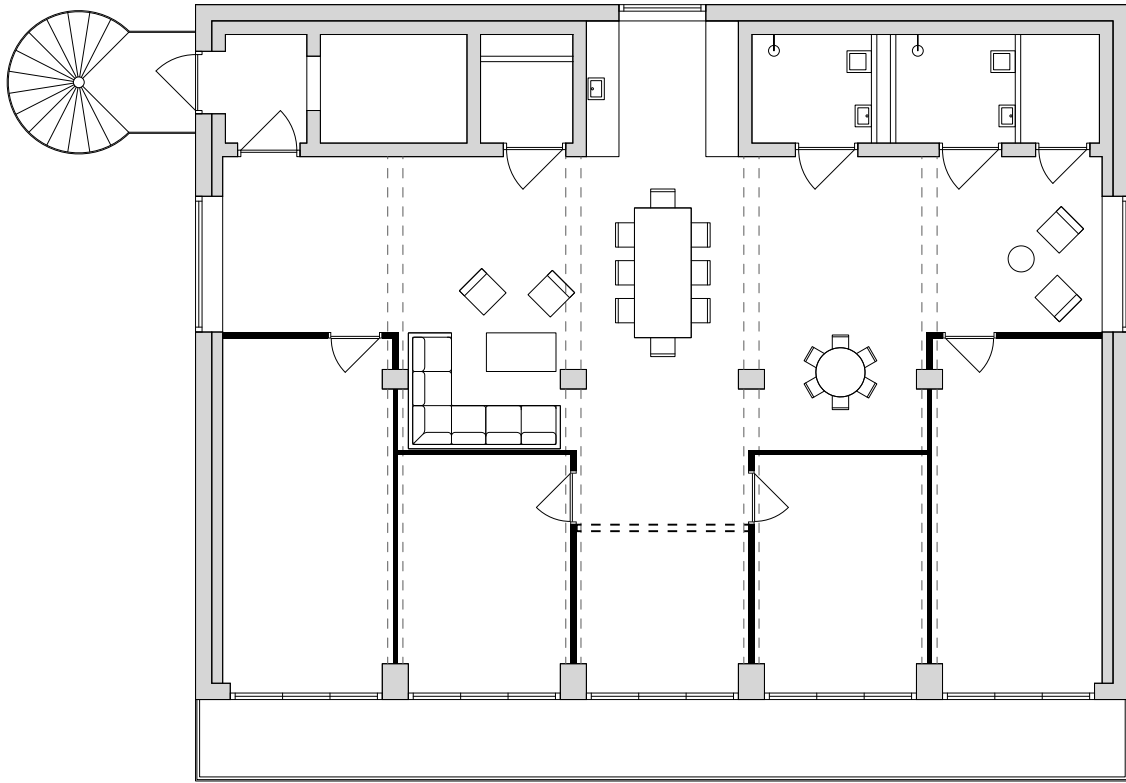
Sharing Apartment 6



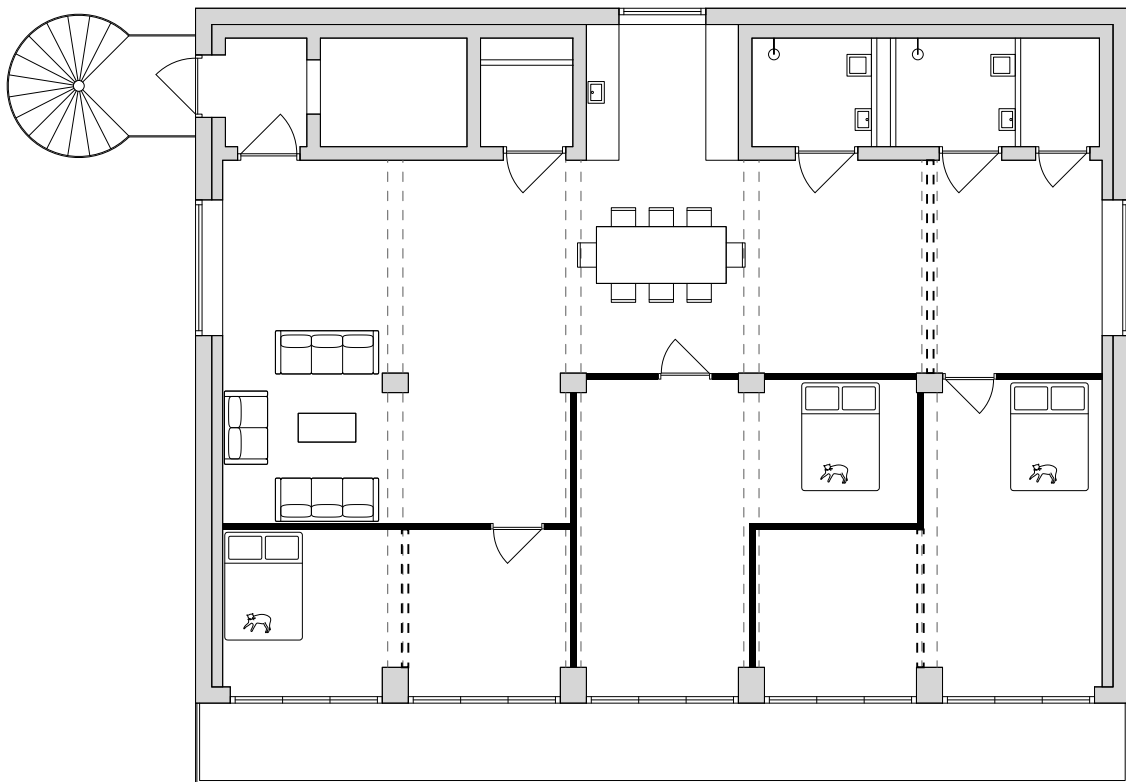
Sharing Apartment 7



