

THE INTERMEDIATE LAYERS

research on typology of balcony

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abstract

The high density caused by the rapid growth of the urban population makes it impossible for urban residents to have a private yard and live close to nature as if they live in a countryside. Despite the constant efforts of cities to secure more public natural infrastructure, it is undeniable that balconies are indeed the most easiest way for people to enjoy nature in a private space in urban areas.

the thesis focus on the balcony space in housing, which may be a little far from the basic living function. It's the connection between indoor and outdoor space, also the cross point of public sight, natural and personal daily life. This kind of intermediation gives it a special characteristic, making it become a space highly preferred by both the inhabitants and the designers.

The aim of thesis is to explore characteristics of today's balcony design. The typological summary of modern balconies is to discover more the possibilities of balconies in residential design, and also to discuss the relationship between public and private, nature and humanity.

The research of this thesis consist in the initial diachronic analysis of the development of balcony through time, followed by typologizing today's balconies. Reference projects have been used to frame the structure of development of balcony and typologize it. Space syntax methodology and attributes analysis are used to analyze the balcony space, from its configuration and utility of space, to the quality of space and its contribution to the interior room.

The thesis result in a series of typology analysis of balcony .The systematic typological presentation of the different projects allows readers to learn the knowledge and ideas of others. This can be seen as a discussion and research of private and public ,nature and humanity, providing theoretical support for architects' practice and suggestions for dwellers' living as well, so as to in the end, improve the overall quality of Dwelling in urban context.

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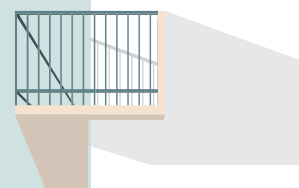
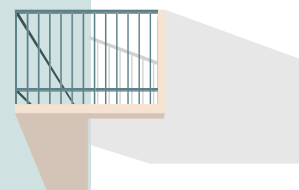
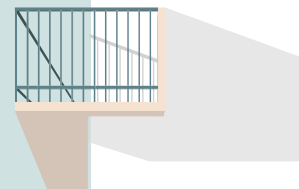
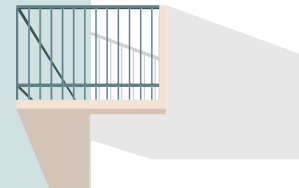
Present typology of balcony

- privacy balcony
 - Type A - Entrance Balcony
 - Type B - In the Middle
 - Type C - In the End
 - Type D - Combination Between Balcony
 - Type E - Transformation of Old Housing
- Public balcony
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Introduction



Background

Looking back to the history of housing in Sweden, the history of balcony has not been long from it was originally sporadic to is now an essential element in many new homes. Today, according to a survey did by Skanska's Bopanel (2014), a home has a balcony or patio is absolutely crucial for three of four home buyers in big cities in Sweden. Meanwhile more and more public terraces and balconies appears in recent projects servicing the whole communities as social space. These all show that in today's commercial housing market, balcony is crucial for home buyers.

Balcony have great significance for the health and well-being of urban residents. S. Omrani (2017) write about the research they did to prove that the addition of a balcony to a building can improve the ventilation.

Emina Mladenovic (2017) did questionnaire and drew the conclusion that gardening in balcony could reduce stress levels and restore the positive energy of residents.

It is a transitional space between inside and outside which softens the interface: it introduce nature into indoor life and is an outward extension of indoor space and activities. It has the characteristics both of privacy and publicity, showing some personal life to the city to some extent. This intermediating grey space makes it flexible and has more possibilities during design process.

Although the balcony are already indispensable in current housing, their neglect still exists in housing design process. The lack of attention in design leads to the inability of the balcony to be fully utilized.

Question

How does
the balcony change in Swedish residences?

Is there
a representative typical balcony form in each period?

What is
the design trend of the balcony today?

How to
determine the classification basis of balcony typeology?

Prupose & Aim

the aim of this thesis has been to examine how the layout of balcony has developed through time in Sweden and, in the light of this, explore and define the typology of today's balcony.

An issue which is particularly focused on is that balcony serves as an intermediary space to connect indoor and outdoor as well as private and public spaces. So the demonstration of the typological presentation includes both the space assigned to an apartment and served as public space in residential area.

Delimitations

The diachronic analysis of the balcony in this thesis will combine the housing policies and the society of different periods in Sweden to summarize the type of balcony. The spatial attributes and configuration are the two features mainly focused on this thesis.

The typology analysis is a review of the types of balconies available today. The cases and projects selected here are not limited to Sweden, but are representative types selected from different countries and continents.

Due to the form of the balcony is closely related to the local climate and residents' living habits, the typology summary does not mean that this is only suitable for the Swedish region, but trying to throw light on balcony design process.

Reading Instruction

After this introductory chapter, this thesis explores the typology of balcony which has been done in 3 steps:

Methods & Theory

introducing methodology used for this study. It includes the space syntax methodology and space attributes analysis.

Diachronic analysis of balcony

Summarize the typical balcony types of the past

Typological analysis of balconies

Define typology From the perspective of the architect

Conclusion & reflection

Working Process

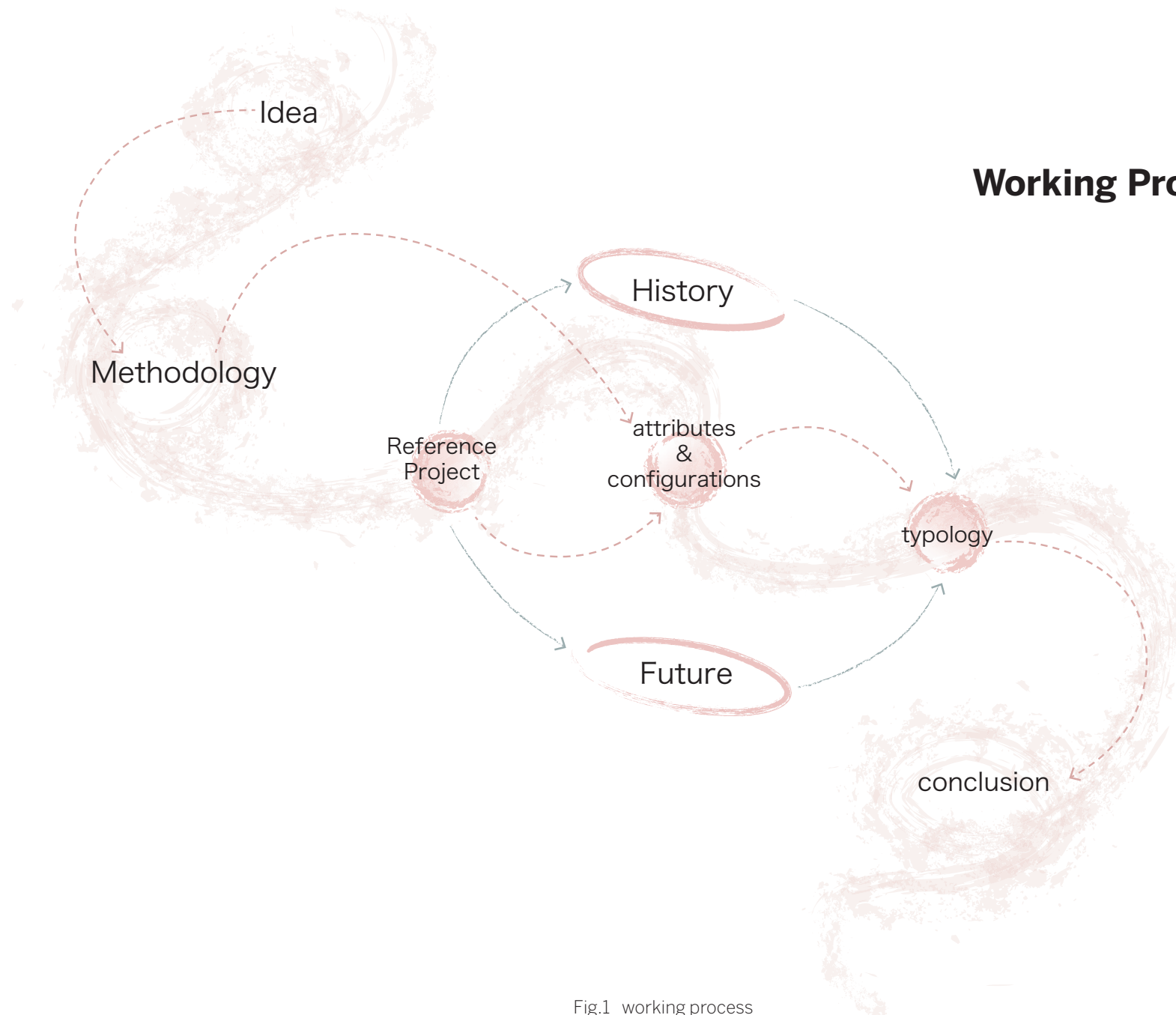
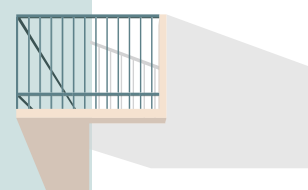
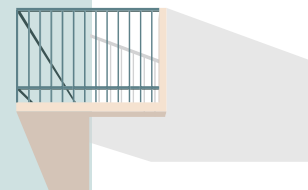
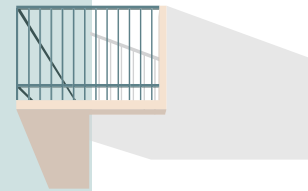
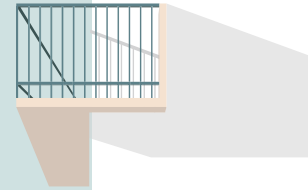
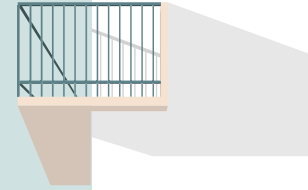


Fig.1 working process

Methods & Theory



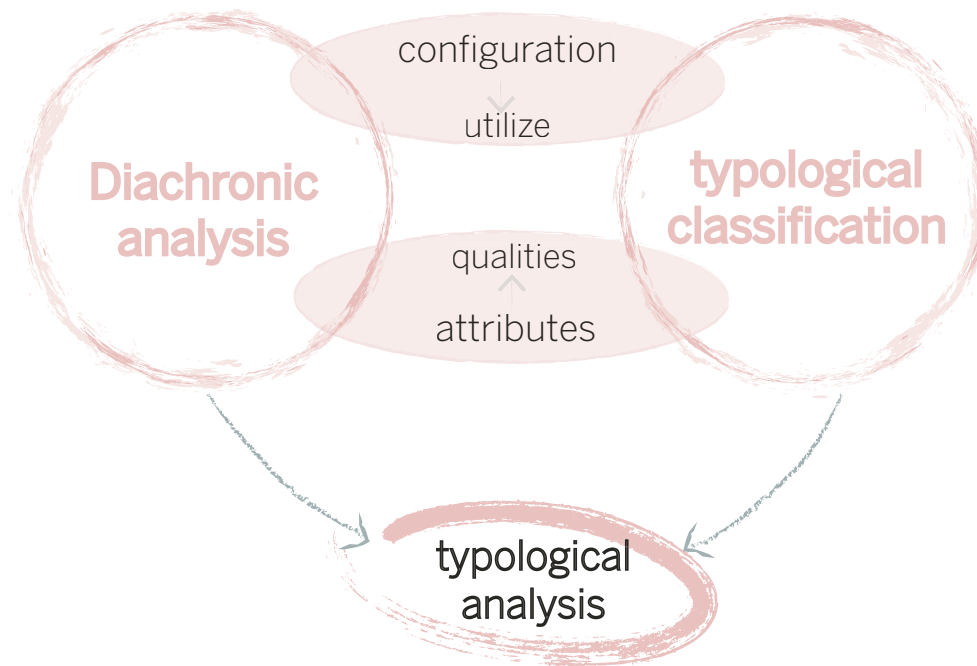


Fig.2 research strategy

research strategy

The research of this thesis consist in the initial diachronic analysis of the development of balcony through time, followed by typologizing today's balconies.

In the first part, by analysing spatial configuration and fields of attributes, it should be possible to identify balcony which is different through time. This have two purpose: The changes may be found might contribute to the knowledge about Swedish housing in a historical perspective. The other purpose is to establish a basis for later typologi Calclassification. The development of Sweden is also a part of the development of the entire Western countries. The type of balcony also reflects the common balcony form throughout Europe, which laid the foundation for the latter part.

The diachronic inquiry examines two features of balcony: the

configuration of the the rooms and fields of attributes. space configuration is about utilize of rooms, analysed by space syntax methodology. Fields of attributes are more focus on "non-measurable architectural attributes"---which reflect the qualities of rooms. It includes seven aspect and in this thesis only several of them related to balcony would be used for analysis. The application of these two methodologies are explained later.

In the second part typological analysis will be based on the previous part while identifying characteristics in today's balcony in order to establish differences that can be utilized for typological classification. Reference projects have been used to frame the structure of development of balcony and typologize it. Floor plan seen as the basic tool for architects are used for reveal the transformation and the qualities of the balcony.

the choice of case

Reference projects are essential for both two research in this thesis, an initial question is what apartments might be appropriate as the empirical basis.

In diachronic analysis, the book "Svensk bostadsarkitektur : utveckling från 1800-tal till 2000-ta" is an very important references as it includes more than 200 swedish floor plans. In addition, the case project of 1920-1980 in this study was also from HSB, which was a leading housing company from 1920-1980 in Sweden, which is very helpful for researching the balcony related to the quality of life. Projects of the 1980-2000 were selected with magazines and other studies on Swedish residential research.

In the typological analysis, the criteria for the selection are representative and innovative housing in recent years. Projects are not only limited to Sweden or Europe, but to countries all over the world. A lot of books and magazines about typology and residential design are used for selection, but since the slower update of them, it is sometimes difficult to guarantee the immediacy, while the new network media can overcome the timeliness and geographical barriers, so some cases are also obtained from the network.

space syntax methodology

space syntax is theory and methods for studying space and spatial configurations. It analyses internal positioning of spatial elements, the utilization and movement of interior space within a spatial configuration, which is considered to be very credible today.

This section will introduce the basic spatial syntax methodology and basic calculation of some statistics used in analysis of syntax methodology.

The **numerical parameters** describes configurational features of the single elements and the system that connects the elements. It can be determined by counting the internal distances between elements. The distance mentioned there can be understood as the number of "steps" from one element to another. For example, the distance between two directly connected elements is one.

The purpose of the space syntax calculation is to determine more elaborated space syntax parameters by mathematical and statistical operations of internal distances. After this we could find some characteristics of the internal space.

Now there are at least three types of graphs used for analysing the statistics, the model used in this thesis is usually called "**connectivity graphs**", which consisting of nodes and connections to represent spatial elements and the connections between them. These simple figures represent a higher abstraction from floor plan used in architecture, which can be used to discover the similarity or difference between different layouts.

By picturing the configuration of elements seen from one particular element in connectivity graphs allowing us to get specific statistics for analysis. And this "particular element" we called it "root" in graphs. Each vertical level of nodes represents the distance of one "space-step" further away from the root node. Since the main research element of this thesis is the balcony, the root in the latter "connectivity graphs" are all balcony.

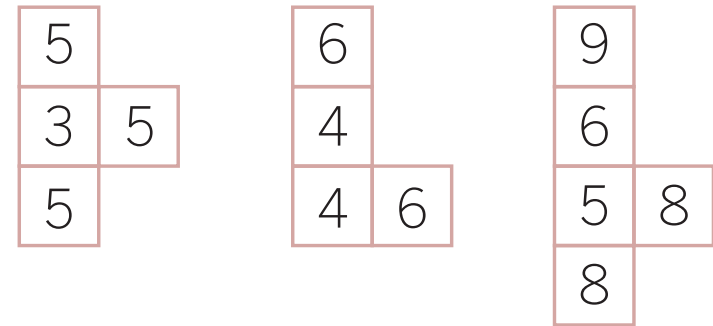


Fig.3 Introduction of depth and integration

The following will introduce the definition of some basic space syntax parameters:

Total depth

TD(n): It summarizes the shortest distance from the element(n) to all the other elements.

mean depth

MD(n): is the mean of the shortest distance from that element to all the others. The formula to find the mean depth of the element(n) is:

$$MD(n) = TD(n) / (K-1)$$

K is the number of elements in the configuration, and K-1 is the number of internal distances.

integration

The positioning according to internal distances in space syntax terminology.

The element with the lowest depth is the one most integrated while the element with highest depth is the one most segregated.

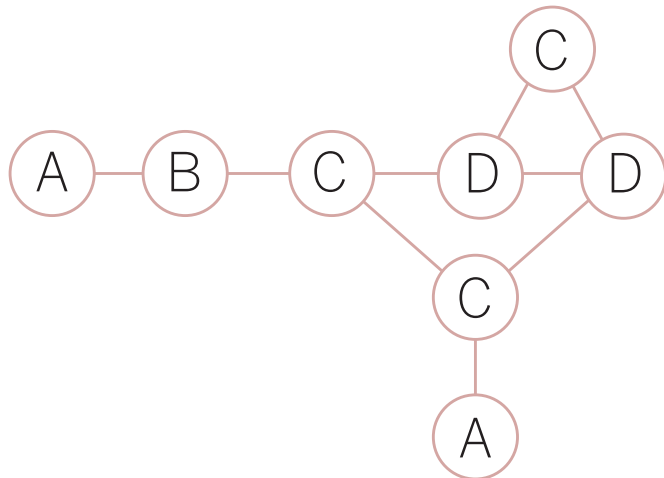


Fig.4 Introduction of spatial typology

relative asymmetry

RA(n): It can be seen from the calculation of MD that its value has large relationship with the number of elements in one system. In order to describe "integration" without the direct correlation to the number of elements, the parameter "relative asymmetry" (RA) has been developed.

It describes the mean depth of an element by a value between or equal to 0 and 1. 0 represents the most integrated position and 1 represents the most segregated position. The formula of RA is:

$$RA(n) = 2 * (MD(n) - 1) / (k - 2)$$

k is the number of elements in a system

control value

CV(n): a parameter describing to what extent one element is controlling the access to the elements to which is connected. It is calculated by letting each element give away the total value of 1.0 equally distributed to its neighbouring elements.

The CV-value of a node(n) is the value received by the node through this operation.

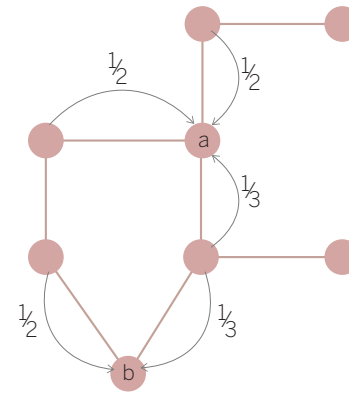


Fig.4 Introduction of calculation of control value

$$CV(a) = 1.3333$$

$$CV(b) = 0.8333$$

typology of positions

Bill Hillier, the proponent of basic spatial syntactic theory, distinguished 4 kinds of positions of space according to spatial configuration, and termed them in A-, B-, C- and D-types of space. By classify a space in different typology we could capture the characteristic that concerning movement versus occupation.

These can be easily understood by the picture next to it:

A-type: a space only connected to one other space.

B-type: a space that is a connection of a space or a sub-composite of a space without a ring, and it is not on a ring itself.

C-type: a space positioned on one ring.

D-type: a space positioned on two or more rings.

From the perspective of spatial syntax, the use of space A and B are strongly influenced by each other, space C and D are on the alternative routes so the space B, which is a through passage, and space A don't have necessary influence to these two space.

Fields of Attributes---Qualities

Fields of attributes are notified by Ola Nylander, who conceptualised seven “non-measurable” architectural attributes which could not be quantified or captured in statistics. In Nylander’s Opinion, a home can be seen as an integration of both measurable and non-measurable aspects, and architects need to resolve two aspects of issues, one is about technic and function, another one is about appreciation and interpretation of the qualities.

These attributes captured poetic and sensory qualities, these could be identified in:

- material and detailing,
- axiality,
- enclosure,
- movement,
- spatial figure,
- daylight,
- organization of space

Among them, movement is similar to space syntax to some extent since both of them concern about movement of users in homes but through different angles.

In this thesis, axiality, spatial figure and movement these three attributes would be used to analyse the qualities of balcony space.

The following aspects are important for each attribute according to fields of attributes.

perception of axiality: length of axes,

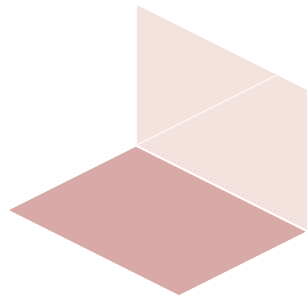
- number of spaces connected by axis,
- similarities, symmetries and repetition,
- form of openings between rooms,
- starting point and goal of axis.

perception of enclosure: number of openings,

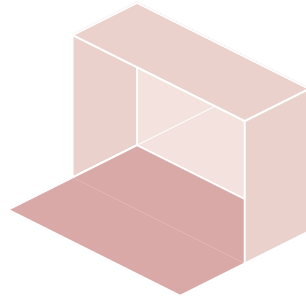
- size of openings,
- placement of openings in the wall,
- the form of openings.

perception of movement:

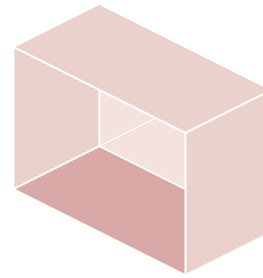
- form and size of room decides the rhythm of movement,
- contrasts of dark and light to emphasise the orchestrated movement.



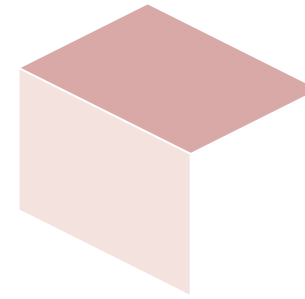
balcony



mix



loggia



terrace

Typology

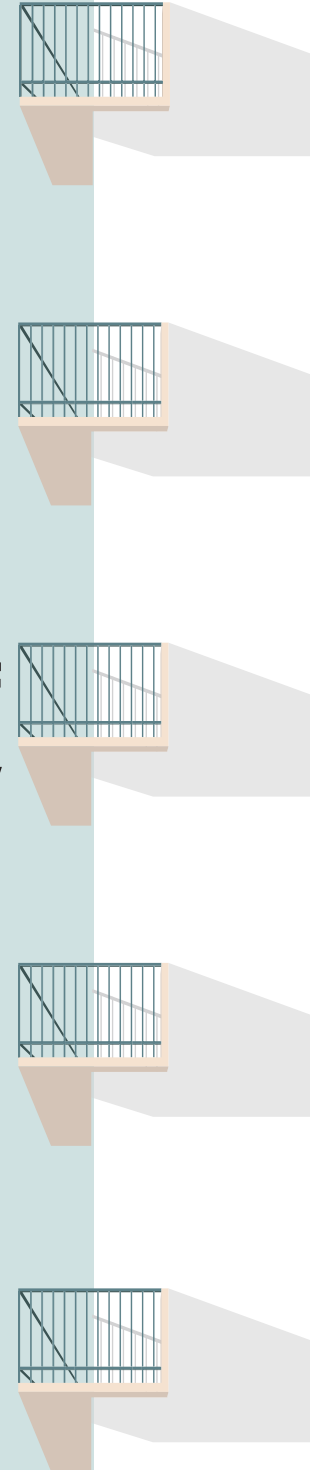
The book "Typology +" published in 2010 has carried out a type analysis of several basic elements of a house. In this book, balcony is divided into three types according to different forms: loggia, balcony and terrace. This kind of division is very suitable for us as an architect, since it clearly shows the logical relationship between the building blocks. This thesis will use this classification of balconies as one of the basis for typological classification of balconies.