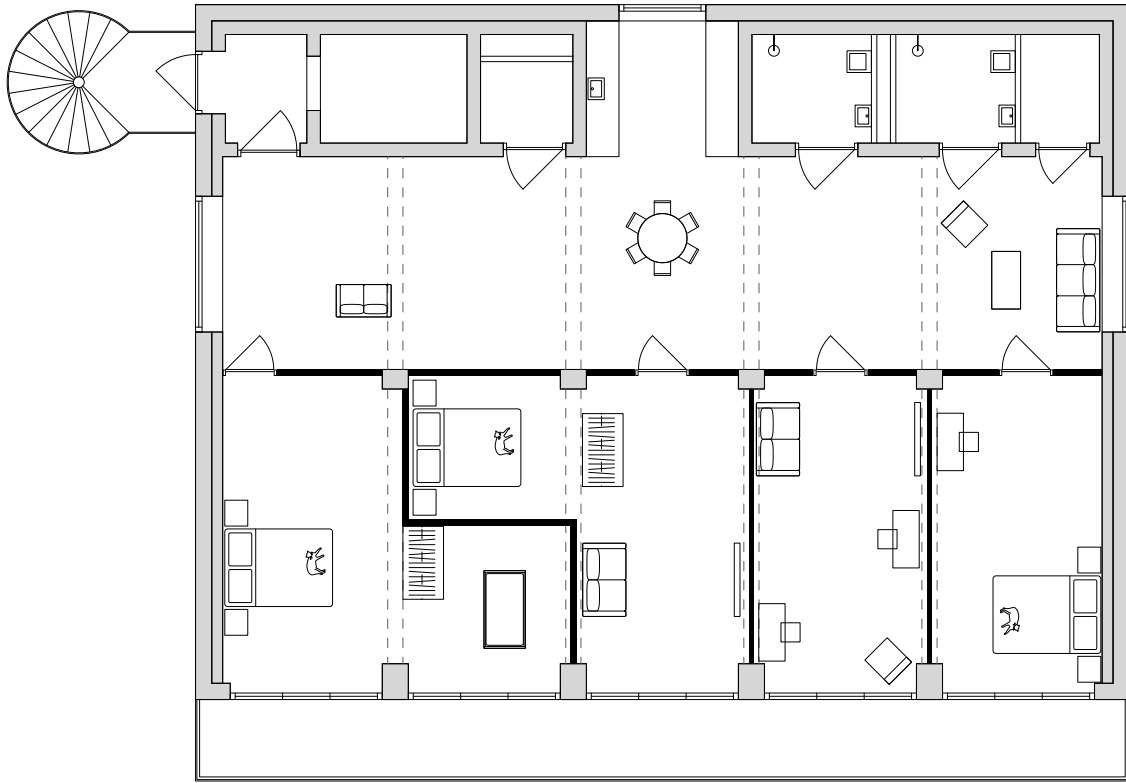
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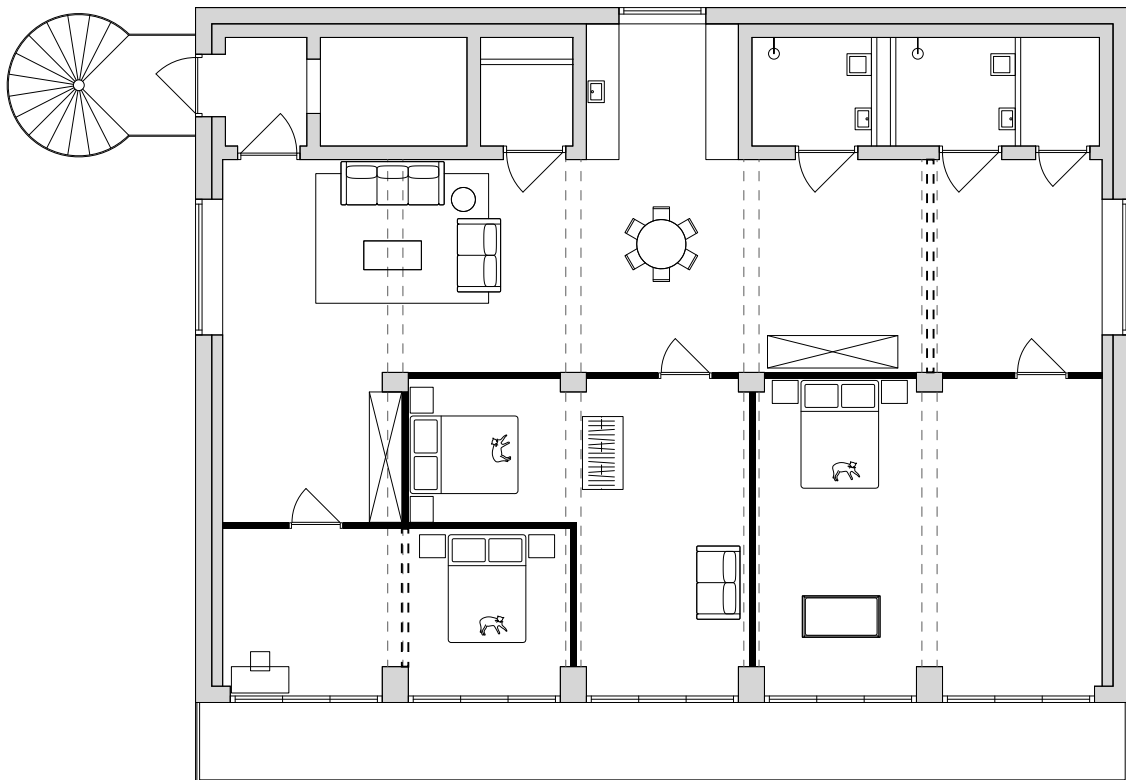