Definitions for **balcony** in British Dictionary is: a platform projecting from the wall of a building with a balustrade or railing along its outer

edge, often with access from a door or window and the definition of **loggia** is: a covered area on the side of a building, esp one that serves as a porch.

However, during the collection of the case, many "mixtures" between these two were found and the effect of the mixtures is also very different from the basic two types, so adding a new type **mixtures** as a new type in this thesis.

Diachronic inquiry of Swedish balcony



Case & Data

The aim of this analysis is to identify the changes of balcony through time, when and what changes have happened. The main method is By studying a presumably representative sample of apartments to obtain basic data for spatial syntactic analysis, and finally to summarize the changes.

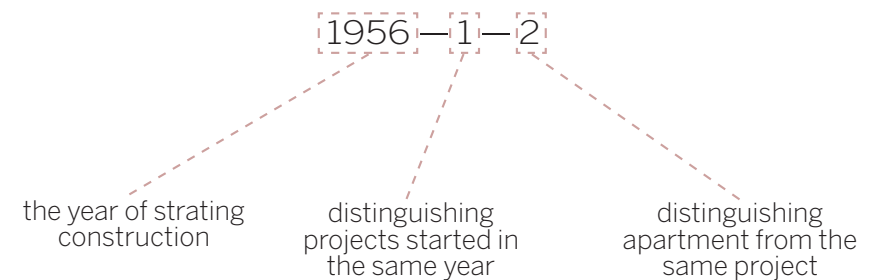
Case Projects

As mentioned before, the case project of 1930-1980 in this study was mainly from HSB, and projects of the 1980-2000 were selected from magazines and other studeis.

The principle of the selection of cases is to ensure that the number of cases selected in each period is equal, and is widely distributed in major cities in Sweden. The selected apartment floor plan is either the most representative of that projects, or the floor-plan that fits the residential trend at the time.

This was done in order to make sure each apartment selected have even qualities represent that time, which make it possible to compare them different different ages.

Each apartment is identified by a number according to the system developed by Manum(2006) who also did a syntax analysis of norwegian apartments. This system is that:



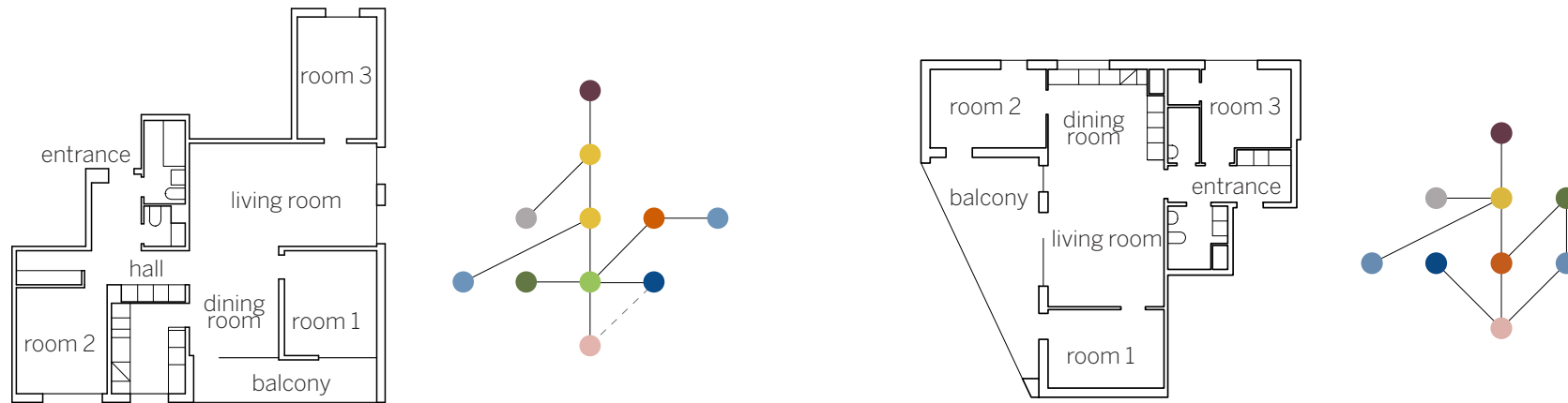


Fig.5 example of the relation between floor plan and connectivity graphs.

data

This thesis has compiled a number of floor plans and corresponding connectivity graphs of different periods, which clearly illustrate the changes in the attributes of the balcony space. Only the most representative parts of each period are listed here, and more are included in the appendix.

For the analysis of attributes, such as sight, axially and the opening, etc. will be analyzed by the floor plan. The spatial configuration has been analysed in drawing the connectivity graphs and doing some basic space syntax calculations explained before.

In collectivity graphs, lines between node reveal the real connections, and the dotted line means sight connection between two rooms. Rooms are represented by nodes, and these nodes are differed by different colour as well as by abbreviation in accordance according to the function of rooms

ROOM	IN SHORT	COLOUR
balcony	B	
access balcony	Ba	
living room	L	
family room(meeting room or study room)	F	
dining room	D	
kitchen	K	
largest bedroom	Bd	
other rooms	R	
entrance	E	
hall	H	
corridor	C	
public traffic core	TR	
bathroom,toilet,washingroom	T	

Spatical Configuration

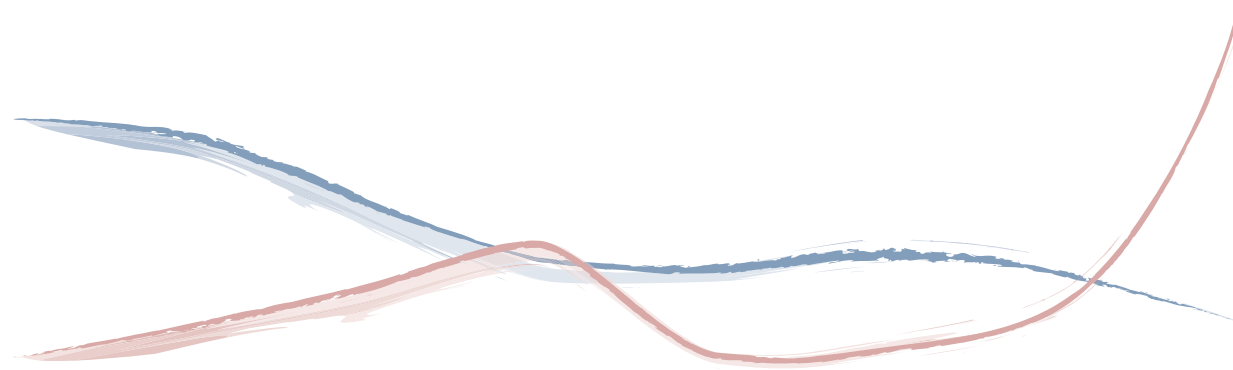


Fig.6 Trends of Control Value and Rank of Integration.

Control Value & Rank of Intefration

Through a comprehensive analysis of three parameters(rank of integration, control value and circular route), the results show that the balcony was segregated at beginning but become more and more integrated in housing unit and from 1950,it gradually participated in circular route,this trend has becomes even obvious after 2000.

RA describes the integration of balcony,which is a value between 0 to 1,where 0 represent the highest integration and 1 means the highest segregation. CV describes the control of access to its neighbouring space,higher value means the higher control of its neighbour space.

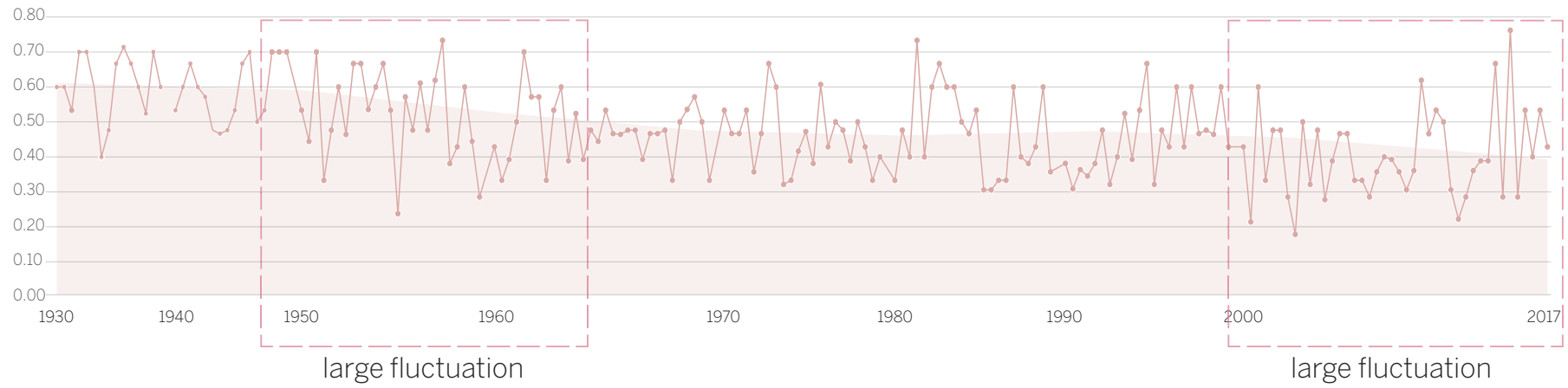
During the period from 1950s to 1960s, the balcony in Sweden has changed a lot compared to the one before 1940: the RA value

decreased significantly, and the value of CV began to fluctuate greatly from the late 1950s.

In the 1970s, the development of multi-family housing was temporarily stagnant due to the slowdown in overall housing construction in Sweden and the question of the millions programs.

In 2000, multi-family units became more and more diverse. At this time, the RA and CV values showed great fluctuations, which indicated that the types of balconies were more and more diverse, and there is a trend that balcony has a close relationship with indoor space, it is no longer just a marginal space, but a space that high real life control.

Rank of Integration



Control Value

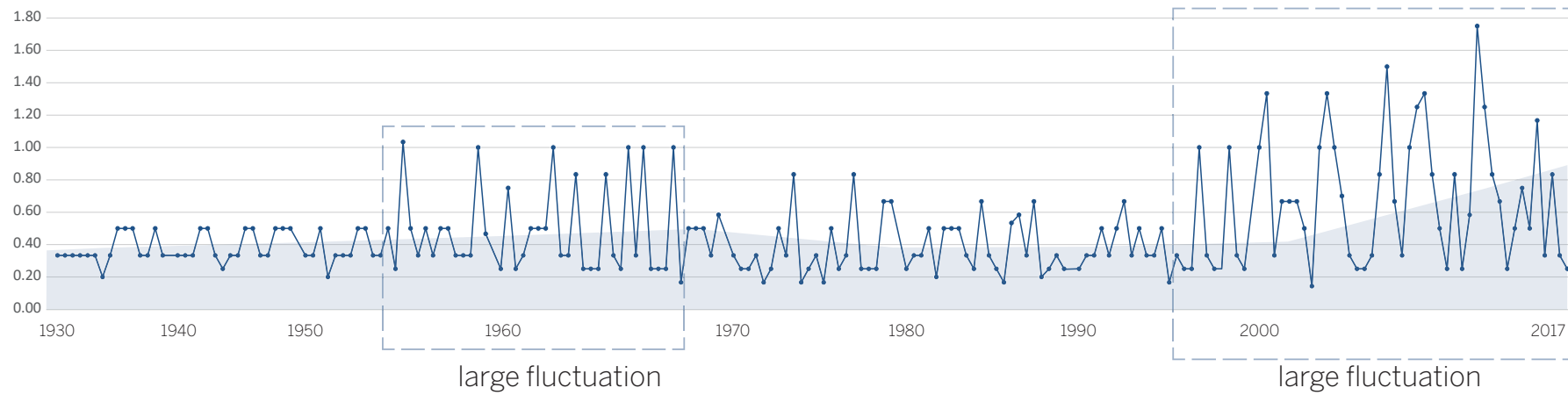


Fig.7 specific changes in Control Value and Rank of Integration.

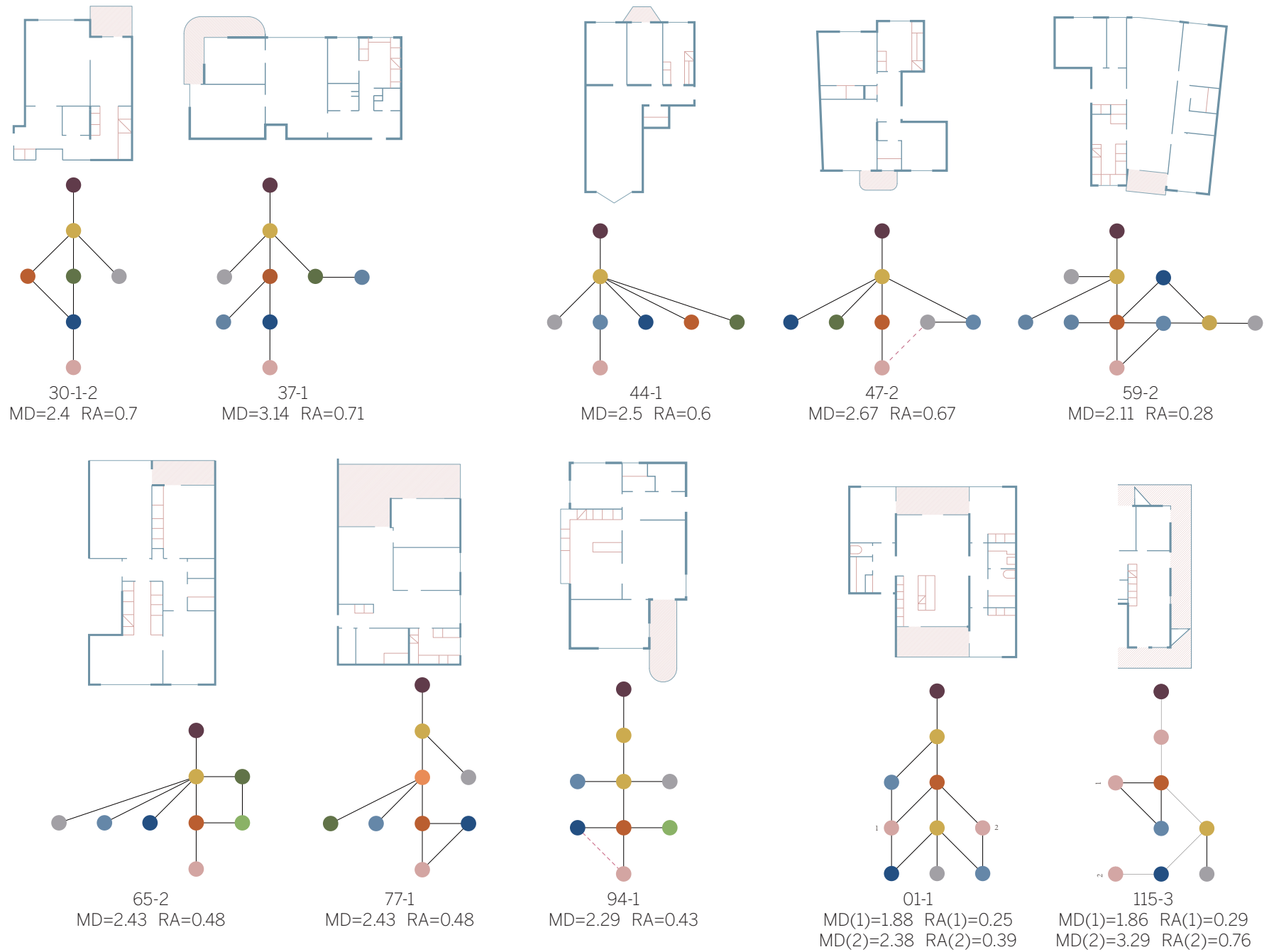


Fig.8 floor plan with connective graphs to show changes in Mean Depth(MD) and Rank of Integration(RA)

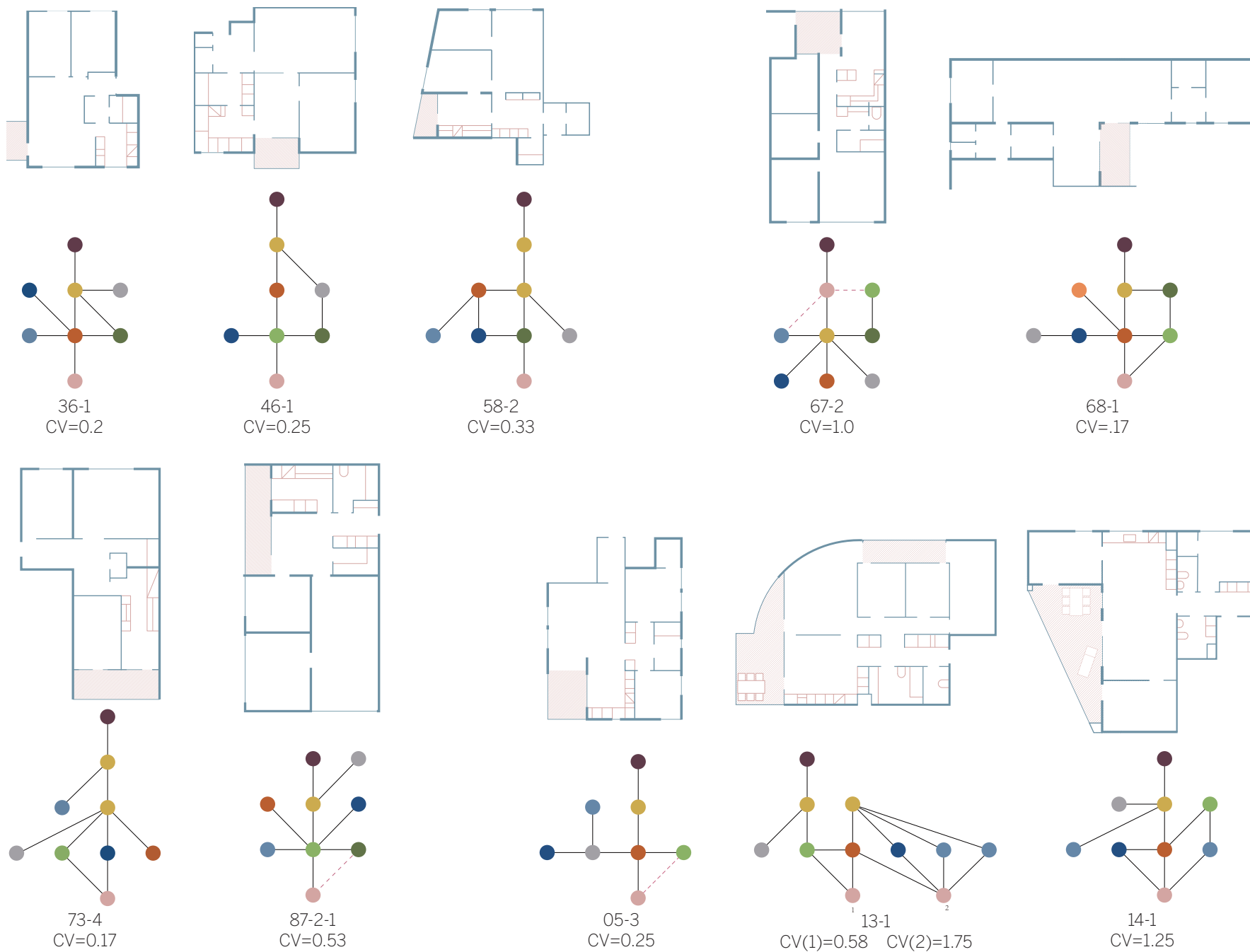


Fig.9 floor plan with connective graphs to show changes in control value(CV)

Spatical Configuration



Fig.10 trends in circular route.

Circular Route & Spatial Typology

The circular loop in a home can improve the quality of apartment because it offer various options to walk inside which makes the space more flexible and it also integrate varios of visual and circulation axes together.

At first, since the balcony's decorative meaning was more than practical meaning, it was almost not involved in the indoor circular route until the mid-1950s.

until 1960s, one thrird of apartments had intenal ring route with balcony participated in it. Most of these rings consisted 3-5 rooms, more than half of the balconies are C-type, which means they only participate in one loop.

During the period 1970s and 1980s, the frequency of balcony with

circular route ws much lower.This downward trend continued until the 1990s, when the proportion of balconies participating in the circular route was less than 15%.

Although the number of balconies participating in the ring route is low in this period, its location in the circular route is very important: many participate in at least two circular routes, and these routes often consisted 5-7 rooms, means the quality is higher than before.

After 2000, big change happend where more than half of balcony take part in circular route.

At this point, the polarization is very obvious:they either participate in a small loop with only 3-4 rooms, or participate in a large loop of 6-7 rooms, and the C-type and D-type are basically flat.