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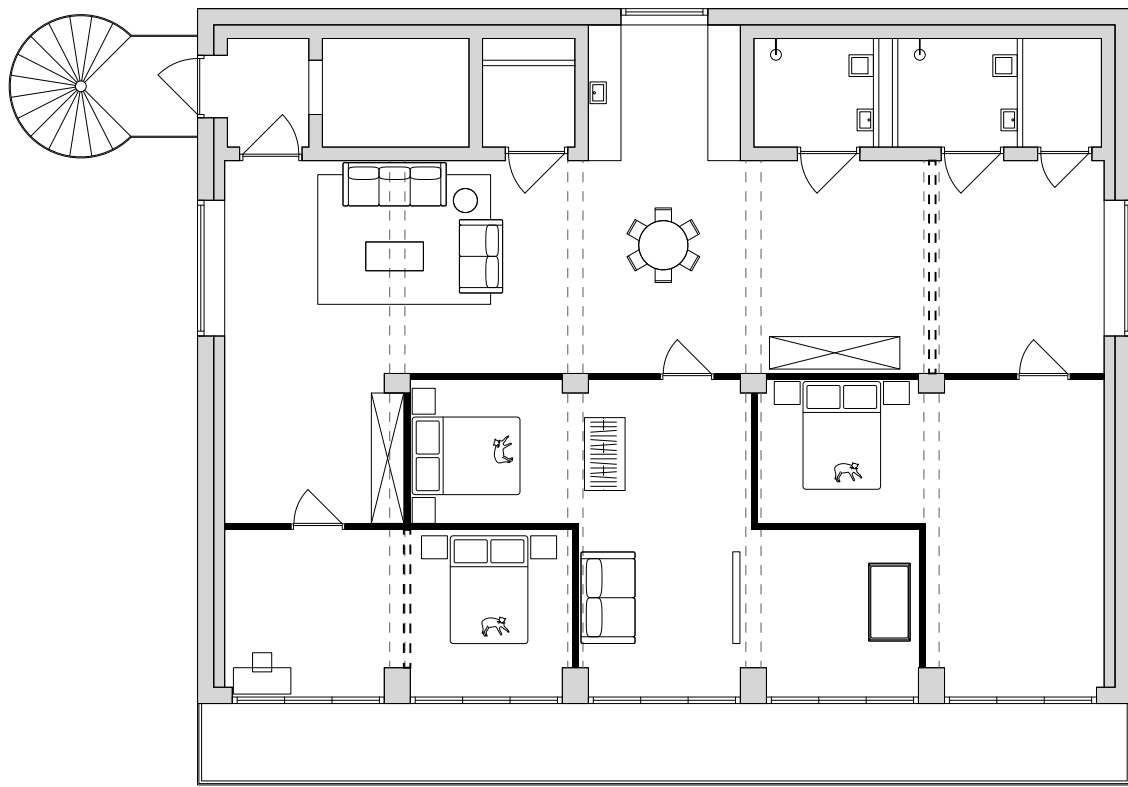
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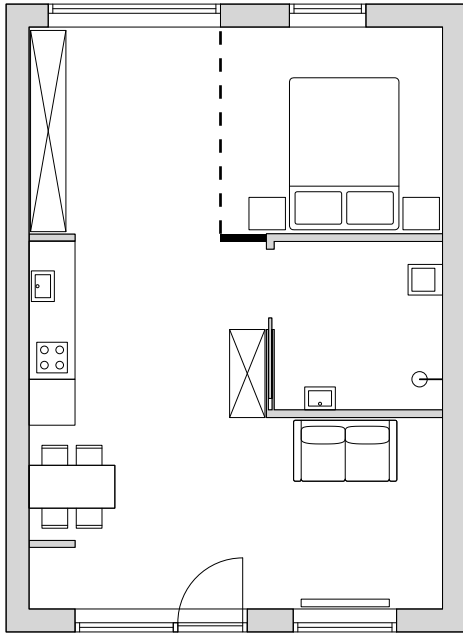
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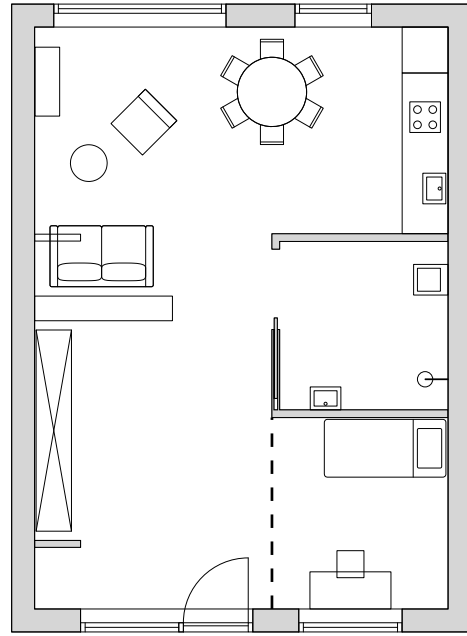
Sharing Apartment 12