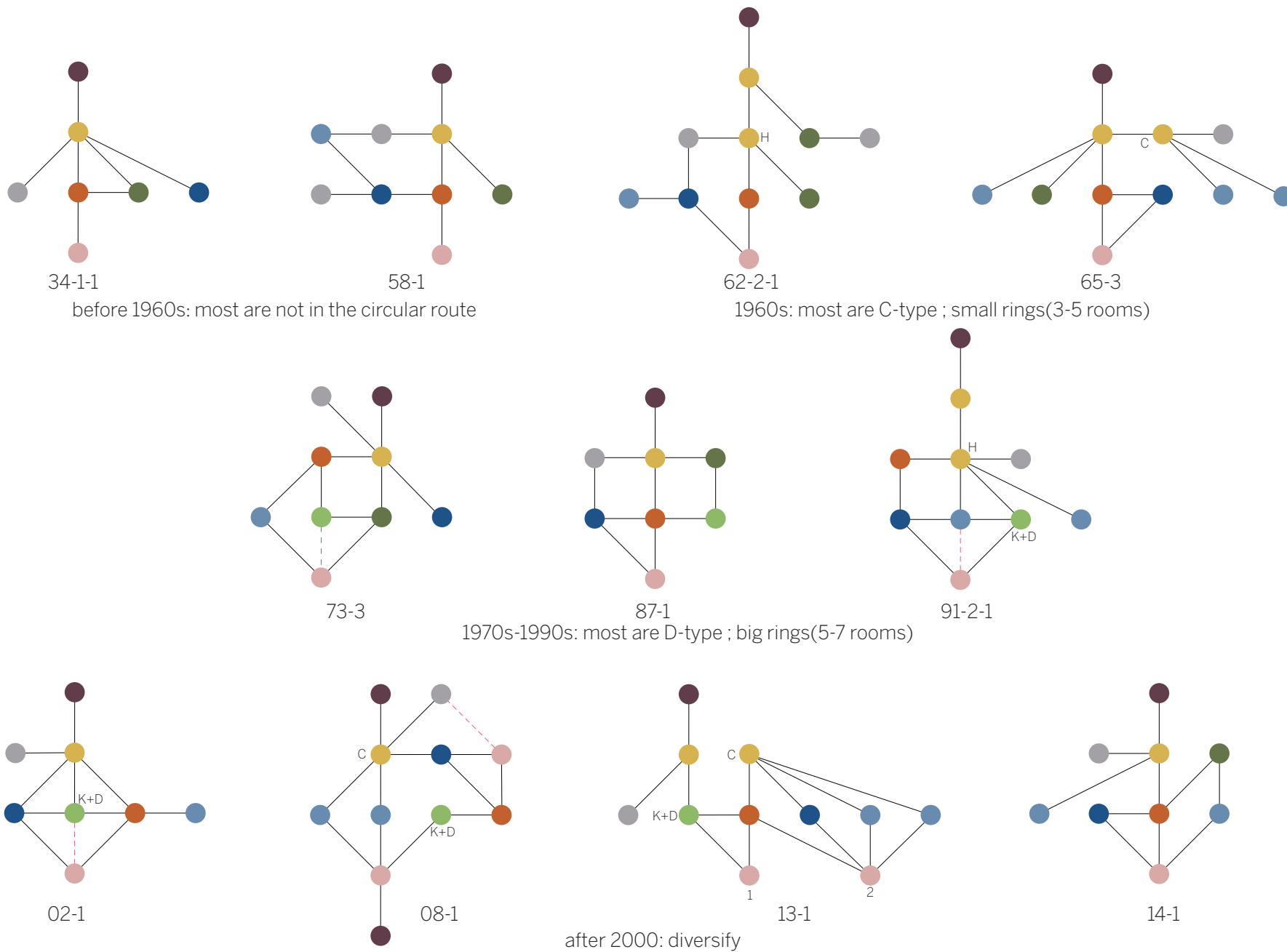


Fig.11 typical connective graphs in each period.

Spatial Configuration

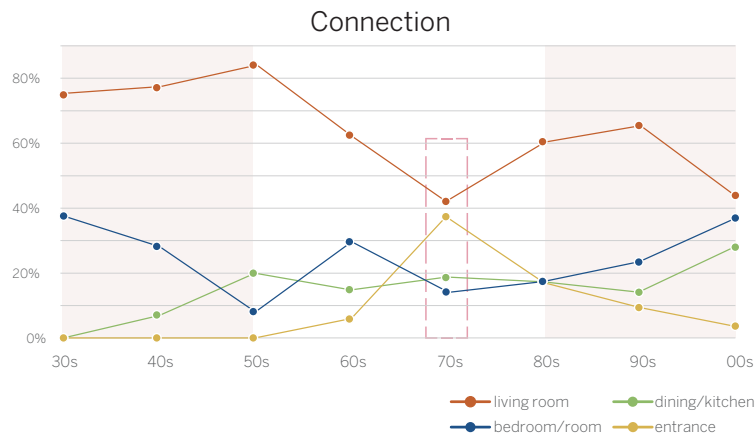


Fig.11 charst about connection between balcony and neighbouring rooms

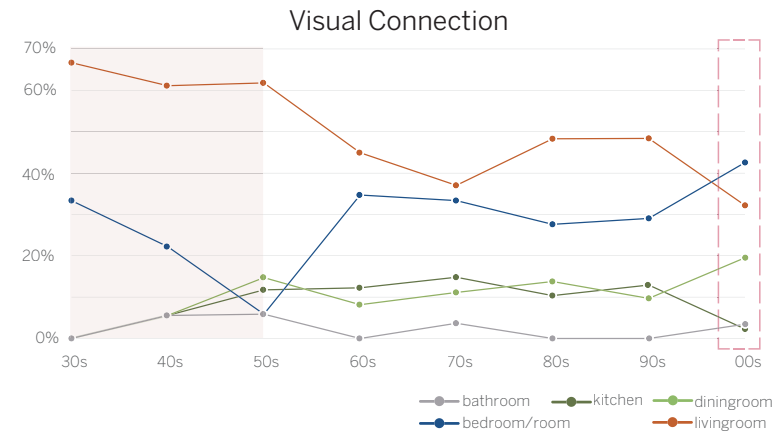


Fig.12 charst about visual connection between balcony and neighbouring

Connections

Overall, the relationship between the balcony and the indoor room has transformed from dominated by the living room in the beginning to more flexible and diverse. In the 1930s, due to the small and simple apartment, and the difference between the living room and the bedroom in many apartment is small, the balcony was mainly connected to the living room, some of them entered from the bedroom. In the 1940s, in addition to the connection between the balcony and the living room in the public part, there was also balcony that entered from the dining room. where dining rooms were usually the center of the apartments layout. Such a balcony is located in the public space of the apartment and serves as outdoor space of all family members. In the 1970s, there were many access balconies appeared, because this could reduce construction costs. After a small decline in the 1990s, access balcony re-popular these years. As the balcony begins to connect with other rooms such as bedrooms, dining rooms, etc., the balcony

after 2000 is no longer limited to just connected with the living room. Many rooms have access to the balcony, making activities available on the balcony become more flexible and diverse, people can relax and socialize on the balcony no matter where they are.

The main trend of visual connection is change very differently. At beginning besides the connection with livingroom and some bedroom, just some serving space, such as washing room, kitchen get light from the balcony. Until 1960s to 1980s, some service space like bedroom, dining room, etc. also have visual connection with balcony. balcony balustrade frames the view from the inside and interesting stories can happen between these served rooms and balcony. The balcony has not been simply tied to the livingroom anymore. After 2000, the visual connection between bedroom/room even exceeded the livingroom, which again confirmed the conclusion reached from the 'connection'.

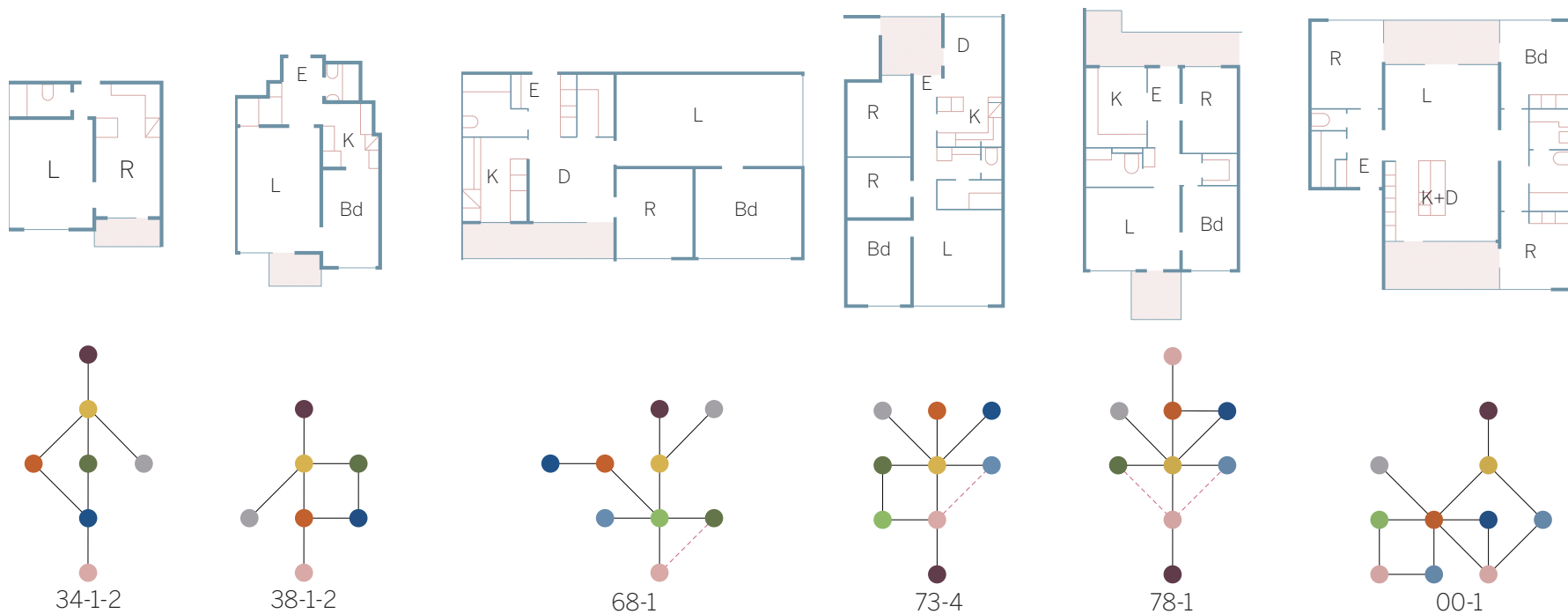


Fig.13 typical connections of balcony in each period

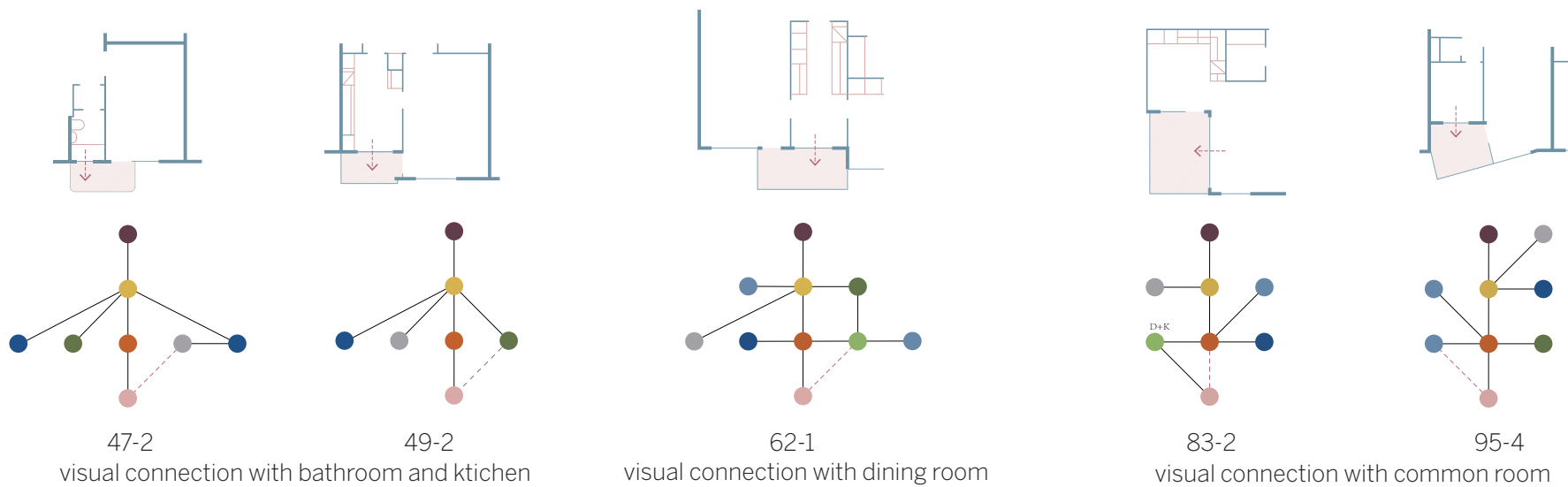


Fig.14 typical visual connections of balcony in each period

Size & Enclosure

Size

The size of the balcony varies greatly. It is judged on the basis of whether there is enough space for socializing, such as the ability to accommodate four people dining together on the balcony. According to the human scale standard of Swedish, if the above requirements are met, the size of the balcony should be at least 2050*2400mm.

The balcony before the 1930s was mainly used to serve as decorations of facade. During the 1930s to 1950s, the width of the balcony was usually half-width or the same width as the connected room, and the depth was also small. Most of the balconies during this period were unable to accommodate dining for 4 people at the same time, but there were also balconies that were specially set up outside the dining room, and their size met the requirements.

Since the 1960s, the area of the balcony has made a big leap: there have been many large balconies. Some of them even have two or three rooms wide and more and more full-facade-balcony appeared. Although there are many large-area balconies, it is important to emphasize that there are only balconies in large apartments. Almost all small houses have no balcony, or only one very small balcony. About 1970s, there was a change again, the small balcony once again became the mainstream, but most of the balconies at this time can still accommodate 4 people while resting outdoors, so it is still larger than the balcony in the 1940s. In recent years, the balcony area and depth have a qualitative leap. There are balconies as large as the living room, and they often very deep, forming a cool shaded area in the summer, or can be closed with glass as a winter garden for winter use.



Fig.15 typical balcony in each period

Size & Enclosure

Enclosure

The above typology is mainly about the closeness of the balcony with external space as the intermediary space, in the enclosure the main discussion is the connection between the balcony and the indoor space.

According to fields of attributes ,the perception of enclosure is related to the number and size of openings. So the focus here is the size and number of façade openings between the balcony and the indoor room. Before the 1950s, in order to ensure that the additional balcony would not affect indoor lighting, often only one small door leads to the balcony, or one more small window.

By the 1960s, lower windowsill and long horizontal windows were more and more common in housing, leading the opening between the balcony and the room was significantly larger than before. In addition, many balconies participate in the circular route during this period,

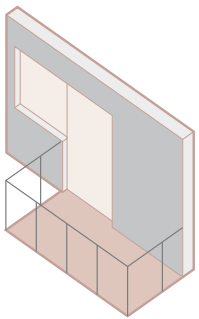
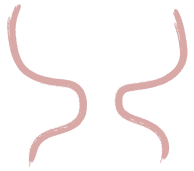
there is more than one opening between balconies and the indoor rooms.

A new corner balcony appeared in the 1880s. It has two sides that are connected to the room. Often these two sides has window at the same time, which allows residents enjoy what was happening on the balcony no matter which way he goes inside the house.

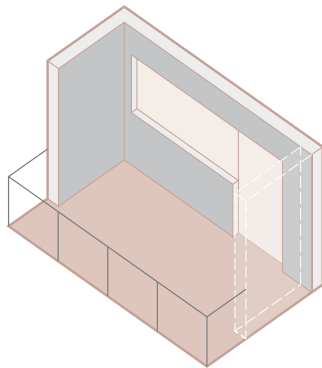
Since the late nineteenth century, floor-to-ceiling window have been used, which has completely blurred the climate boundary and maximizing visual penetration. The balcony and interior space can be fully integrated.

To sum up, from the beginning of the small and few openings, to now completely transparent interface, from the beginning of they can not be seen from each other until they can be integrated. The balcony is more and more open to the inside, which guarantees that the balcony will not be separated from indoors.

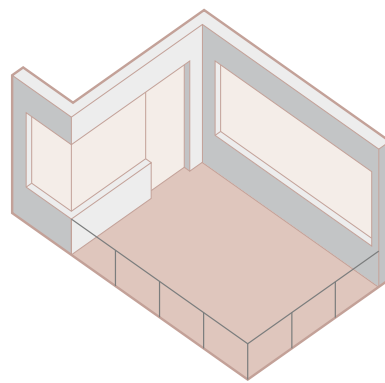
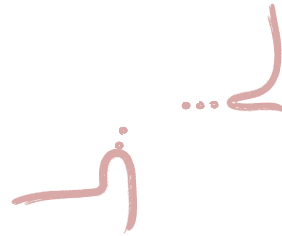
one small opening



door + window



two sides with indoors



visual permeability

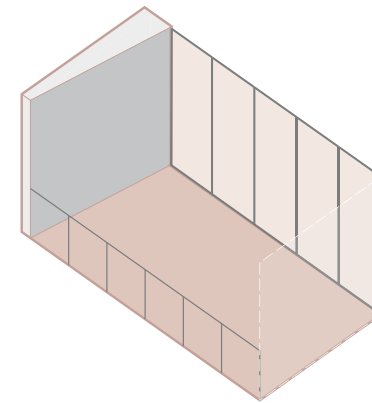
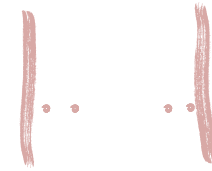


Fig.16 four changes in enclosure



Fig.17 indoor scene with one door



Fig.18 indoor scene with one door and window



Fig.19 indoor scene with windows on both sides



Fig.20 indoor scene with floor-to-ceiling window

Size & Enclosure

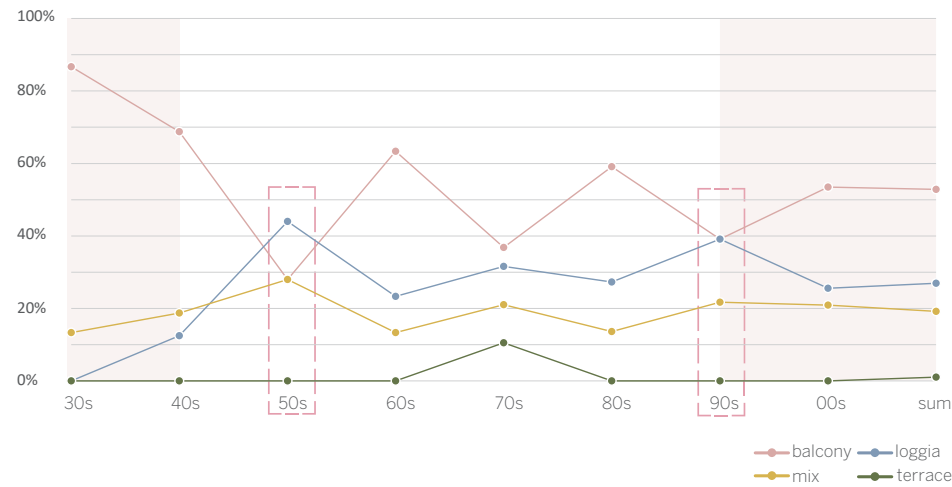


Fig.21 chart of typology of balcony

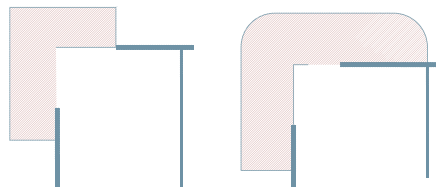
Typology & Form

Since the number of cases selected in each era varies, the data will be compared by the proportion of the various categories in their respective years. In terms of the total proportion, the balcony is still the mainstream balcony form, but the ratio of the balcony, loggia, and the mix is not too big. Although the terrace is not much in total, there are still some new terrace housing appearing.

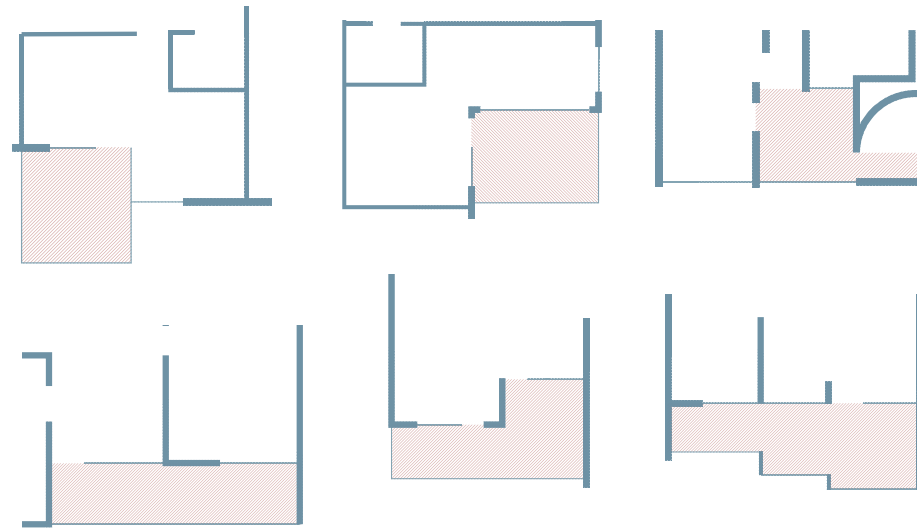
In the 1930s, most of the balconies are projected the main part, they are employed to animate the facade, like a building accessory rather than provide functional outdoor space for residents. A few of them in the mixed form, some of balcony are corner balcony for letting more light into rooms. The form of loggia appeared from 1940, and a large number of loggia and mix form appeared during the 1950s. During the 1960s and 1980s, the proportion of loggia was relatively stable, until it became popular again since 1990s.

Terrace housing appeared from 1960s and during 1970 there are a lot terrace housing in Sweden. Also in the 1970s, there was the entrance loggia, which served as an outdoor space for contacting the traffic nuclear and houses, and as a home garden.

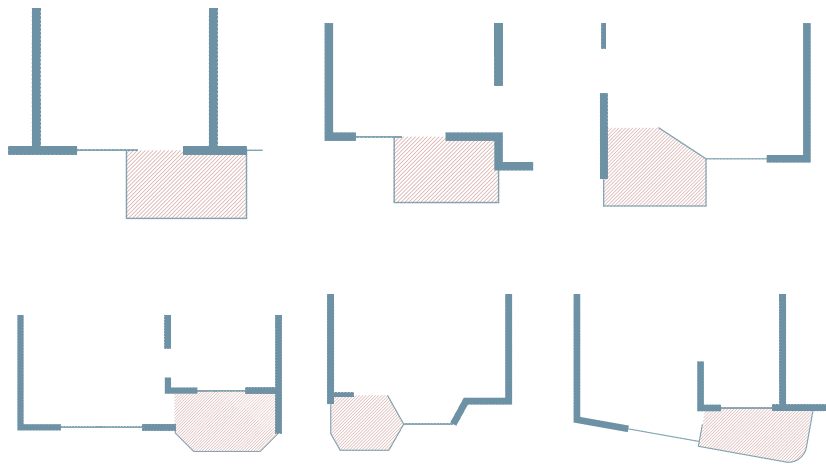
In the 1960s and 1970s, balcony appeared popular again, but it became wider than before and a lot of them were full-facade balconies and combined together, giving people a similar feeling with loggia. Compared to Sweden more than 80 years ago, today's balconies are very diverse. Although the form of the balcony is still relatively large, the three forms (balcony, loggia, mixed) are not much different in proportion.



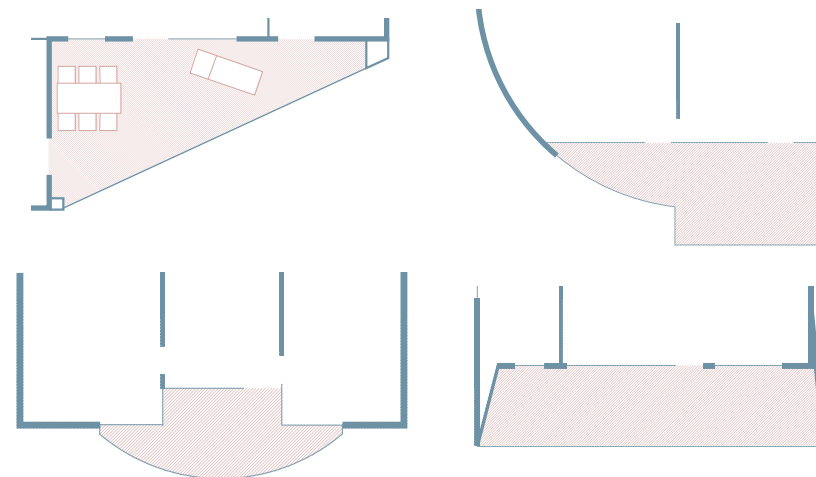
1930s
L shape, Fillet



1960s—1990s
square, right angle



1930s--1950s
square & special form



1990s—now
diversity

Fig.22 examples of balconies in different periods

Conclusion

Now we could discover the development of balcony easily: at the beginning it's more like a space segregated from the main housing part, we seen it as a decoration of building facade; then it gradually integrated with housing form as well as our daily life. The design of the balcony in the beginning was still in a fixed mode, but with the constant experimentation and development of housing, today's balconies are more flexible and diverse. It is no longer just one place closed to nature, but a layer available for socialise and high real life control.

Combining the above analysis, we could divide Swedish housing balcony development into 5 parts. Different periods have their own unique characteristics that make them distinctly different from other time periods.

The first stage is 1930s to mid-1950s. The balcony of this period is basically completely out of touch with the interior. The decoration is more than practical. The difference from a window may be that he can

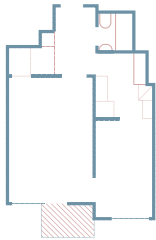
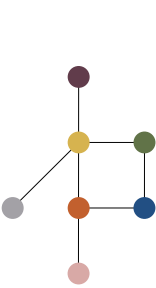

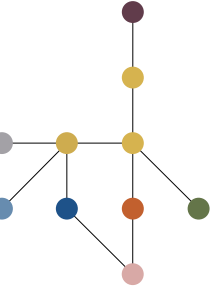
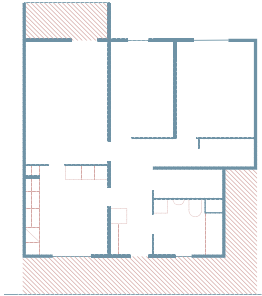
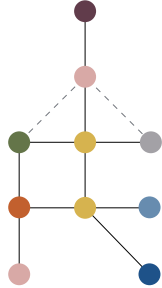
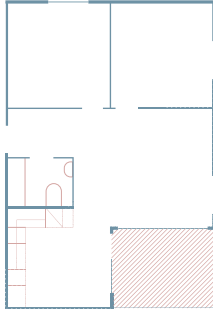
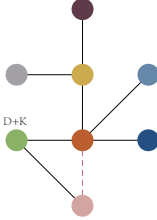
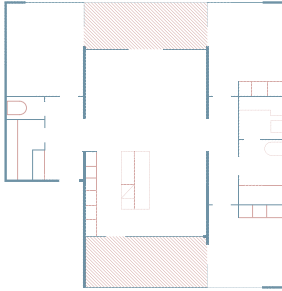
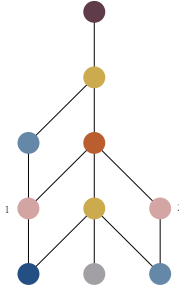
completely put the body outdoors instead of just Can go out on the upper body.

In the second stage (mid-1950s to 1960s), the balcony was greatly improved. He began to integrate indoor functions, and the area began to grow. Many balconies began to participate in the circular loop.

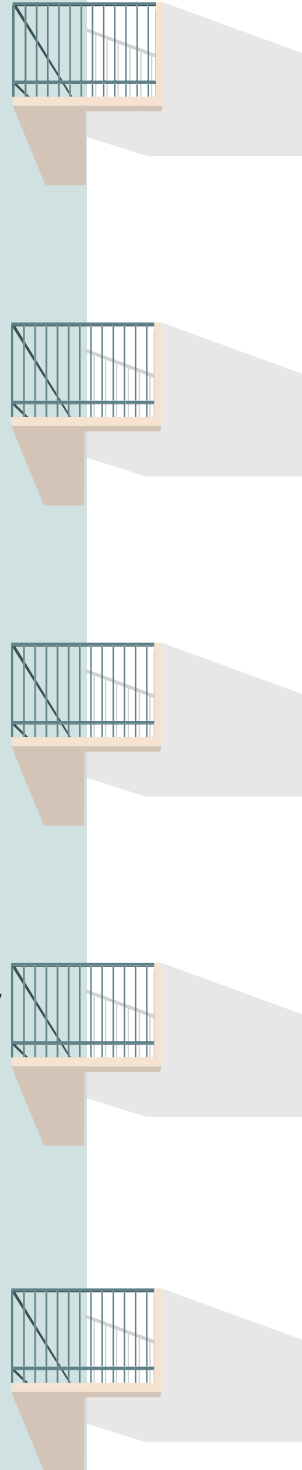
The third phase began in the 1970s. During this period, there were many access balconies and entrance gardens. Compared to the previous period, the balcony of this period has returned to the first stage in many aspects. It is a period of serious thinking after the big exploration and innovation.

The fourth stage is mid-1980s to 1990s. The connection between the balcony and the interior space is slowly and steadily increasing, and the boundary between the balcony and the interior is increasingly blurred.

The twentieth century is a great leap forward and diverse. The balcony blends in with the interior and the balcony is more flexible and diverse.

PERIOD	1930s-- 1950s	1960s	1970s--1980s	1980s--1990s	2000s--
TYPOLOGY	mainly balcony	balcony, many loggia	balcony	even	diversify
CONTROL VALUE	(low) edge position	(↗) first peak vary a lot	(→) higher control of access vary a lot	(↗) slowly	(↗) more central position vary a lot
RANK OF INTEGRATION	(high) segregate	(↘) less segregate vary a lot	(→) vary a lot	(→)	(↘) integrate vary a lot
LOOP	almost only one	many	some	few	much
OPENNINGS	few,small openings	more bigger openings	--	bigger balcony	more bigger openings
SIGHT CONNECTION	almost none, served room	many, bedroom,dining room	few, bedroom	some, bedroom	few, bedroom,dining room
SIZE	small	enough for socialise	smaller, enough for socialise	→	really big, enough for socialise
REPRESENTING APARTMENT	  <p>38-1-2</p>	  <p>61-2-2</p>	  <p>75-2</p>	  <p>83-2</p>	  <p>01-1</p>

Present typology of balcony



Classification Basis

The balcony here is not limited to Sweden, but hope to draw inspiration from all over the world. First, according to whether balcony serves a single family or the entire building, it can be divided into private balcony and public balcony.

In the category of private balcony, although the balcony can be used as a space unit that can be connected to any space, it is meaningless to discuss the difference between a balcony connected to a kitchen or dining room. Through the research results of the space syntax and space attribute these two methodologies, it's easily to find out that the classification of balconies in spatial order can clearly divide the balcony into three types:

- >The balcony is placed in the first place in the spatial order, it can be seen as the transition space between the public part of the building and the entrance to the apartment;

- >The balcony is at the end of the spatial sequence and is only connected to one of the functional spaces in the apartment;

- >The balcony is located in the middle of the spatial order and participates in the circular route, connecting to at least two spaces in the apartment.

In contemporary multifamily housing design, in addition to providing

outdoor activity space, the balcony has become an important element for architectural forms. The combination of balconies also contributes to architectural form and strengthening relationship among neighborhoods. Therefore, in addition to considering the relationship of single-family houses in residential units, the possibility of multiple balcony combinations is also considered.

Urban renewal has gained the attention of all countries in the world recent years, and people's attention once again pays attention to the transformation of social housing. Therefore, the houses that use the additional balcony as a modification method are also classified into a single category.

Public balconies can be divided into two main types:

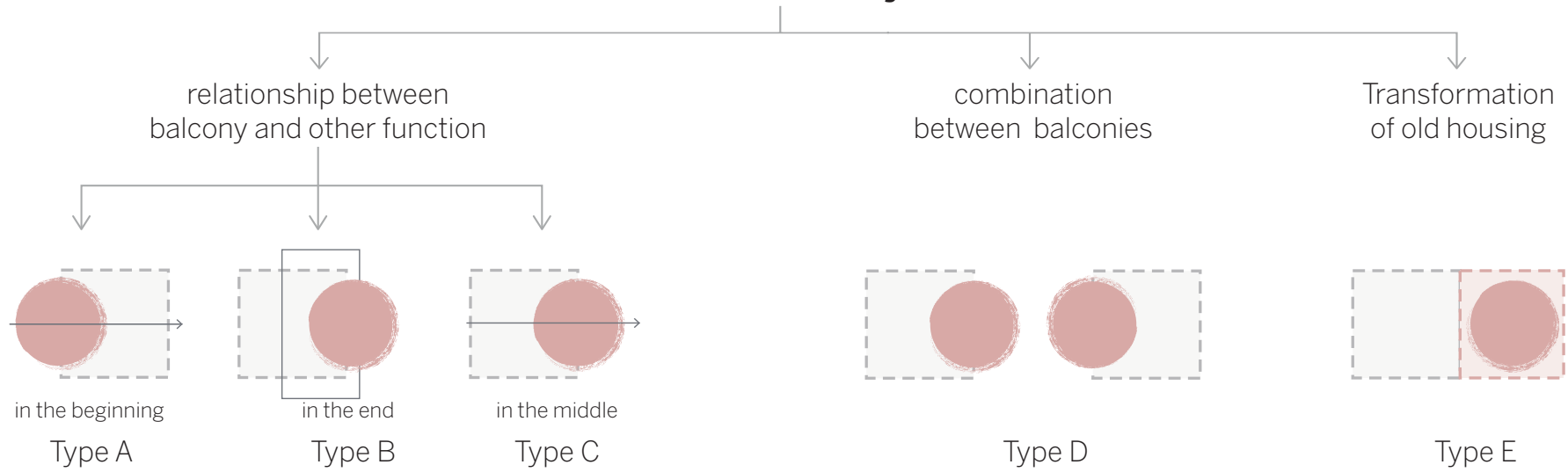
- >Public terraces, roof gardens and winter gardens:

They are either larger platforms, or several small platforms scattered throughout the building to serve different groups of residential units.

- >Combined with traffic system:

Public access balcony or balconies combine with a vertical traffic core.

Private balcony



Public balcony

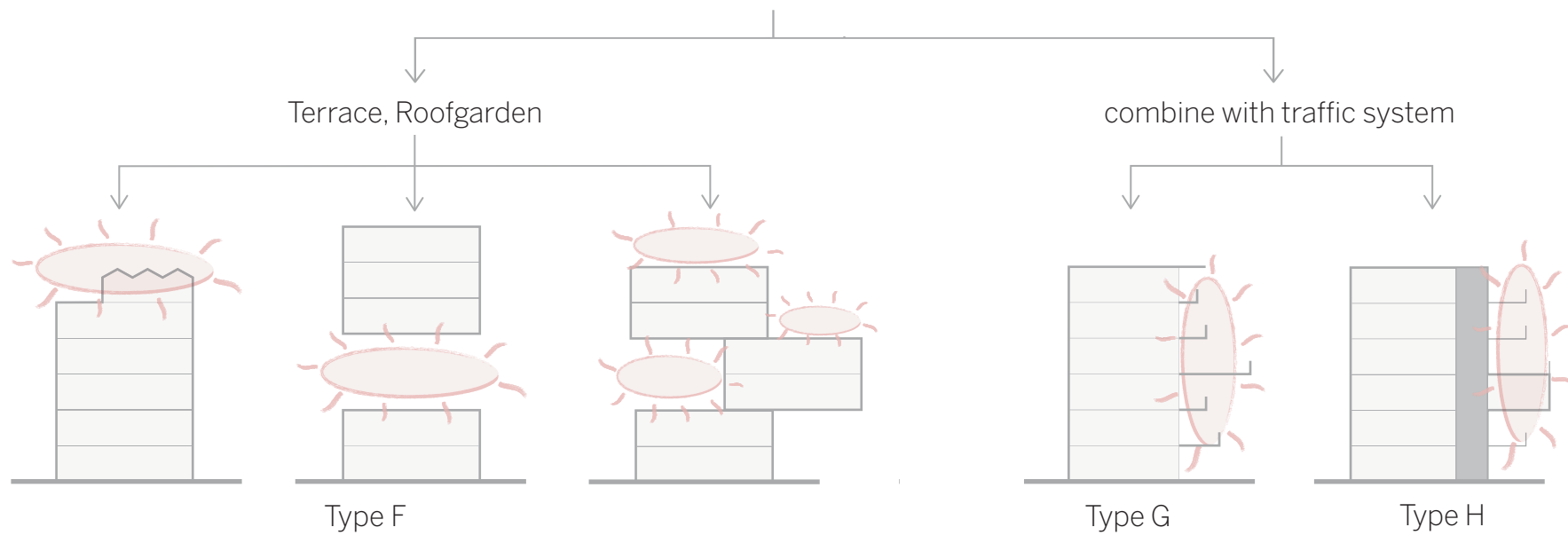
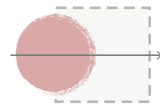


Fig.23 Classification basis

PRIVATE BALCONY



Type A ENTRANCE BALCONY

It's a private space between traffic core and entrance. Compared with the public outer corridor, it's more private: It is a balcony that only serves one apartment. That outer corridor space as a public connection will be introduced in the public balcony section.

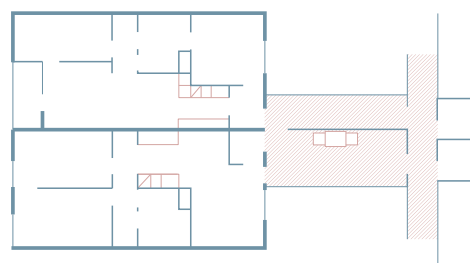
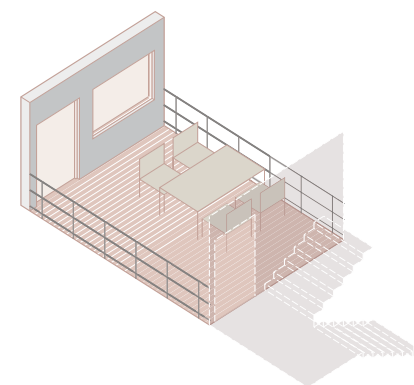
According to space syntax calculation, in the apartment having entrance balcony, the CV value of it is higher than the one connected to other rooms. From the RA value, most of the entrance balconies are also lower than other balconies that only have one room. These two parameters mean that the entrance balcony has great potential to become a central space in people's daily life, rather than just a passing space between public traffic core and entrance.

Many entrance balcony are also connected to the living room or dining room, making it can be used as an outside sheltered part in the apartment, as well as taking part in the circular route, residents may

occupy entrance balcony more frequently, which increase its "social control of life".

The addition of the balcony enhances the quality of the space between the core of the public transport and the foyer: the introduction of sufficient light and outdoor natural scenery naturally creates a sense of space. Although the balcony in the form of a loggia may be lacking in daylighting, the more enclosed outdoor space is more intimate and more convenient to glassing as a winter garden, which is more suitable for the Nordic region with lower winter temperatures.

The entrance garden in the apartment is seen as a charming starting point to the axis passed through it; at the same time, the axis is integrated interior and exterior, this makes the level of the axis more abundant.



Performative Brise- Soleil, 2016, Austria

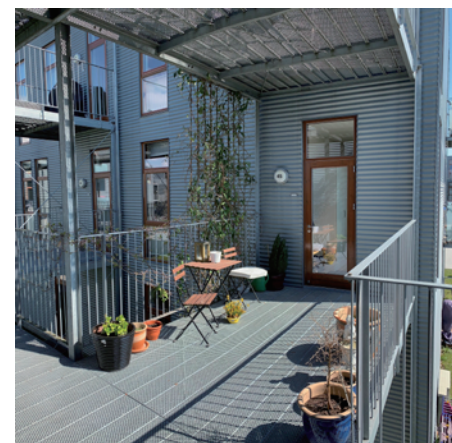
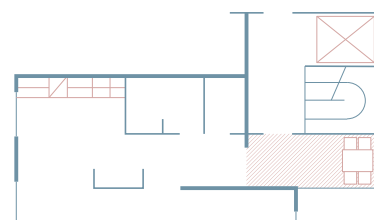
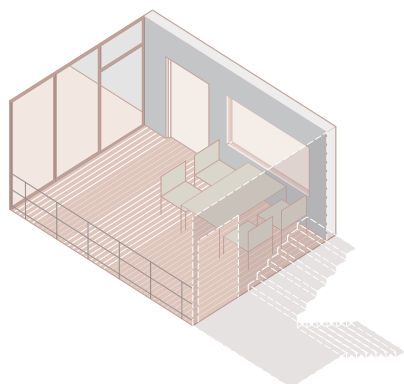


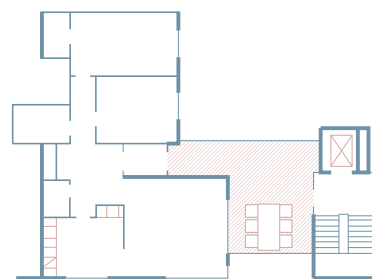
Fig.25 entrance garden in Denmark.



kv. Balder, 2001, Sweden



Fig.26 Sihlhölzlistrasse,1995, Zürich



Sihlhölzlistrasse, 1995, Zürich

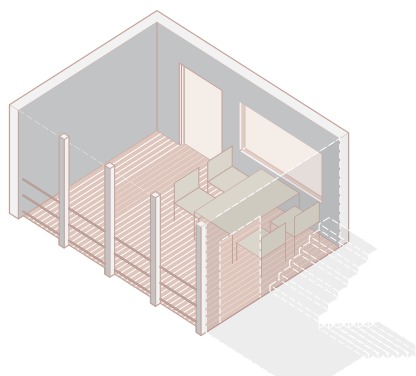
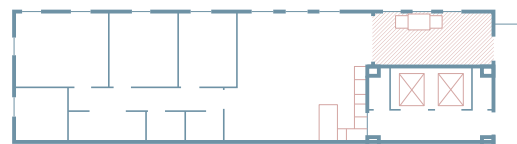


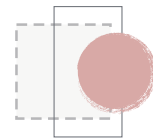
Fig.24 basic types of entrance balcony



Celosía, 2009, Spain



Fig.27 Celosía2009, Spain



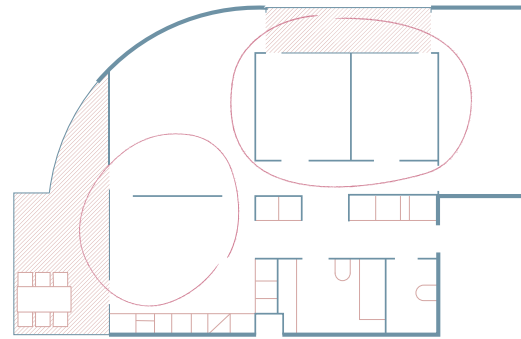
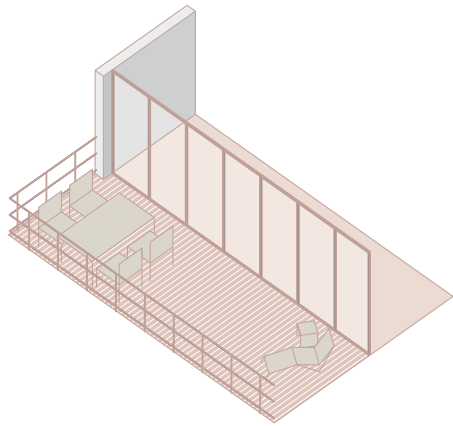
Type B IN THE MIDDLE

When the balcony is connected to more than one space, with the trend many apartments have open space as a whole in the public area and connected to a big balcony, the balcony is part of the circular routes. The number of activities that can be carried and the frequency of use will be greatly improved.

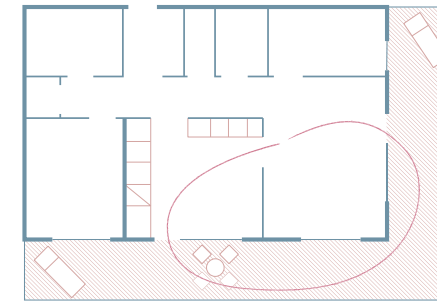
According to syntax calculation, its CV value is higher and the RA value is lower, indicating high real life control of what is happening in the apartment. In addition, the balcony that participates in the route can be used as a surprising point to enrich the movement in the apartment. In this way, balcony has changed from an edge area to an important space that has possibility to control daily life.

In addition to connecting the various public parts mentioned before, this type also includes the ones that connected public and private parts. It's more like another buffer space between the two. Compared with simply connecting to the corridor, this outdoor connection creates more functional and spatial relationships between different rooms, which can be experienced and actively used, making this space serves both rooms, for socialize and personalise.

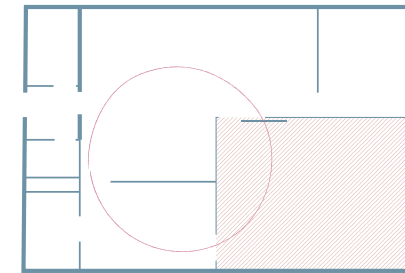
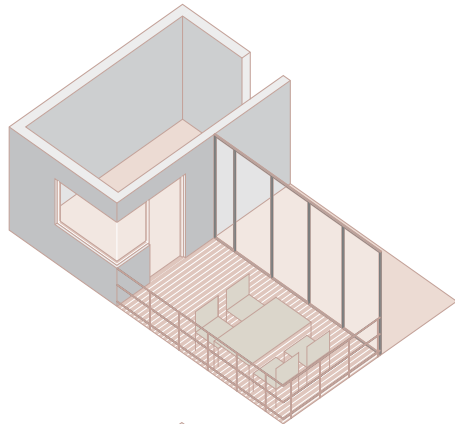
The balcony in the circular route is also sometimes located at the center of the intersection axis, they often connects with several rooms. We can think of it as a courtyard or patio, where can be experienced and actively used. Visual contact with other rooms ensure that the layout can be recognised clearly.