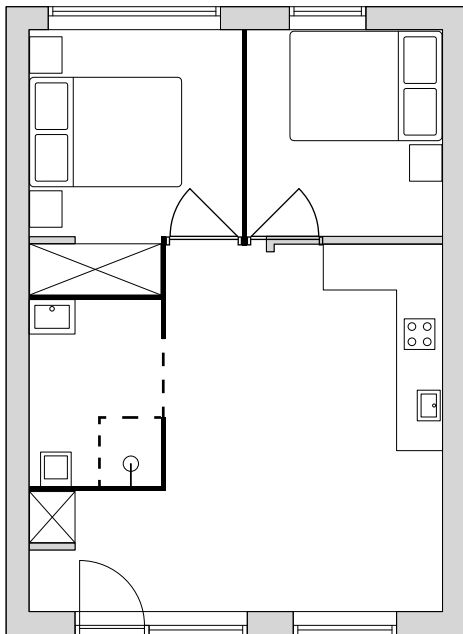
Sharing Apartment 13



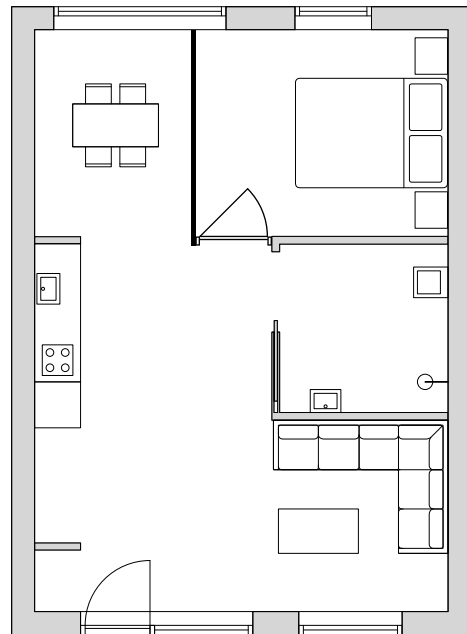
Studio 1



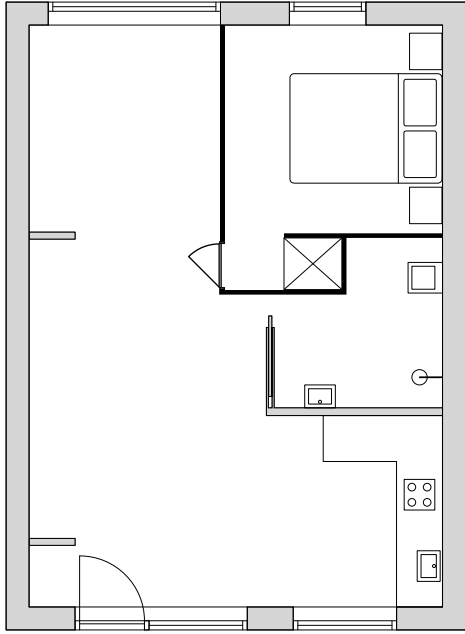
Studio 2



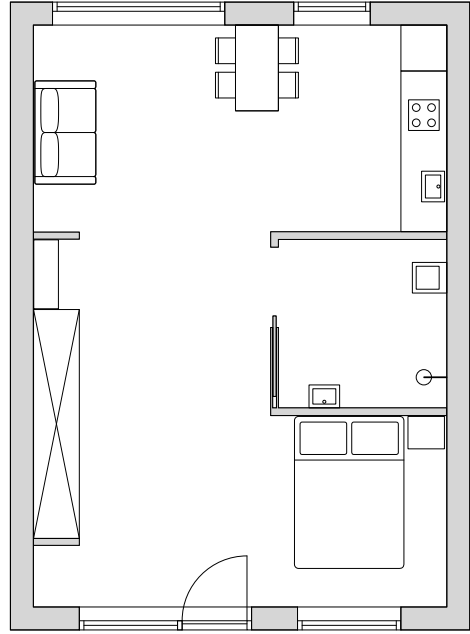
Studio 3



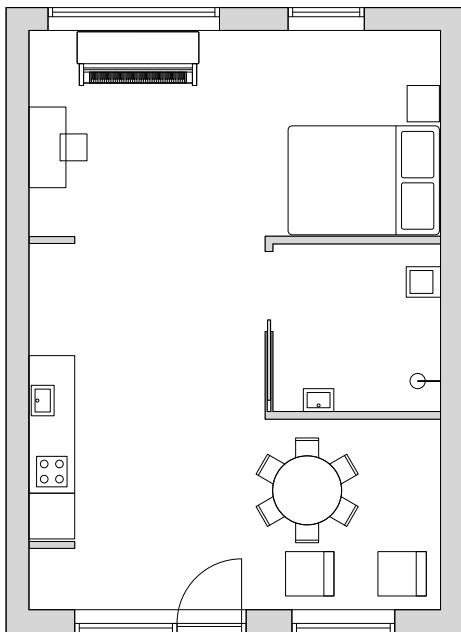
Studio 4



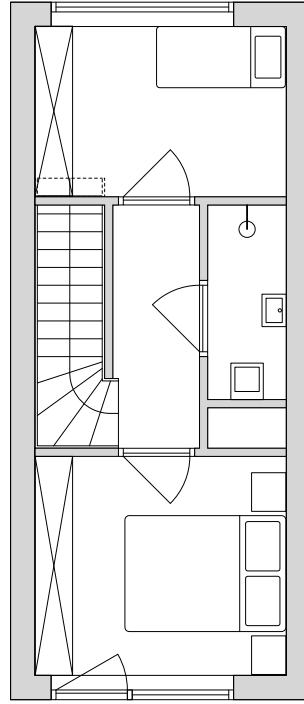