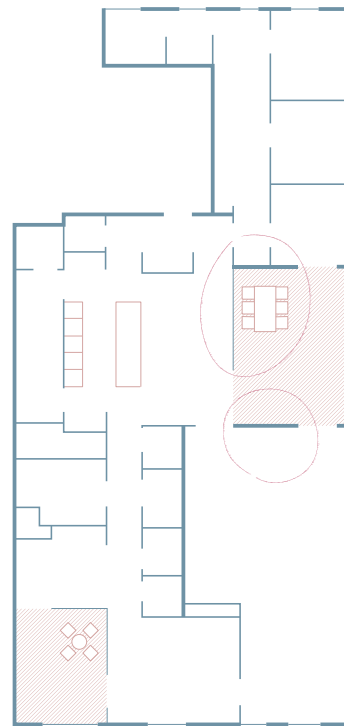
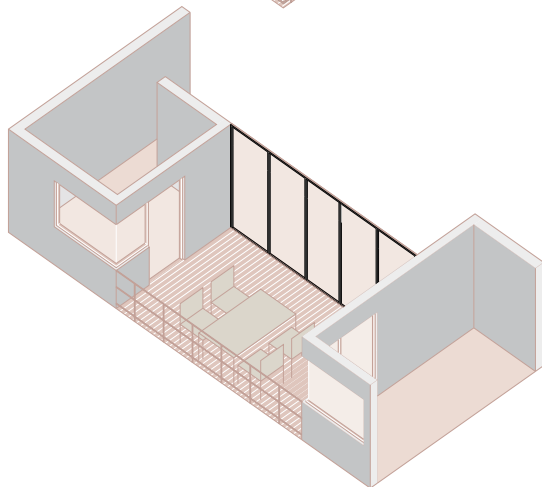
2013, Sweden



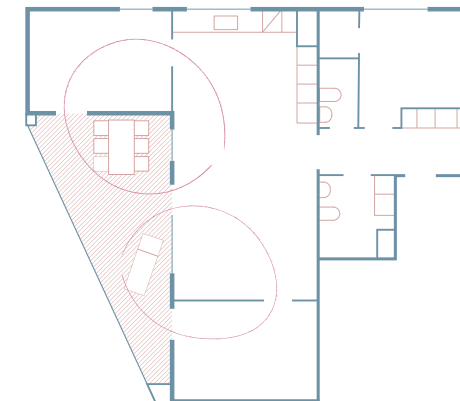
Västra Kajen , 2015, Sweden



The Mountain, 2008, Denmark



Continental Apartment, 2017, Sweden



BRF Ronsendahl, 2014, Sweden

Fig.28 basic types of balcony in the circulat route



This type of balcony is the most classic one and it only directly connect to one room in apartment. Type B and type C are divided in spatial order and actually similar in many respects, such as the form and axuality.

When the balcony is at the end of the spatial sequence, it's also usually the end of the axis and motion, which may be a bright goal for walking through the whole housing. Seeing the balcony in the sightline, spatial quality, visual experience and light intensity increase the pleasure of walking along the axis. When the movement finally stops at the delicate balcony, the bright and spacious exterior space will form a strong contrast with the interior space, making it more attractive.

Now balcony has become the “basic unit” of residential apartments in many countries, the area and width of the balcony are also growing to accommodate a variety of daily activities.

some of which can be as large as the living room. The large and wide balcony is more flexible to use in many ways, greatly increasing the willingness of people to have activities there. A wider balcony also offers the possibility of vertical greening. Double height planted balcony gives the feeling of a “house” and creates a strong link with nature, in order to satisfying the dream of city dwellers who want to own a small garden.

Many apartments also have storage space on the balcony, they often become the dividing part between different apartment.

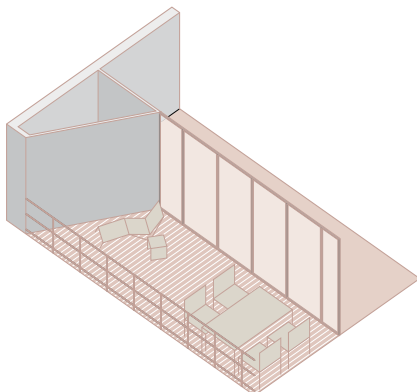
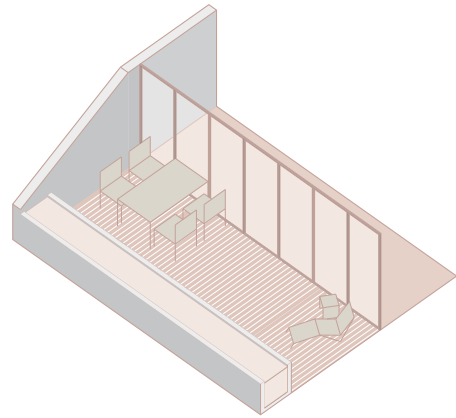
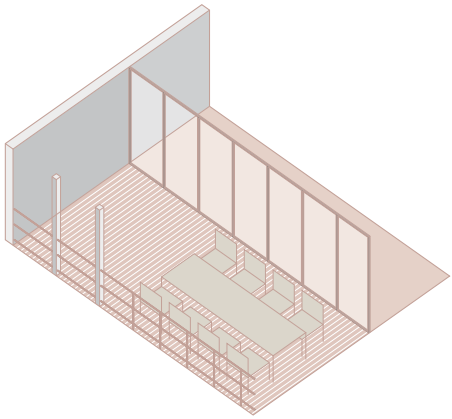
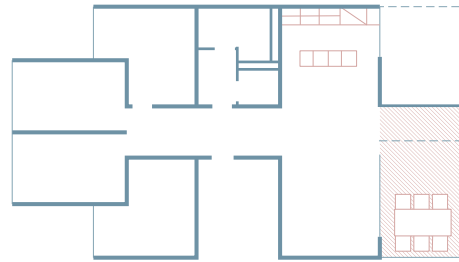
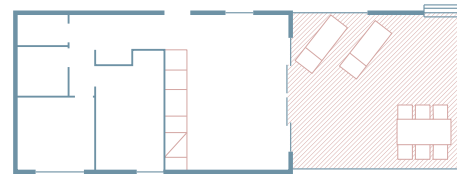


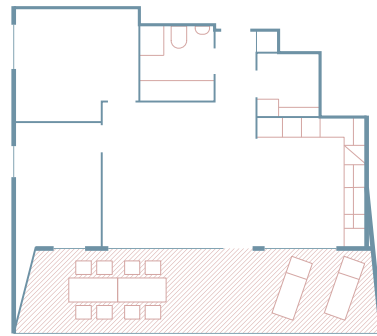
Fig.29 basic types of balcony in the end



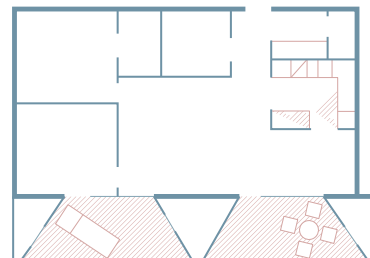
Paul-Clairmont-Strasse, 2003, Zürich



Carré Lumière, 2015, France



Bergskroken, 2017, Sweden



Kotisaarencatu Housing, 2013, Finland



Fig.30 Paul-Clairmont-Strasse, 2003, Zürich

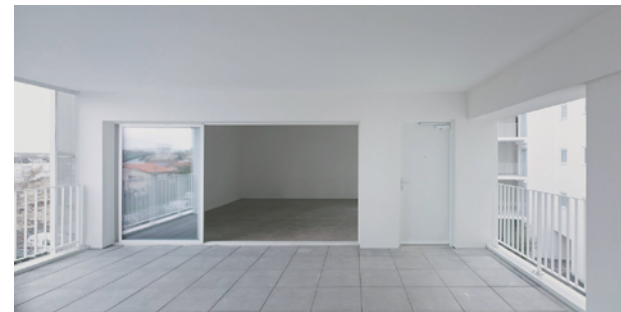
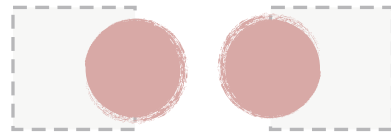


Fig.31 Carré Lumière, 2015, France



Fig.32 Bergskroken, 2017, Sweden



Type D COMBINATION BETWEEN BALCONIES

The combination of private balconies has a greater impact on the form of the building and the creation of a neighbourhood atmosphere, and the combination is increasingly diverse with the continuous development and research of new apartments.

The form of horizontal connection wrapping indoor space is very common. They form a soft intermediation space between indoors and outdoors, making the building blocks become lighter and softer, while each household also got a large balcony that is as wide as their own

apartment.

Another type of horizontal connection is to use a balcony as a connector to connect multiple building blocks. This type has appeared in Sweden from 1940s, and nowadays, designers have made a new adaptation to this type: they often block the noise with glass which on the side of the road, to meet the Swedish noise requirements. Such a balcony is transparent in both directions and does not affect indoor lighting.

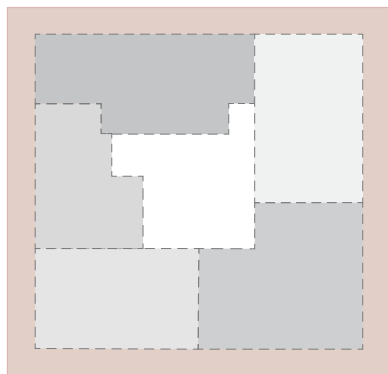
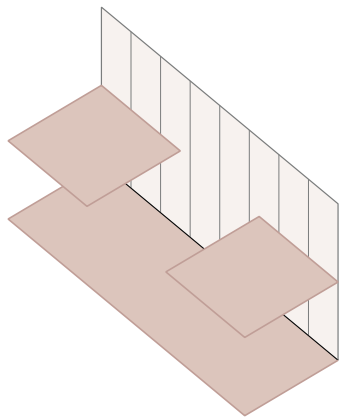
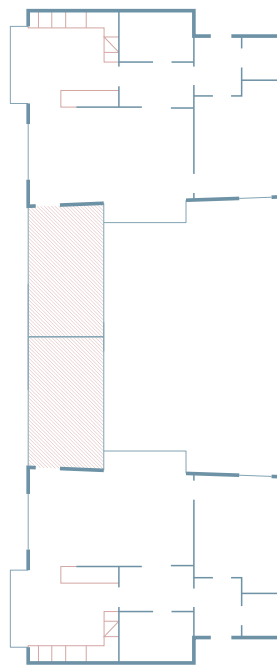
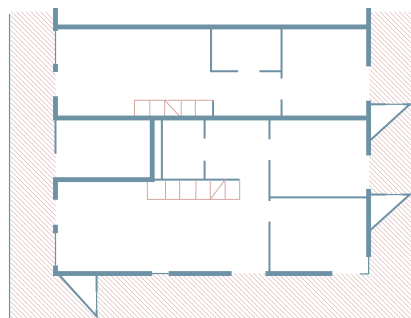


Fig.33 basic types of horizontal combination of balcony



Brf Holmen, 2002, Sweden



Kungsterrassen, 2015, Sweden



Fig.34 Brf Holmen, 2002, Sweden

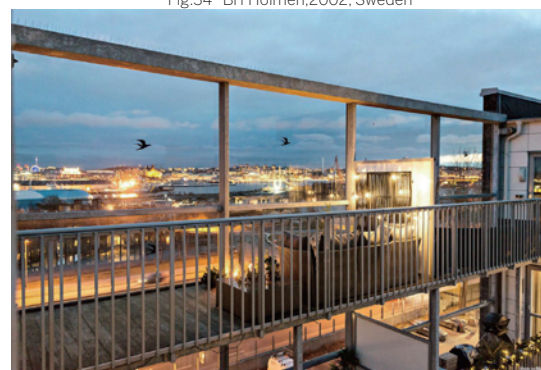


Fig.35 kvillegatan



Fig.36 Vastra Kajen Housing, 2015, Sweden



Fig.37 basic types of vertical combination of balcony

In vertical combination, staggered arrangement of the balconies creates two-storey areas that allow daylight to penetrate far into the homes. This combination sometimes also divides the balcony from height to form two external partitions of different brightness and height. The two-story balcony, as previously described in the type C, can be used as a planted balcony, making the entire building a “vertical forest” or urban farming, bringing city dwellers closer to the nature by giving them interesting experience in planting. This combination in the vertical direction can in turn be combined with a ventilation well to form a ventilation system to improve air circulation and keep the homes continually ventilated.



Fig.38 MFH Dali Rain, 2016, Switzerland



Fig.39 Paul-Clairmont-Strasse, 2003, Zürich

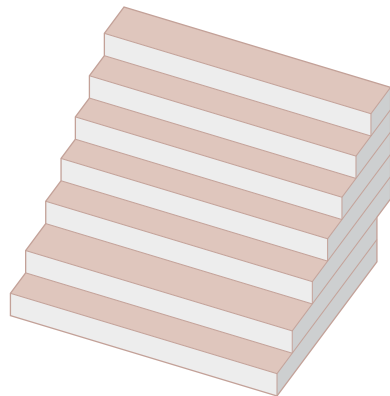
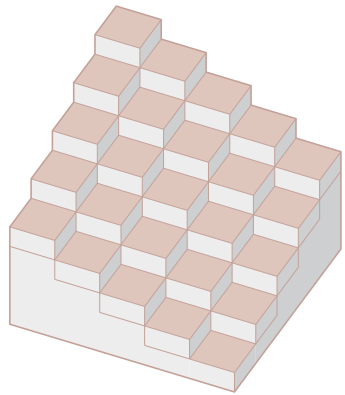


Fig.40 basic types of terrace housing



Fig.41 Klencke, 2018, Netherlands



Fig.42 The Mountain, 2008, Denmark

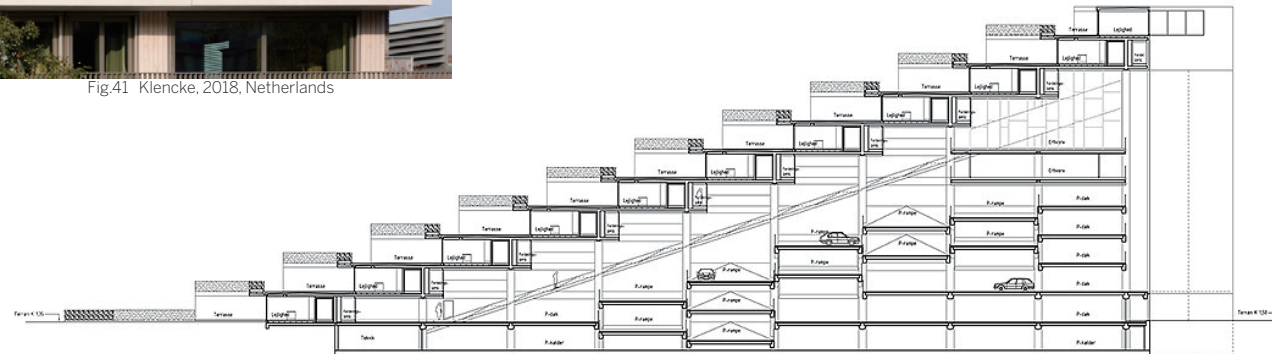


Fig.43 The Mountain, 2008, Denmark

Another special combination forms a unique terrace house. This typology is characterized by outdoor space not covered by the upper house. Owing to their horizontality and staggering, its external space has become more open and has formed topography. In combination with green planting, residents are jumping out of the living box, affords them an expansive panoramic view and a vast sky. This typology can be either on a natural slope or by creating an artificial terrain with special features that do not require natural daylight.



Type E TRANSFORMATION OF OLD HOUSING

Today, more and more architects have seen the enormous potential of old social housing. Rather than simple and rude dismantling of old homes into new homes, many wonderful transformation have reinvigorated the space. Balcony is often considered as a representative of good living quality, therefor adding balcony flexibly becomes one of interesting methods for transformation.

An important drawback of old social housing is the small living space and the low insulation by the inferior quality building materials. Therefore, the addition of winter gardens and outdoor balconies has become a common means of transformation. The added winter garden can improve the thermal comfort and greatly reduce the building energy consumption. At the same time, the winter garden can be used as an extension of some indoor rooms, increasing the residential area and improving the quality of life. This type is an effective response to changes in family patterns and lifestyles in the 21st century.

In addition to the mismatch between size and lifestyle with contemporary life, the old social housing has another shortcoming—monotonous repetition. In the era of the pursuit of quantity and basic residence requirements, the uniformity of construction has been significantly improved. However, the individual differences that they have annihilated have made them lose their appeal in today's society, and they have not provoked the enthusiasm of the residents and led to the defeat of the community. A variety of new balconies and terrace break the large monotonic facades and repeating residential units, get rid of the consistency of the residential units, differentiate them, and make the building a suitable place for people to live, finally appeal new residents to come back.

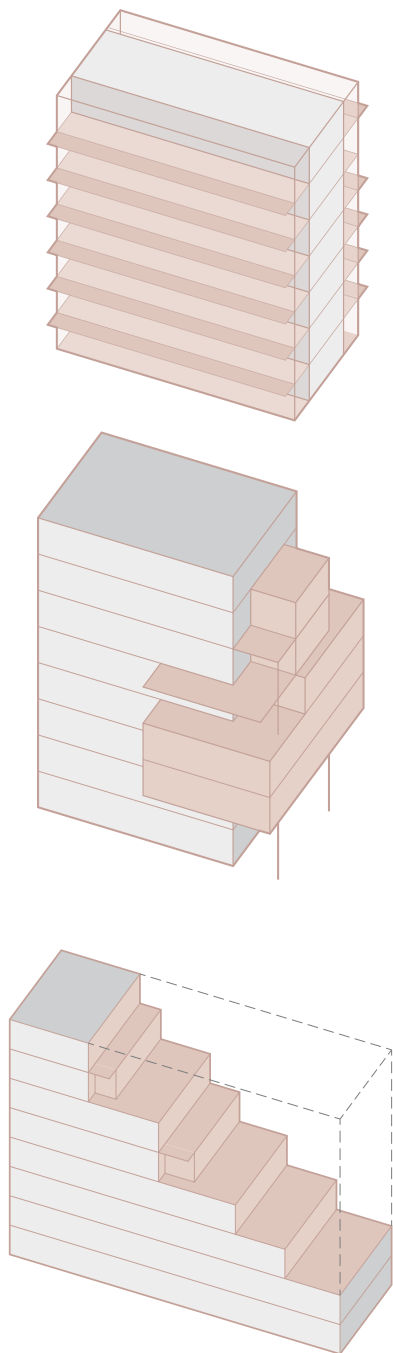
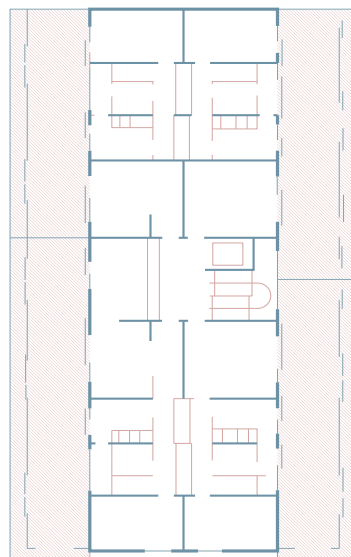
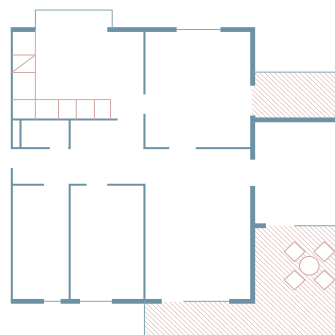


Fig.44 basic types of transformation with balcony.



2016, France



Norsborgs, 1996, Sweden



Fig.45 transformation of housing in France.



Fig.46 Gardstensbostäder, Sweden

PUBLIC BALCONY

Type F TERRACE & PLATFORM

the term living environment, which coined by sociologists, is described for an area that surrounds the residence, protects it while still being a part of it and at the same time providing an additional sphere of activity for the residents. The public outdoor activity space in the community --such as roof garden, sky courtyard-- is a good way to create a quality living environment without increasing the building area. It can quickly create a friendly environment and has been welcomed by designers and residents in recent years.

The public terrace which can be used by all residents as a common space is isolated from a completely public neighborhood space, offering urban panorama. They can be in the form of a sky garden, compensated for the occupied land area, or they can be in the middle of the building, often occupying several floors to form an open urban platform.

The disassembly of the large terrace into several small platforms scattered throughout the building has positive implications for shaping the building appearance and provide additional natural light and better view for apartments. Such a small platform is usually shared by several units, form an expansive interconnected network of living and communal spaces.

The terrace combined with some access balcony enrich the layers of public space, and sightline between them offer residents a myriad opportunities to socialise and engage in community activities. (eg. xxx)

The glass-enclosed winter garden is ideal for cold nordic area: it avoids the low usage rate due to the climate and can be combined with the greenhouse.

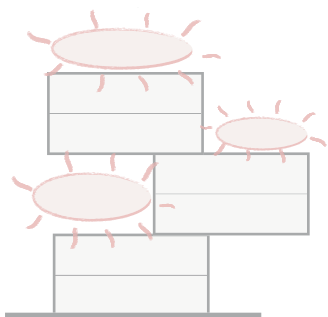
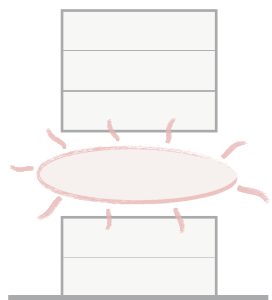
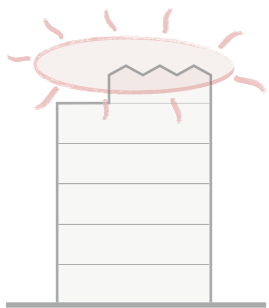


Fig.48 basic types of public balcony.

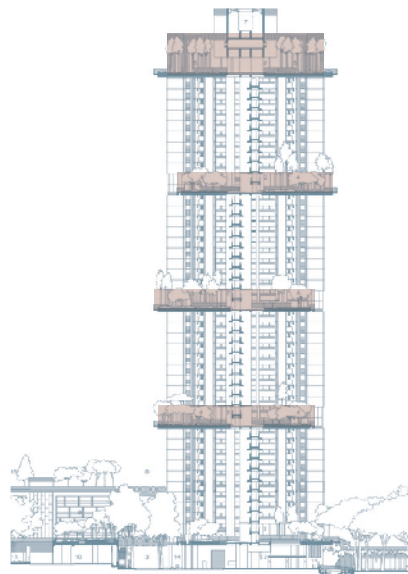


Fig.49 SkyVille,2015, Singapore

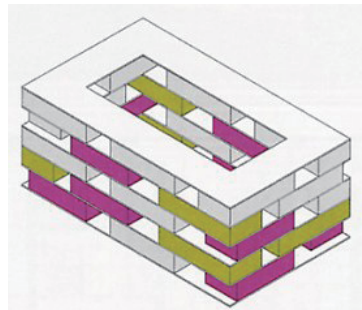


Fig.50 Celosia, 2009, Spain

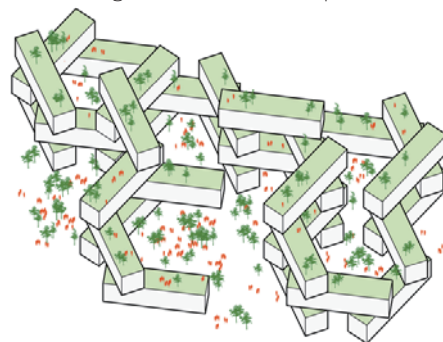


Fig.51 Interlace,2013, Singapore



Fig.52 milzdor,Spain



Fig.53 winter garden in Sweden



Fig.54 roofgarden in Interlace.

Type G COMBINE WITH TRAFFIC SYSTEM

ACCESS BALCONY

The access balcony, once used to save construction costs during 60s to 80s, has regained people's attention these years. In book <floor plan manual housing>, the access balcony is defined as an outside path connected to vertical circulation cores. The access balcony can be seen as a scenic sequence of spatial perception, the epilogue of the public part and the prelude to the apartment.

Compared to closed interior corridor, the more open access balcony has daylight, and the transparency created by placing in a semi-public view makes it feel more safety. As described by Alison and Peter Smithson's term "street in the air", it increases the fun of walking along the balcony, maximizing the value of encounters and creating opportunities for social interaction between neighborhoods.

In such an area where residents can feel safe, the people will be willing to take place out of necessity and repeatedly, children can play there as an open space besides their own homes and parents could see them through kitchen window when cooking, since the access balcony often offer light and sightline with kitchen, entrance hall or sanitary block.

Some balcony expand into wide bays or set the entrance door sideways to create a kind of forecourt or play platform. This space creates an opportunity to stay and socialise, rather than a monotonous, non-stop corridor.

Some access balcony designed as an independent element of main building and structure, with the result that lighting of the lower floor house will not be blocked by the balcony. Each unit is accessed by a bridge, which is inviting to integrate with entrance garden.

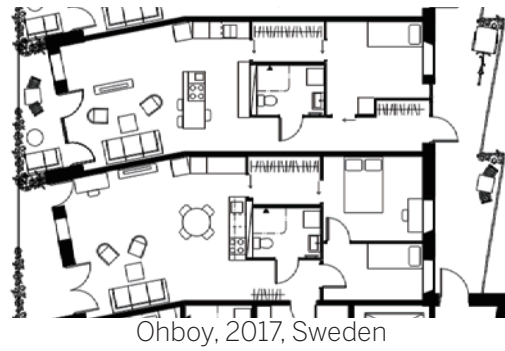
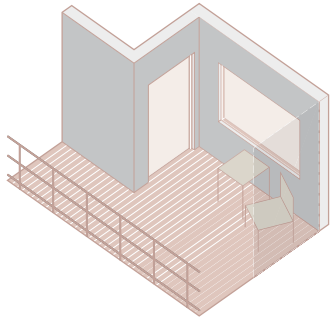


Fig.56 Sofielunds kollektiv hus.



Fig.57 FSB-F.

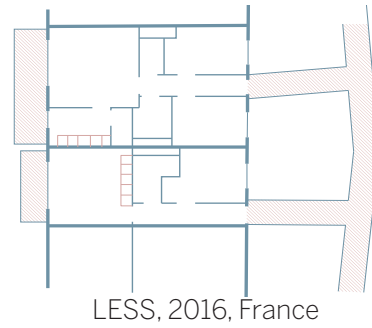
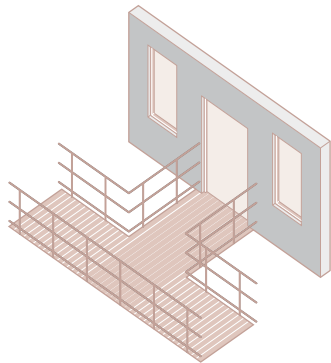
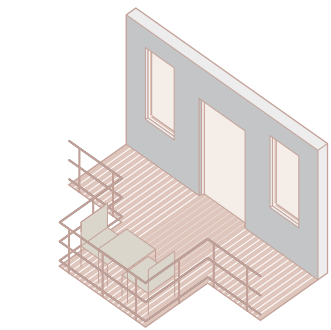


Fig.55 basic types of access balcony.

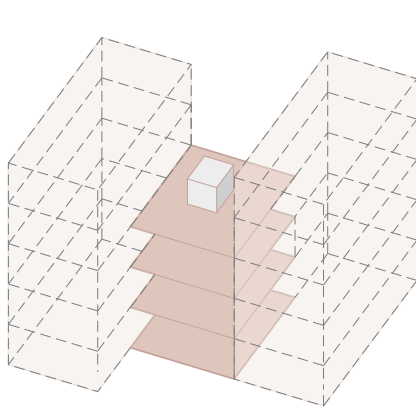


Fig.58 basic types of combination with vertical traffic core.

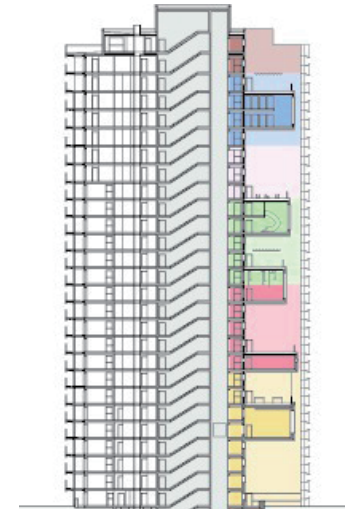
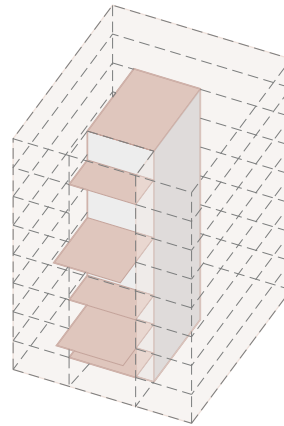


Fig.59 Citygate Tower, 2015, Austria



Fig.60 Det Store Havnehus, 2011, Denmark

Type G COMBINE WITH TRAFFIC SYSTEM

VERTICAL COMBINATION

In high-rise residential buildings or compact floor plan, elevators are essential and effective, public platforms that are directly connected to the elevators can increase the possibility of usage, while as the height of the floor rises, different platforms harvest different city views.

We often overlook the ever-changing vision as we walking along the stairs and the surprises of meeting our friends at the corners. Instead, we prefer to stand up and down in a small box. Instead of banning the staircase to a dark structural core, some projects are trying to use generous staircase and balcony-like landings.

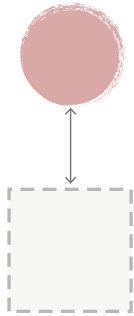


Fig.61 Panache Maison Edouard François,2018

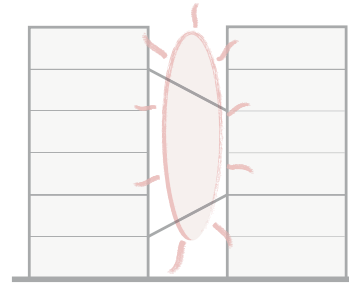


Fig.62 Tianhe Youth Commune,20

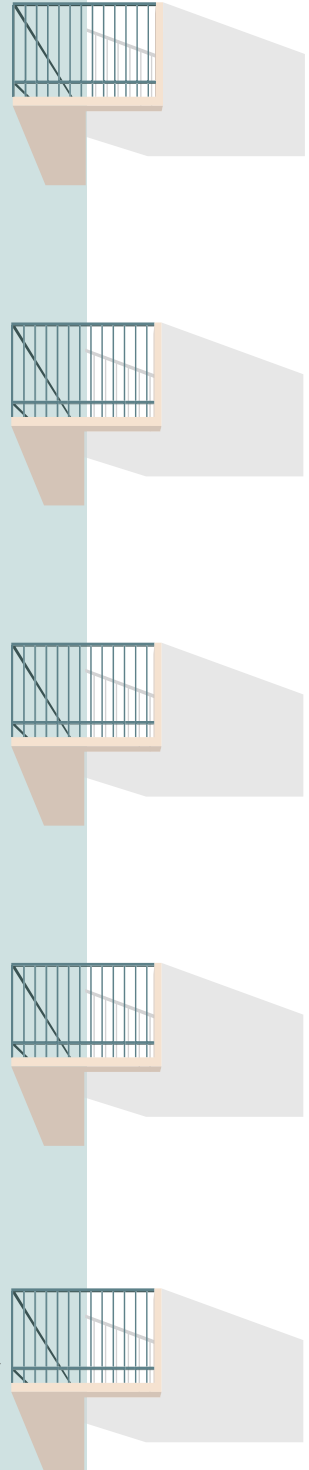
OTHER NEW TRENDS

For a balcony, the conflict between the building depth with good lighting for inner core is always not easily to solve for a balcony. Residents' demands for a large balcony is increasing sharply, so recently there has been a large private rooftop in France that is completely separated from the apartment. They are staggered to form a shadow for easily use in summer, and the separation from the private apartment ensures the lighting of the apartment. However, a problem with complete detachment may be how to make the balcony more integrated into life. After all, through the previous space syntax calculations, we know that when the balcony is connected to multiple necessary living spaces, it has higher degree of integration, the more daily activities the residents will be happened in the balcony.




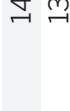









Another new type of public terrace is to set up a public platform between two buildings, residents can enter it through the public corridor. The difference from the previous ones is that it is actually separated from the public transportation system.


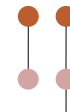





























Another type that is well suited for developing in Nordic area is the combination of access balcony with a large greenhouse. The public greenhouse has actually appeared very early in Swedish housing. The combination with the access balcony can solve the problem that the outer corridor is dominated by climate so the comfort is reduced. At the same time, the rich spatial level can increase the interaction of the residents and increase the fun of the green house.

Appendix



Connection	Case	Total Depth	K	Mean Depth	Rank of integration	Control Value	Form	Space Typology
	30-1-1	11	6	2.20	0.60	0.33	BALCONY	
	30-1-2	12	6	2.40	0.70	0.33	MIX	
	30-2	14	7	2.33	0.53	0.33	BALCONY	
	34-1-1	12	6	2.40	0.70	0.33	BALCONY	
	34-1-2	12	6	2.40	0.70	0.33	MIX	
	34-2	15	7	2.50	0.60	0.33	BALCONY	
	36-1	12	7	2.00	0.40	0.20	BALCONY	
	36-2	17	8	2.43	0.48	0.33	BALCONY	
	36-3	16	7	2.67	0.67	0.50	BALCONY	
	37-1	22	8	3.14	0.71	0.50	BALCONY	
	38-1-1	16	7	2.67	0.67	0.50	BALCONY	
	38-1-2	11	6	2.20	0.60	0.33	BALCONY	
	38-2	18	8	2.57	0.52	0.33	BALCONY	
	39-1-1	12	6	2.40	0.70	0.50	BALCONY	
	39-2-1	11	6	2.20	0.60	0.33	BALCONY	
	40-1	14	7	2.33	0.53	0.33	BALCONY	
	42-1-1	11	6	2.20	0.60	0.33	BALCONY	
	42-1-2	8	5	2.00	0.67	0.33	BALCONY	
	44-1	15	7	2.50	0.60	0.50	BALCONY	
	45-1-1	19	8	2.71	0.57	0.50	LOGGIA	
	45-1-2	17	8	2.43	0.48	0.33	BALCONY	
	46-1	13	7	2.17	0.47	0.25	MIX	
	46-2	17	8	2.43	0.48	0.33	MIX	
	47-1	14	7	2.33	0.53	0.33	BALCONY	
	47-2	16	7	2.67	0.67	0.50	BALCONY	
	47-3	12	6	2.40	0.70	0.50	MIX	
	48-1-1	22	9	2.75	0.50	0.33	BALCONY	
	48-1-2	14	7	2.33	0.53	0.33	BALCONY	
	48-2	12	6	2.40	0.70	0.50	BALCONY	
	49-1	12	6	2.40	0.70	0.50	BALCONY	
	49-2	12	6	2.40	0.70	0.50	LOGGIA	
	50-1	14	7	2.33	0.53	0.33	MIX	
	50-2	25	10	2.78	0.44	0.33	LOGGIA	
	50-3	12	6	2.40	0.70	0.50	LOGGIA	
	51-1	21	10	2.33	0.33	0.20	LOGGIA	
	51-2	17	8	2.43	0.48	0.33	BALCONY	
	51-3	15	7	2.50	0.60	0.33	MIX	
	52-1	21	9	2.63	0.46	0.33	BALCONY	
	52-2	16	7	2.67	0.67	0.50	LOGGIA	
	53-1	21	8	3.00	0.67	0.50	BACONY	
	53-2	23	9	2.88	0.54	0.33	MIX	
	54-1	11	6	2.20	0.60	0.33	BALCONY	
	54-2	16	7	2.67	0.67	0.50	LOGGIA	

	55-1	14	7	2.33	0.53	0.25	BALCONY	D
	55-2	13	8	1.86	0.29	1.03	LOGGIA	
	56-1-1	19	8	2.71	0.57	0.50	MIX	
	56-1-2	17	8	2.43	0.48	0.33	MIX	
	56-2-1	31	10	3.44	0.61	0.50	LOGGIA	
	56-2-3	17	8	2.43	0.48	0.33	LOGGIA	
	57-1	20	8	2.86	0.62	0.50	BALCONY	
	57-2	17	7	2.83	0.73	0.50	MIX	
	58-1	15	8	2.14	0.38	0.33	BALCONY	
	58-2	16	8	2.29	0.43	0.33	LOGGIA	
	58-3	11	6	2.20	0.60	0.33	LOGGIA	
	59-1	25	10	2.78	0.44	1.00	MIX	
	59-2	16	9	2.00	0.29	0.47	LOGGIA	D

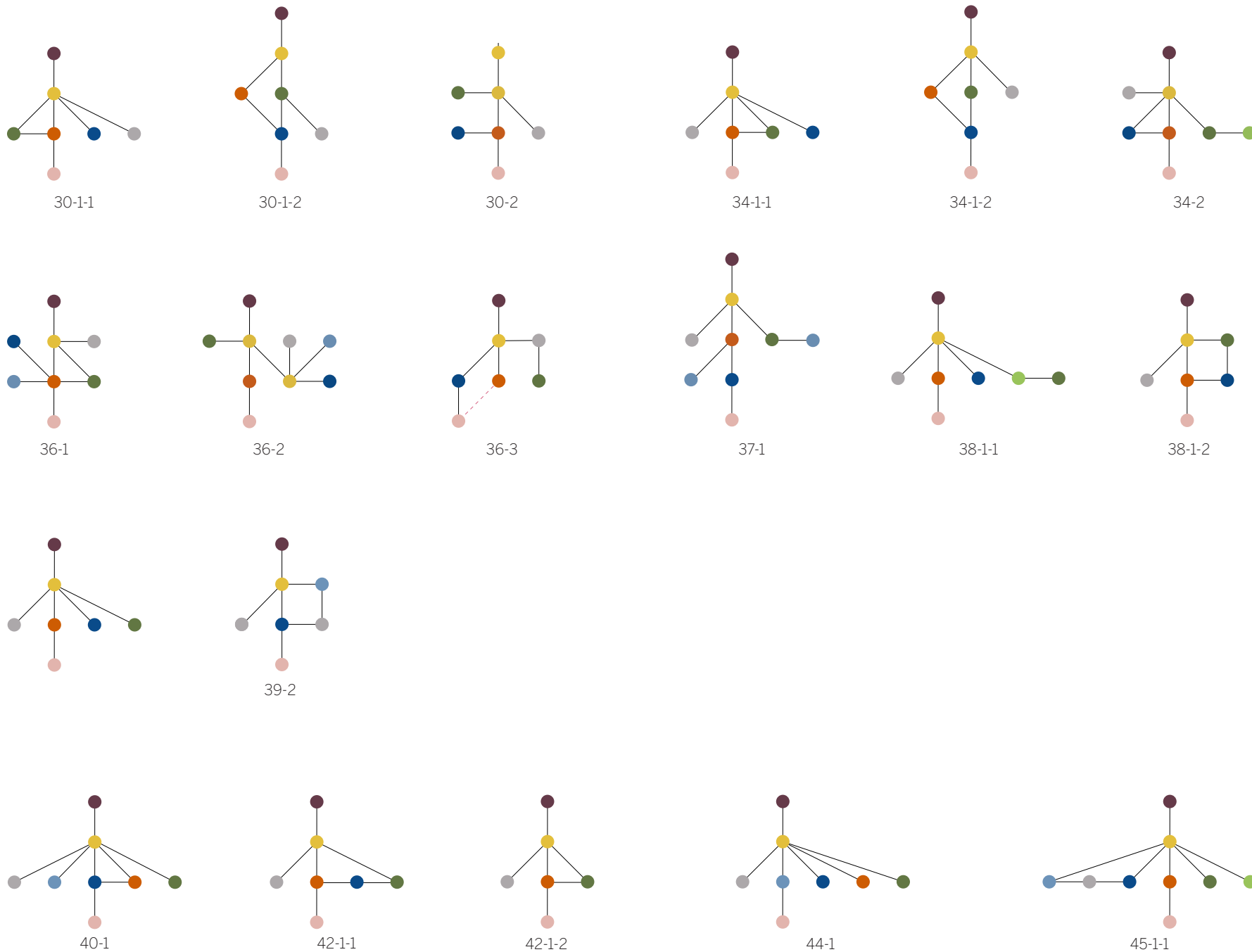
	60-1	16	8	2.29	0.43	0.25	BALCONY	C
	60-2	14	8	2.00	0.33	0.75	LOGGIA	
	60-3	19	9	2.38	0.39	0.25	EN BALCONY	
	60-4-1	12	6	2.40	0.50	0.33	BALCONY	
	60-4-2	19	8	2.71	0.70	0.50	BALCONY	
	60-5	19	8	2.71	0.57	0.50	BALCONY L.	
	60-5	14	8	2.00	0.33	1.00	BALCONY K	
	61-1-1	14	7	2.33	0.53	0.33	LOGGIA	
	61-1-2	11	6	2.20	0.60	0.33	BALCONY	C
	61-2-2	23	10	2.56	0.39	0.83	BALCONY	
	61-3	18	8	2.57	0.52	0.25	MIX	
	62-1	19	9	2.38	0.39	0.25	BALCONY	
	63-2	17	8	2.43	0.48	0.25	MIX	C
	64-1	25	10	2.78	0.44	0.83	BALCONY	
	64-2-1	14	7	2.33	0.53	0.33	BALCONY	
	64-2-2	13	7	2.17	0.47	0.25	BALCONY	
	65-1-1	21	9	2.63	0.46	1.00	BALCONY	D
	65-2	17	8	2.43	0.48	0.33	BALCONY	D
	65-3-2	17	8	2.43	0.48	1.00	LOGGIA	
	66-1	19	9	2.38	0.39	0.25	BALCONY	
	66-2	13	7	2.17	0.47	0.25	MIX	
	67-1	13	7	2.17	0.47	0.25	LOGGIA	C
	67-2	17	8	2.43	0.48	1.00	LOGGGIA	
	68-1	14	8	2.00	0.33	0.17	BALCONY	
	69-1	22	9	2.75	0.50	0.50	BALCONY	
	69-2	23	9	2.88	0.54	0.50	BALCONY	
	69-3	24	9	3.00	0.57	0.50	EN LOGGIA	
	69-3	22	9	2.75	0.50	0.33	BALCONY	
	69-4	14	8	2.00	0.33	0.58	LOGGIA	
	70-1	14	7	2.33	0.53	0.33	LOGGIA	D
	70-2	13	7	2.17	0.47	0.25	MIX	

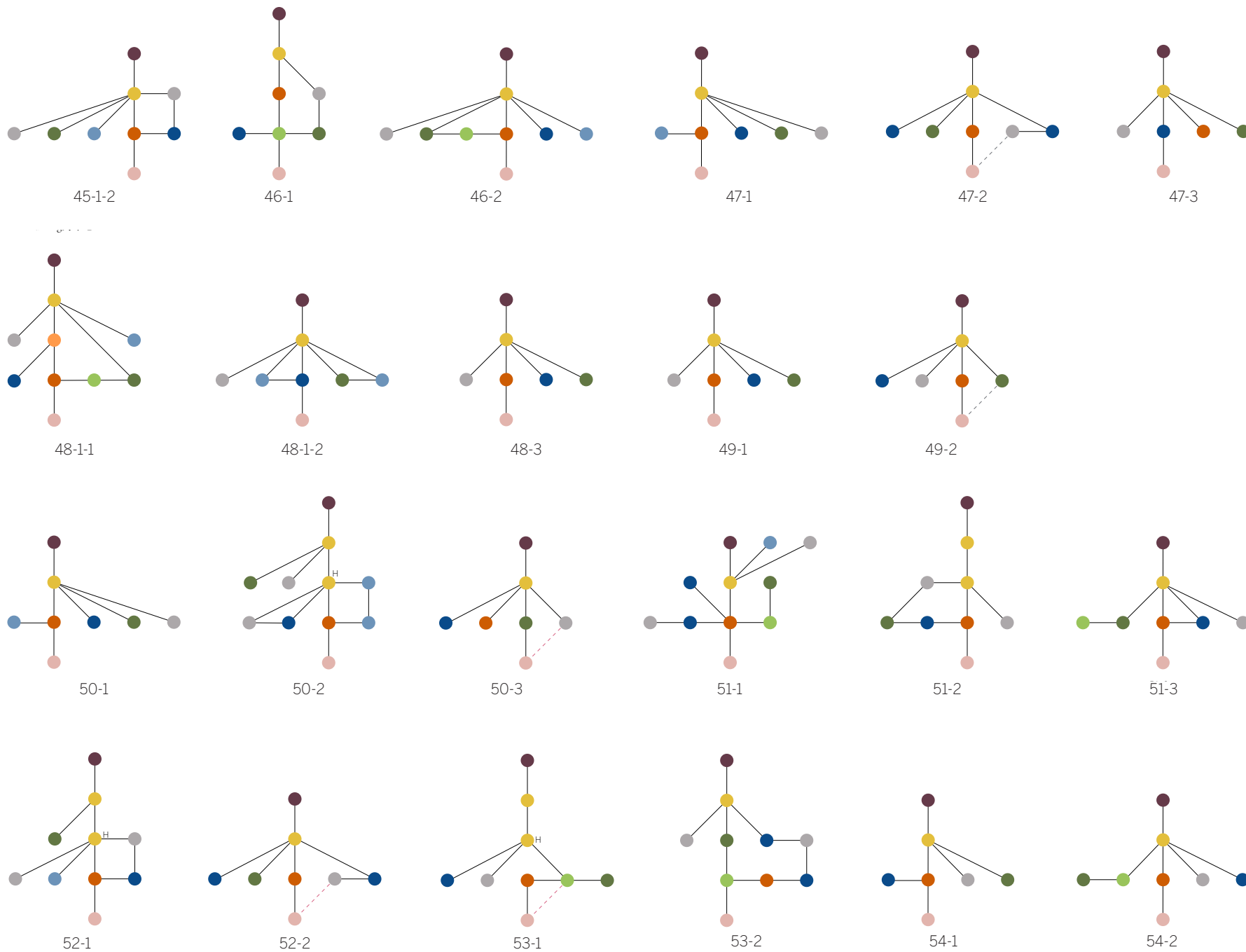
	90-1	32	12	2.91	0.38	0.25	MIX
		28	12	2.55	0.31	0.33	EN LOGGIA
	91-1-1	31	12	2.82	0.36	0.33	MIX 1
		30	12	2.73	0.35	0.50	BALCONY 2
	91-1-2	15	8	2.14	0.38	0.33	LOGGIA 1
		17	8	2.43	0.48	0.50	LOGGIA 2
	91-2-1	17	9	2.13	0.32	0.67	MIX
		12	7	2.00	0.40	0.33	MIX
	91-3-1	18	8	2.57	0.52	0.50	LOGGIA
	91-3-2	19	9	2.38	0.39	0.33	LOGGIA
	92-1	14	7	2.33	0.53	0.33	LOGGIA
	92-2-1	21	8	3.00	0.67	0.50	LOGGIA
	92-2-2	17	9	2.13	0.32	0.17	MIX
	93-1	17	8	2.43	0.48	0.33	LOGGIA
	94-1	16	8	2.29	0.43	0.25	BALCONY
	95-1	15	7	2.50	0.60	0.25	LOGGIA
	95-2-1	16	8	2.29	0.43	1.00	BALCONY
	95-2-2	11	6	2.20	0.60	0.33	BALCONY
	95-3	13	7	2.17	0.47	0.25	BALCONY
	97-1	17	8	2.43	0.48	0.25	BALCONY
	98-1	21	9	2.63	0.46	1.00	BALCONY
	98-2	11	6	2.20	0.60	0.33	BALCONY
	99-1	16	8	2.29	0.43	0.25	BALCONY