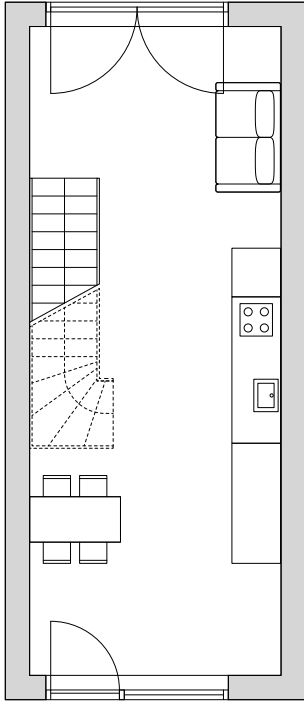
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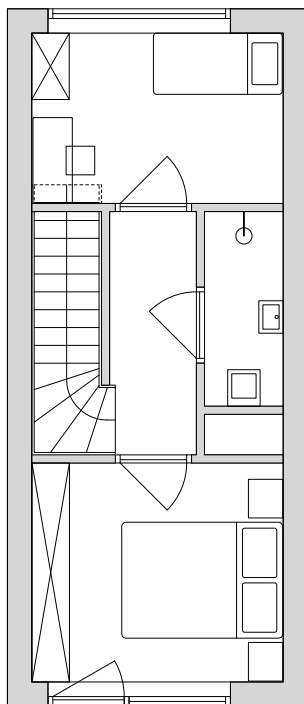
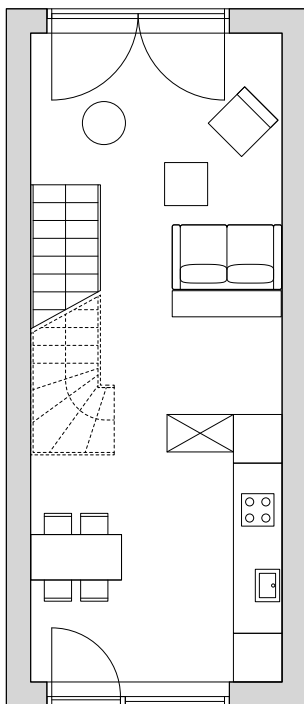
Studio 6



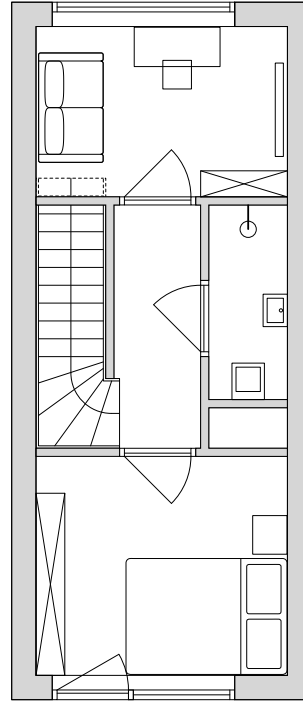
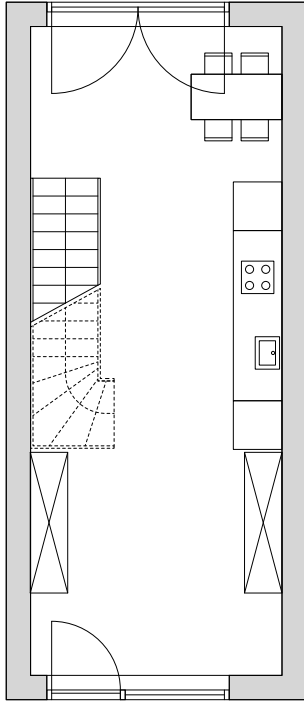
Studio 7