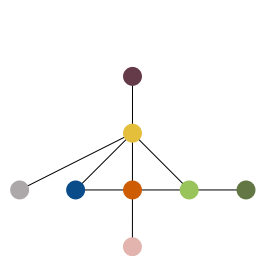
	00-1	20	9	2.50	0.43	1.00	LOGGIA 1
		14	9	1.75	0.21	1.33	LOGGIA 2
	01-1	15	7	2.50	0.60	0.33	EN BALCONY
	02-1	11	7	1.83	0.33	0.67	BALCONY
	03-1	17	8	2.43	0.48	0.67	BAOCNY 1
		17	8	2.43	0.48	0.67	BLACONY 2
	04-1	16	9	2.00	0.29	0.50	MIX 1
		13	9	1.63	0.18	0.14	MIX 2
	04-2	22	9	2.75	0.50	1.00	LOGGIA 1
		17	9	2.13	0.32	1.33	LOGGIA 2
	04-3	17	8	2.43	0.48	1.00	BALCONY
	05-1	19	10	2.11	0.28	0.70	BALCONY 1
		23	10	2.56	0.39	0.33	BALCONY 2
	05-2	13	7	2.17	0.47	0.25	MIX
	05-3	13	7	2.17	0.47	0.25	LOGGIA
		14	8	2.00	0.33	0.33	LOGGIA 1
	07-1	14	8	2.00	0.33	0.83	BALCONY2
		16	9	2.00	0.29	1.50	EN BALCONY
	08-1	18	9	2.25	0.36	0.67	MIX
		12	7	2.00	0.40	0.33	BALCONY
	08-2	19	9	2.38	0.39	1.00	LOGGIA 1
		18	9	2.25	0.36	1.25	BALCONY 2
	10-1	18	9	2.25	0.31	1.33	BALCONY 1
		20	10	2.22			

Connection	Case	Total Depth	K	Mean Depth	Rank of integration	Control Value	Form	Space Typology
	10-2	22	10	2.44	0.36	0.83	MIX 2	D
	11-1	20	8	2.86	0.62	0.50	BALCONY EN BALCONY BALCONY	C
	12-1	13	7	2.17	0.47	0.25		
	12-2	14	7	2.33	0.53	0.83		
	13-1	10	6	2.00	0.50	0.25	MIX	C
	14-1	20	10	2.22	0.31	0.58	MIX 1	
	15-1	17	10	1.89	0.22	1.75	MIX 2	
	15-2	13	8	1.86	0.29	1.25	LOGGIA	D
	15-3	22	10	2.44	0.36	0.83	MIX	C
	15-4	23	10	2.56	0.39	0.67	LOGGIA 1	C
	15-5	21	8	3.00	0.67	0.25	BALCONY 2	D
	15-6	13	8	1.86	0.29	0.50	EN BALCONY	
	16-1	23	8	3.29	0.76	0.50	BALCONY 1	
	16-2	16	7	2.00	0.29	1.17	BALCONY 2	C
	17-1	12	9	2.33	0.53	0.33	LOGGIA	
	17-2	14	7	2.00	0.40	0.83	BALCONY	
	17-3	16	8	2.29	0.53	0.33	BALCONY	C
	17-4	12	7	2.00	0.43	0.25	LOGGIA	
	17-5	12	7	2.00	0.40	0.83	BALCONY	

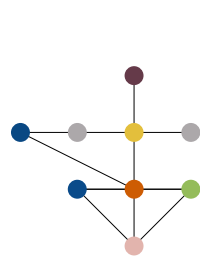
Appendix 5.2 Connectivity Graphs



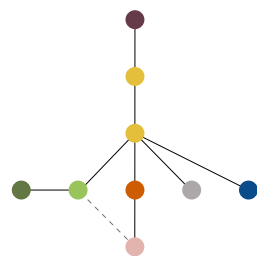




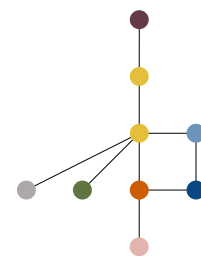
55-1



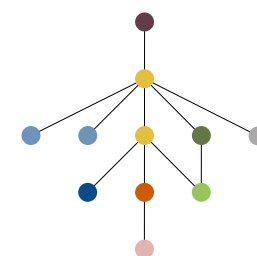
55-2



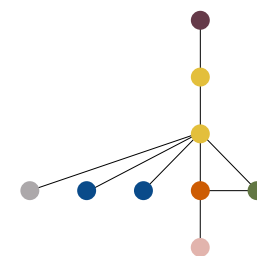
56-1-1



56-1-2



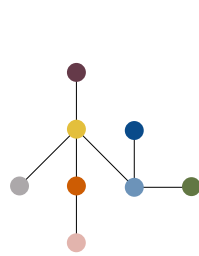
56-2-1



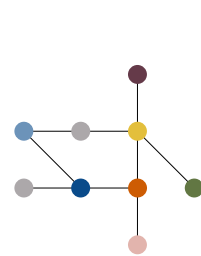
56-2-2



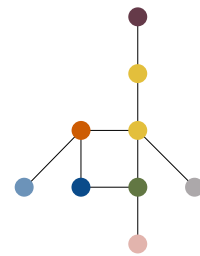
57-1



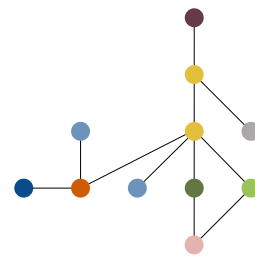
57-2



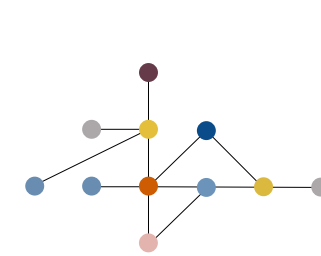
58-1



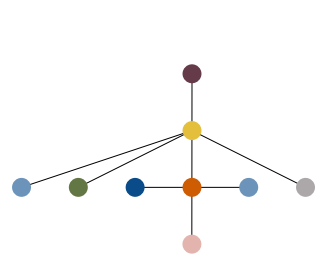
58-2



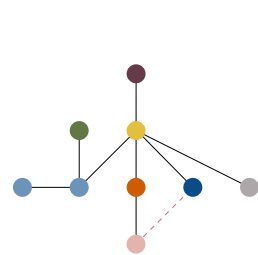
58-3



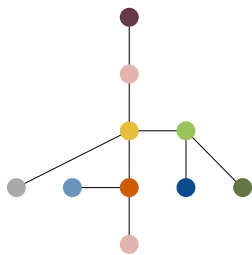
59-1



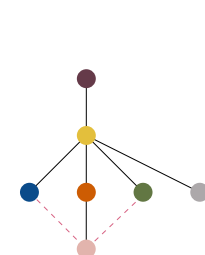
60-1



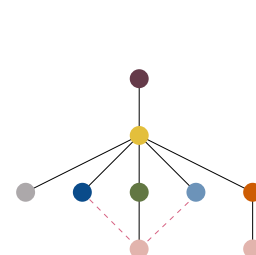
60-2



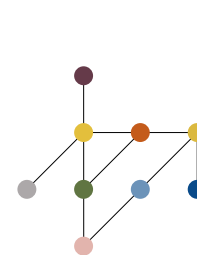
60-3



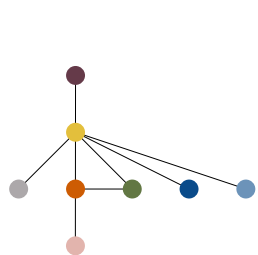
60-4-1



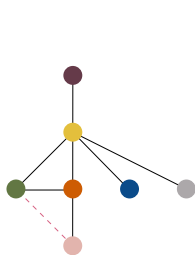
60-4-2



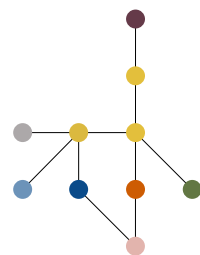
60-5



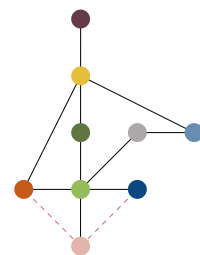
61-1-1



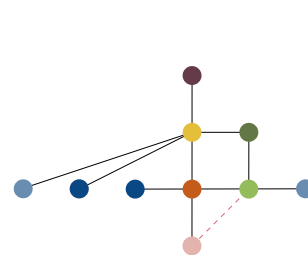
61-1-2



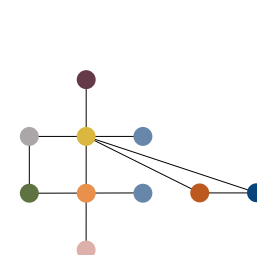
61-2



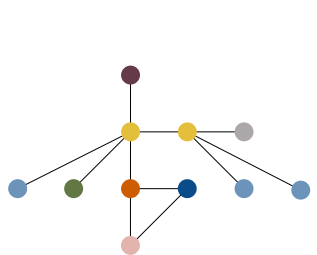
61-3



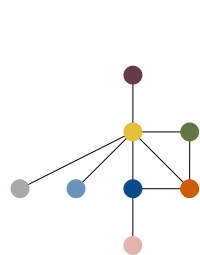
62-1



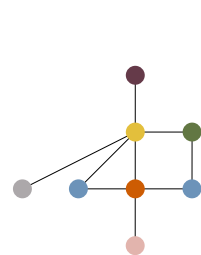
63-1



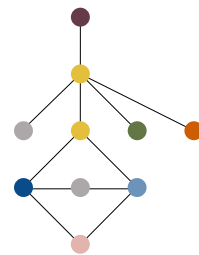
64-1



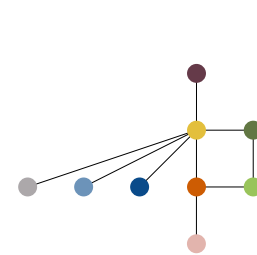
64-2-1



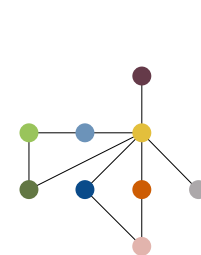
64-2-2



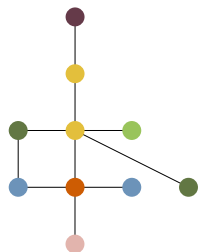
65-1



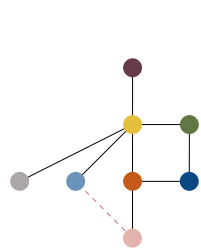
65-2



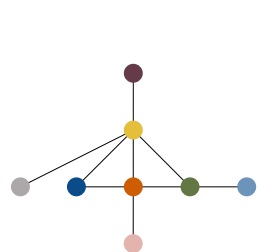
65-3



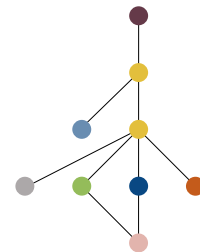
66-1



66-2



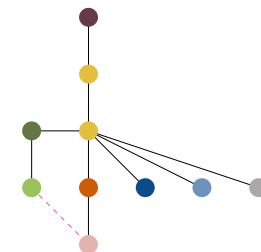
67-1



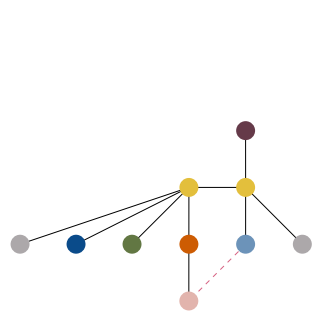
67-2



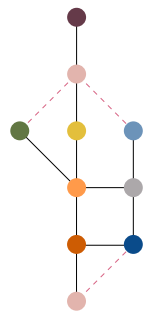
68-1



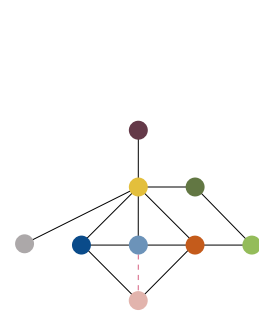
69-1



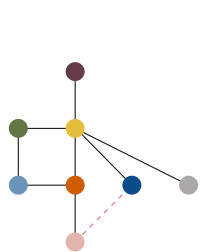
69-2



69-3



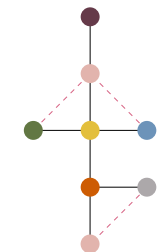
69-4



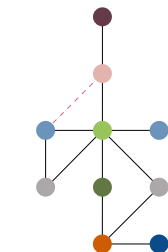
70-1



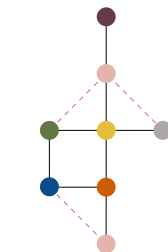
70-2



70-3



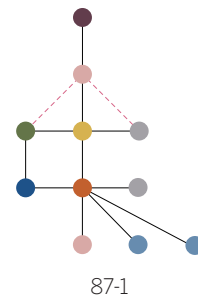
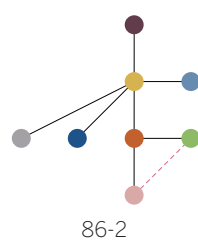
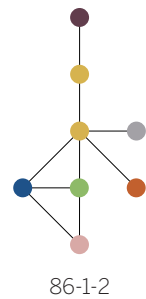
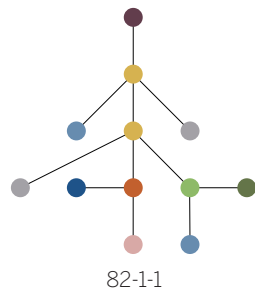
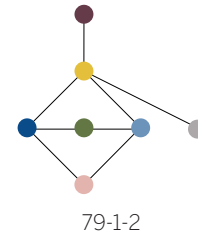
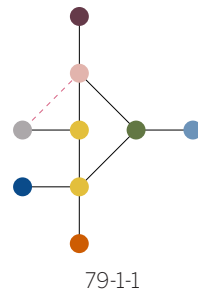
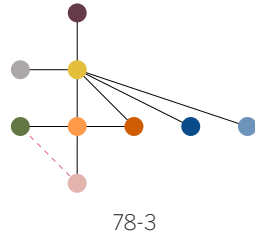
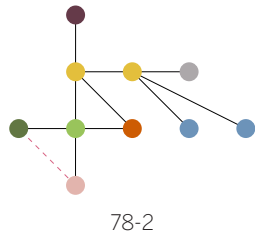
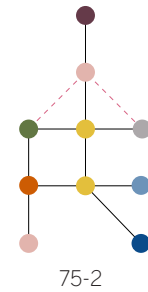
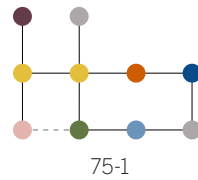
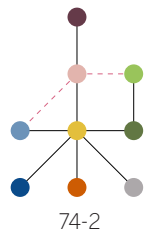
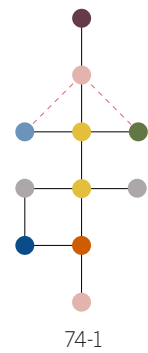
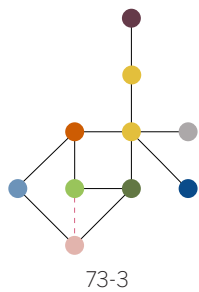
71-1

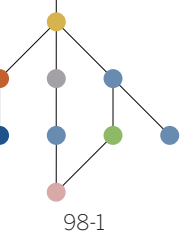
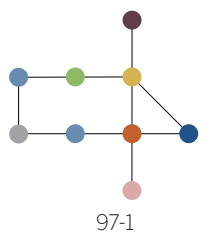
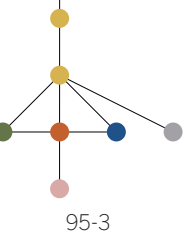
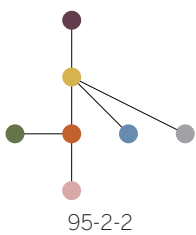
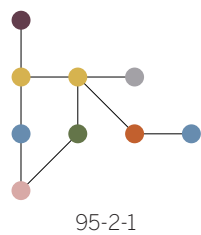
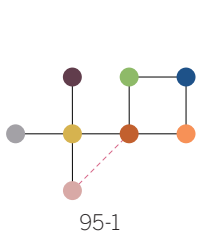
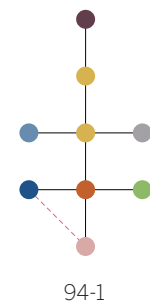
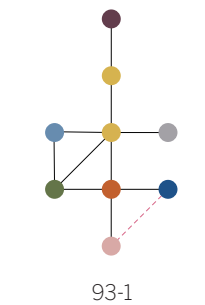
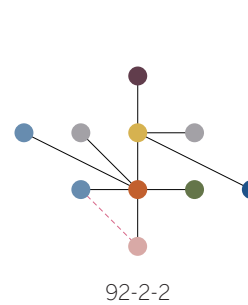
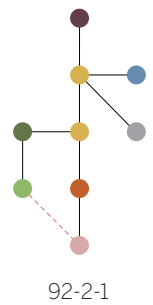
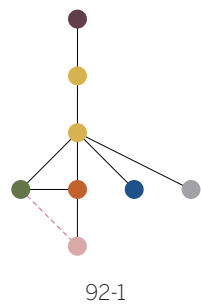
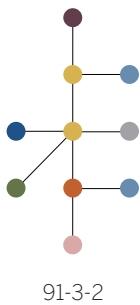
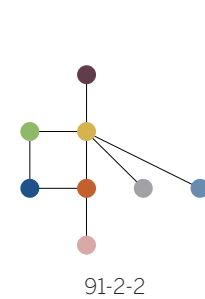
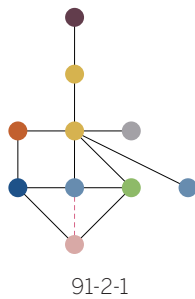
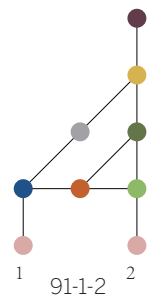
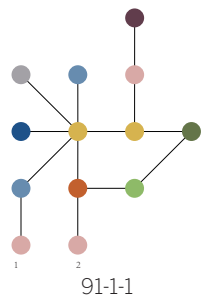
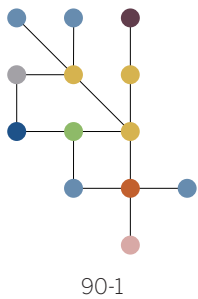
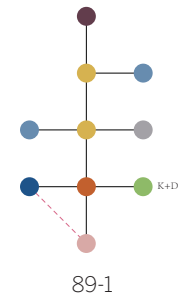
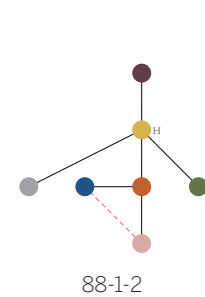
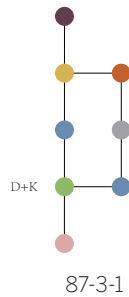
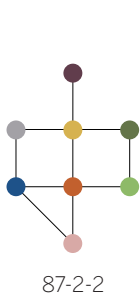