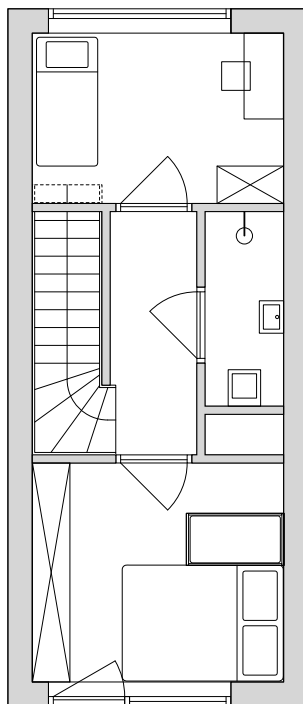
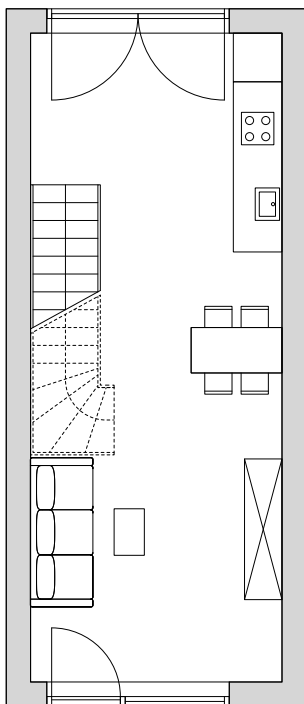
Loft 1



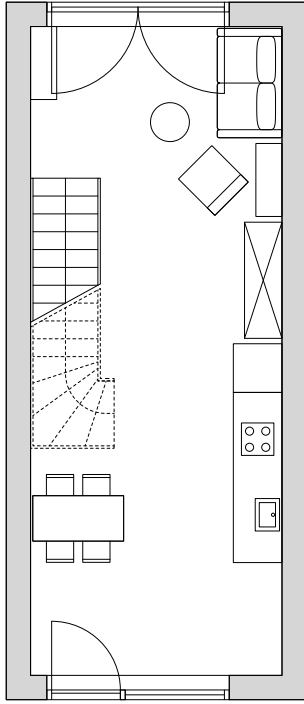
Loft 2



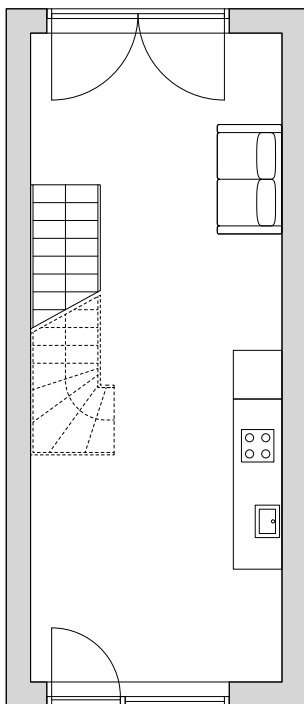
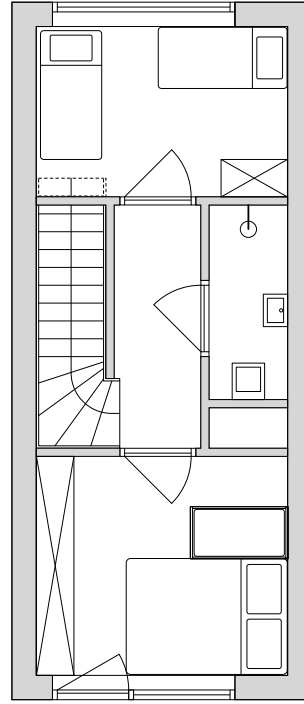
Loft 3



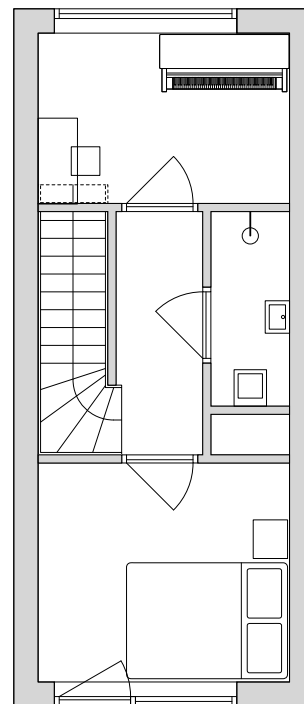
Loft 4

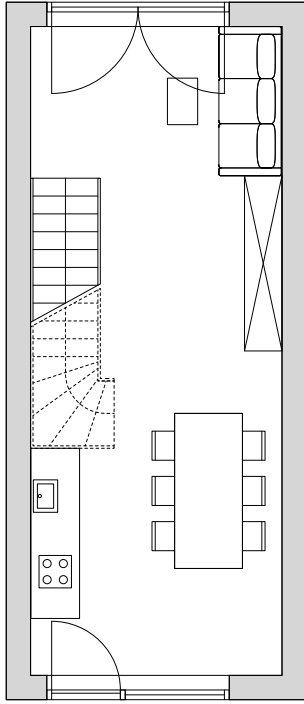


Loft 5

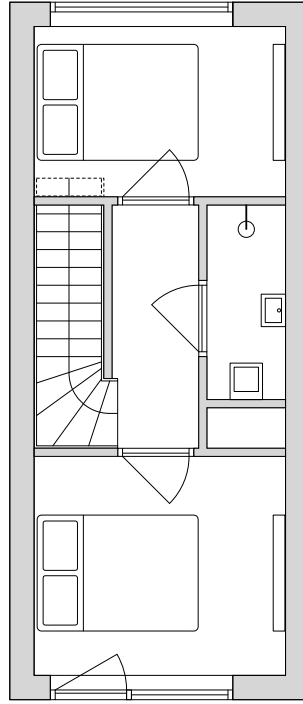


Loft 6





Loft 7



APPENDIX 3. FLOOR AREA PER FUNCTION

SHARED APARTMENT 177.8M²

Number	Household Size (people)	Bedroom Amount	Bedroom (m²/person)	Living Room (m²/person)	Dining Room (m²/person)	Kitchen (m²/person)	Other Entertainment (m²/person)
1	5	5	96.5	12.5	17.6	7	33.5
2	5	3	69	19.5	19.5	12	25.3
3	6	4	90.8	18	13.6	19	24.7
4	5	5	96.5	20.7	14.2	9.4	17.6
5	4	4	44.8	28.3	16.7	7	7.9
6	-	4	75.9	36.2	18.2	7	-
7	-	4	72.2	13.6	20.6	7	12.9
8	-	4	69.2	12	13	7	-
9	-	4	72	9.4	13.3	7	16.2
10	5	3	77.3	11.9	12.9	7	12.5
11	7	3	76.9	12.5	12.9	7	12.9
12	6	3	86.5	20.7	11.9	7	12.5
13	6	3	86.5	20.7	11.9	7	12.5
Average	5.4	3.8	78.0	18.2	15.1	8.5	17.1
Average/Person		0.7	14.3	3.3	2.8	1.6	3.1

STUDIO 40.4M²

Number	Household Size (people)	Bedroom Amount	Bedroom (m²/person)	Living Room (m²/person)	Dining Room (m²/person)	Kitchen (m²/person)	Other Entertainment (m²/person)
1	-	1	5.8	7.8	2	4.9	-
2	-	1	5.8	4.3	4	4.9	-
3	-	1	15.8	15.2*		3.9	-
4	-	1	8.8	5.8	6	4.9	-
5	-	1	7.8	16.8	7.3*		-
6	-	1	5.8	4.3	4	4.9	-
7	-	1	7.8	6.8	5.75	4.9	-
Average	1.5	1	8.2	7.6	4.4	4.7	-
Average/person		0.7	5.5	5.1	2.9	3.2	-

LOFT 43.8M²

Number	Household Size (people)	Bedroom Amount	Bedroom (m²/person)	Living Room (m²/person)	Dining Room (m²/person)	Kitchen (m²/person)	Other Entertainment (m²/person)
1	3	2	14.9	6.5	1.5	4.2	-
2	3	2	14.9	8.6	1.5	4.2	-
3	2	1	8.4	-	2.8	4.2	6.5
4	4	2	14.9	6.1	2.8	4.2	-
5	4	2	14.9	6.5	1.5	4.2	-
6	2	1	8.4	4.7	-	4.2	6.5
7	3	2	14.9	4.7	2.8	3	-
Average	3	1.7	13.0	6.2	2.2	4.0	6.5
Average/person		0.6	4.3	2.1	0.7	1.3	2.2

*These data are merged due to the lack of exact division of different functions in the survey