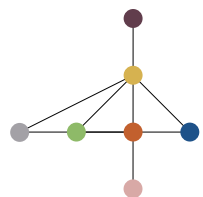
73-1



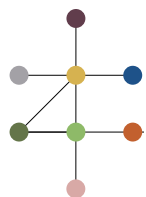
73-2



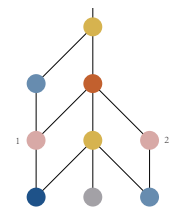




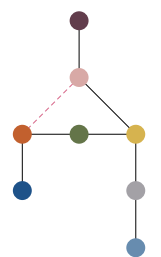
98-2



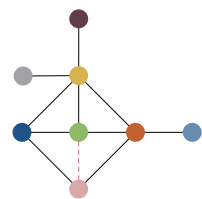
99-1



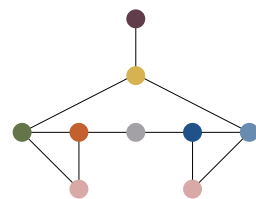
01-1



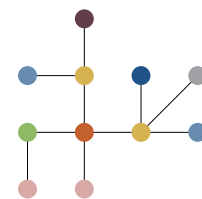
01-2



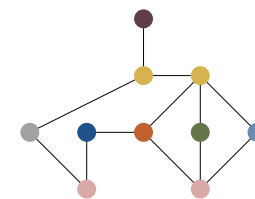
02-1



03-1



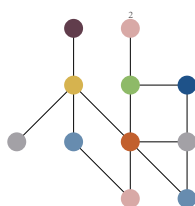
04-1



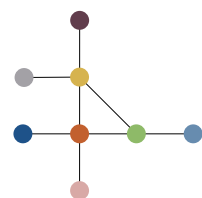
04-2



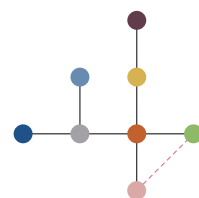
04-3



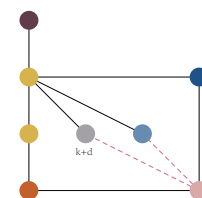
05-1



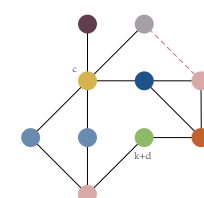
05-2



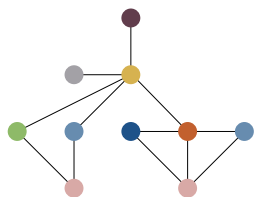
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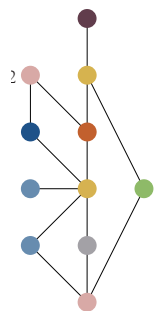
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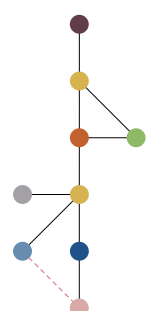
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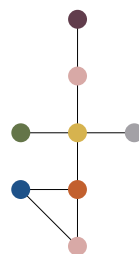
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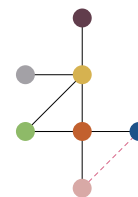
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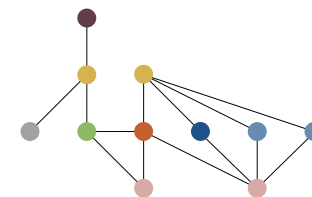
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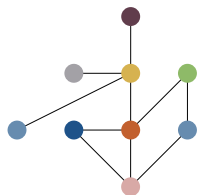
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12-2



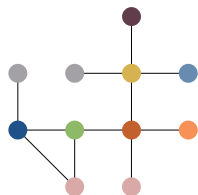
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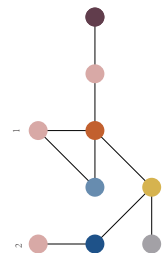
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15-1



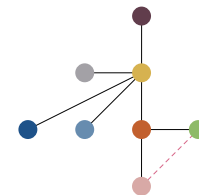
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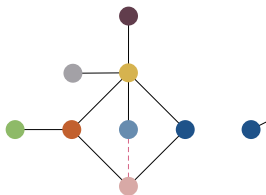
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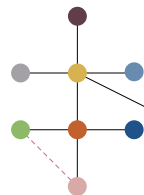
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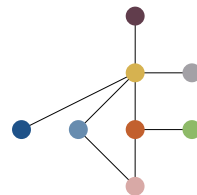
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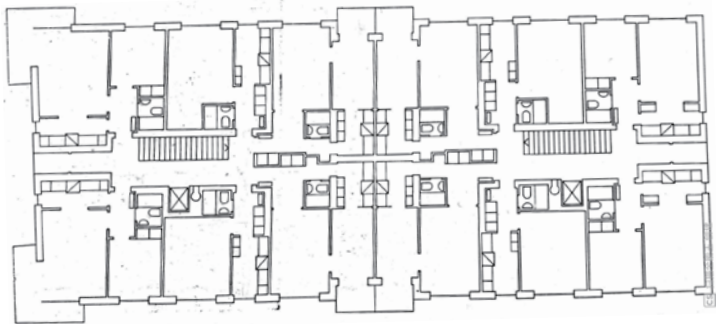


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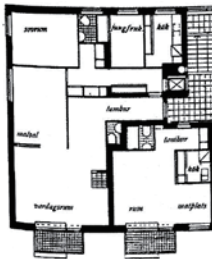


17-1

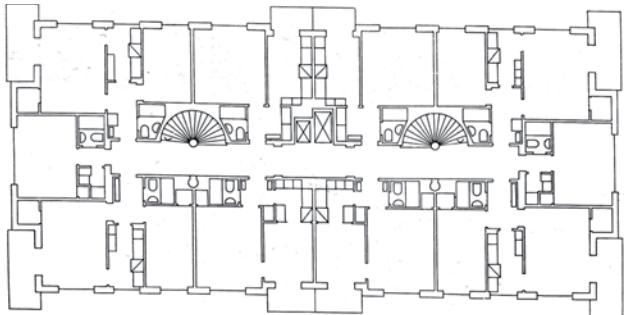
Appendix 5.3 Floor Plan
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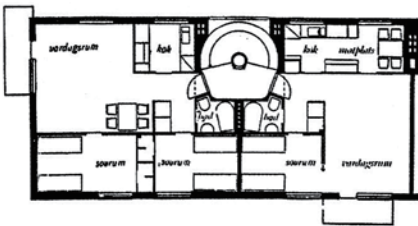
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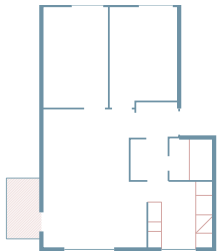
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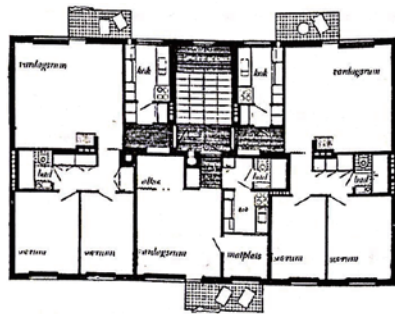
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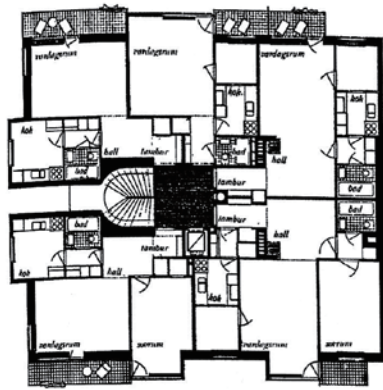
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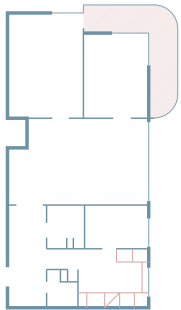
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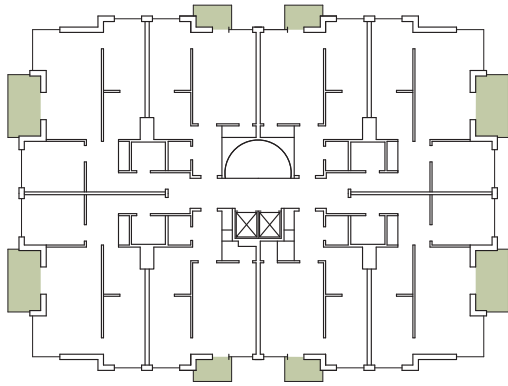
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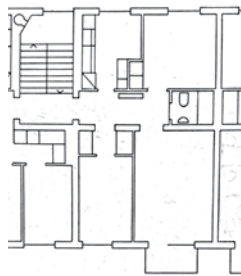
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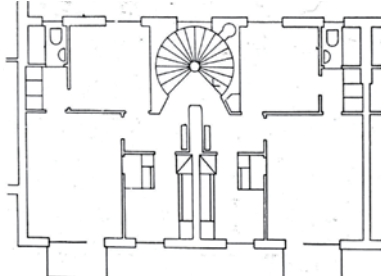
37-1



38-1

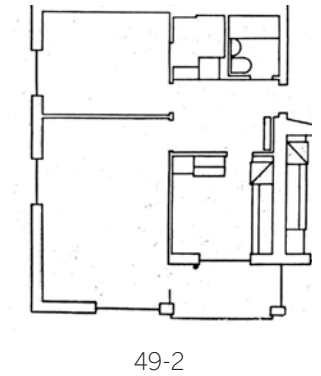
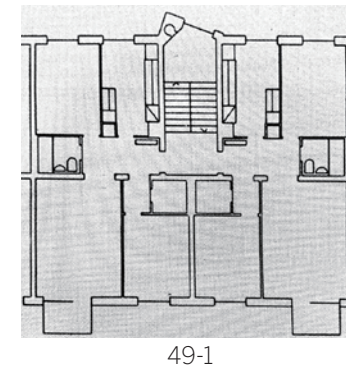
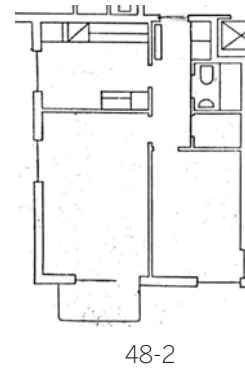
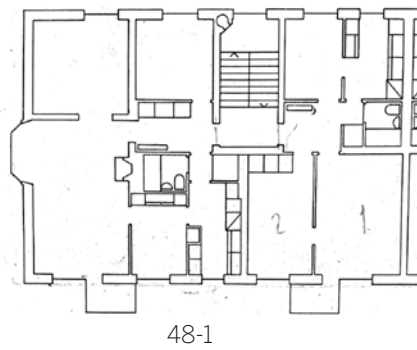
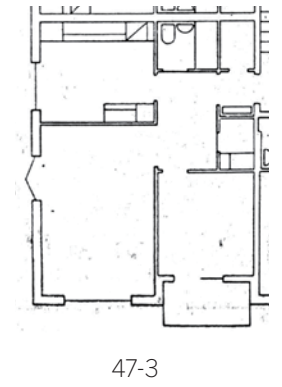
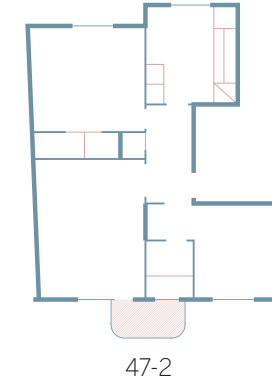
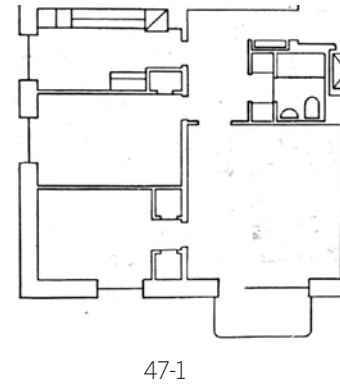
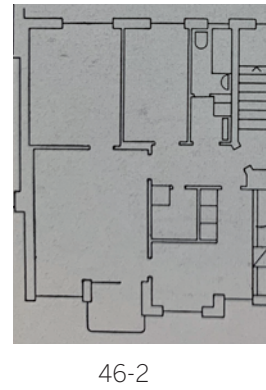
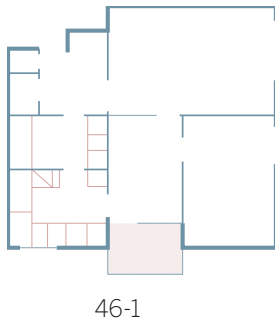
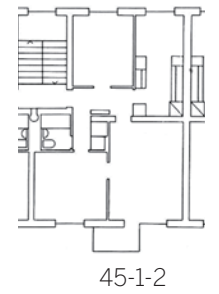
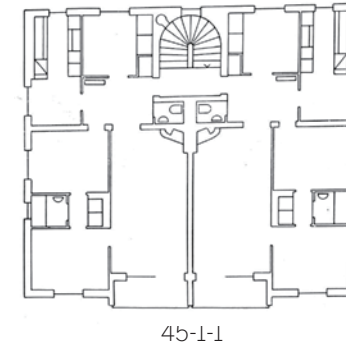
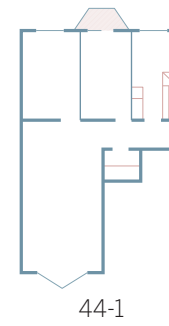
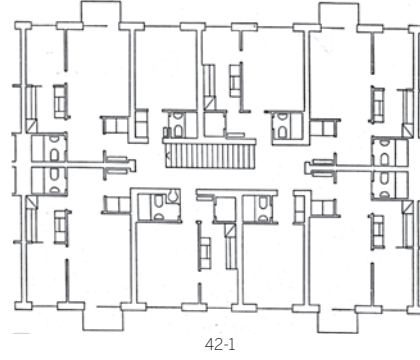
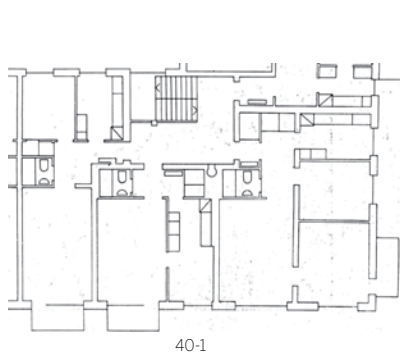


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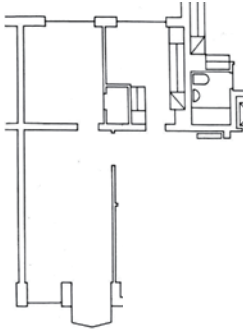


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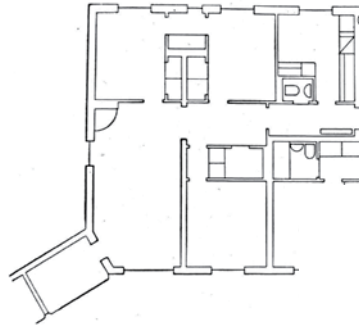
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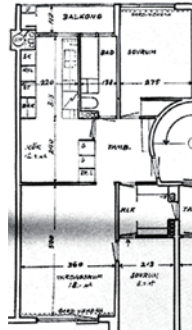
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50-1



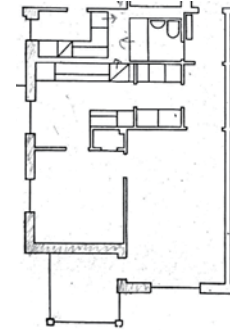
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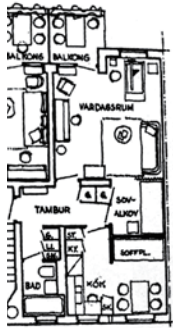
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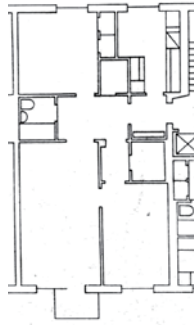
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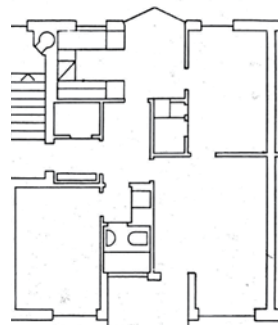
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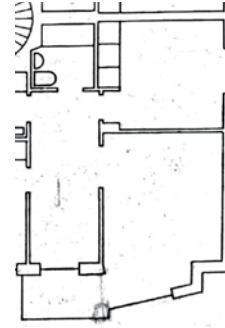
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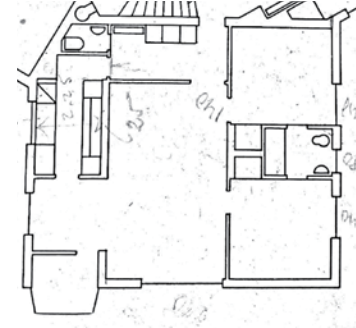
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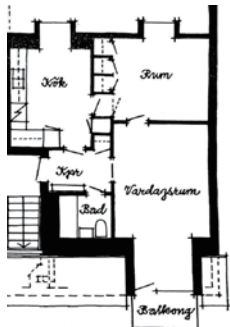
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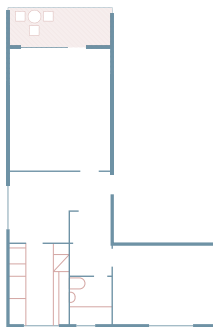
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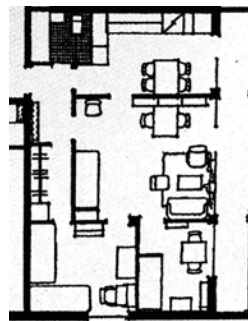
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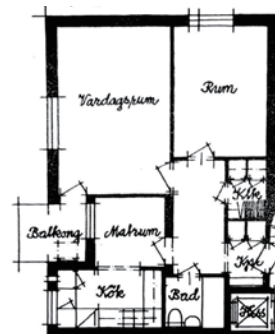
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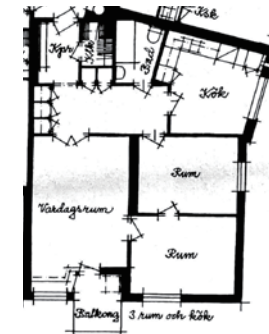
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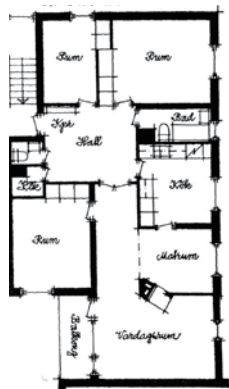
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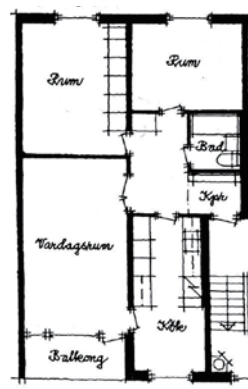
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56-1-2



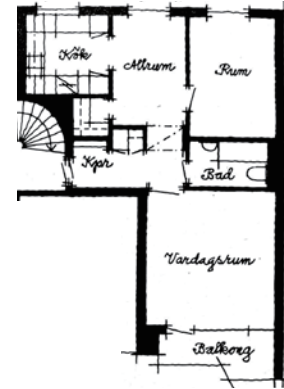
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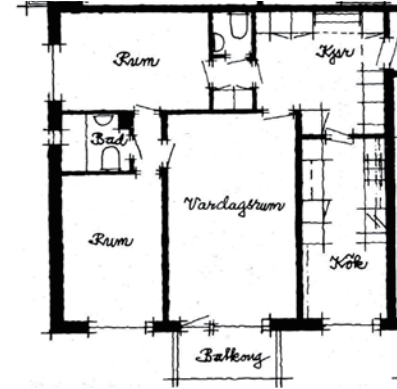
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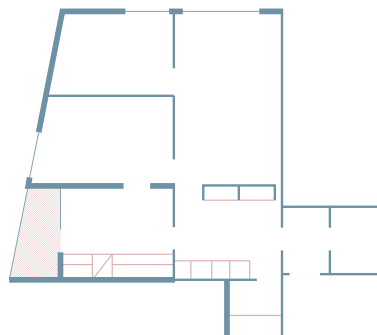
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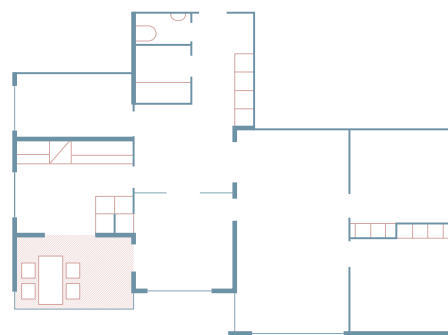
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58-1



58-2

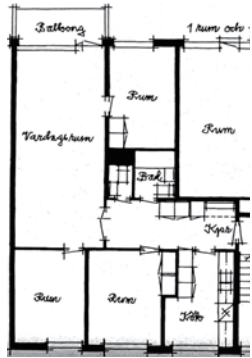


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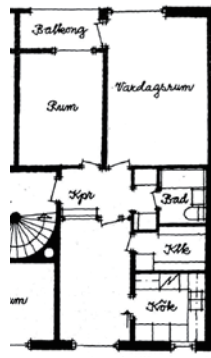


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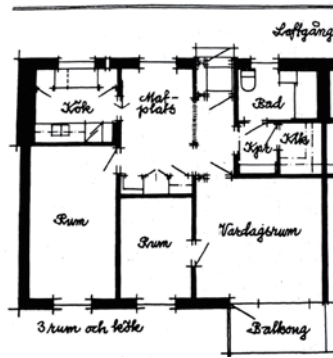
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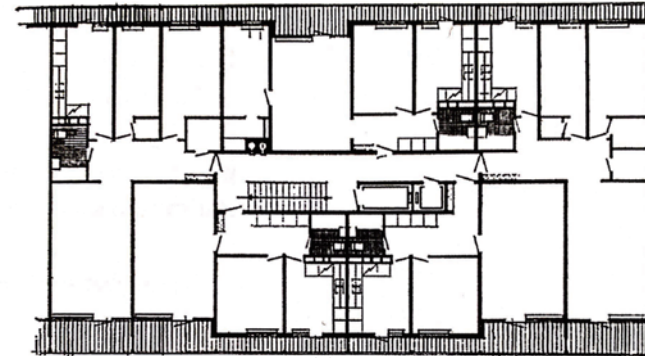
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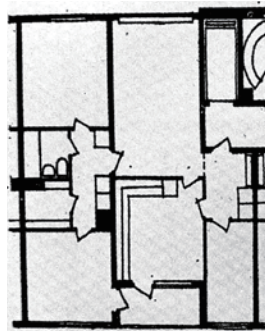
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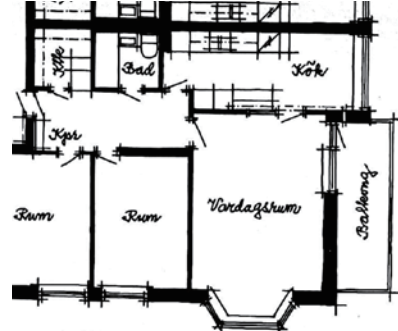
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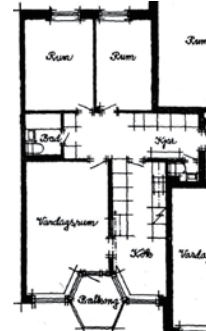
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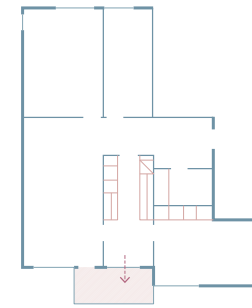
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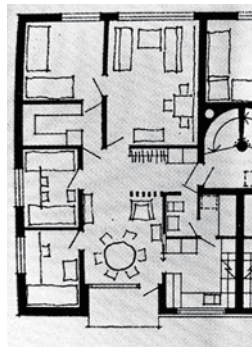
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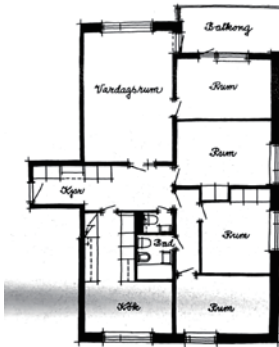
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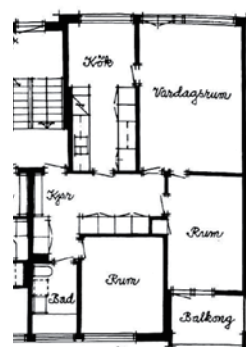
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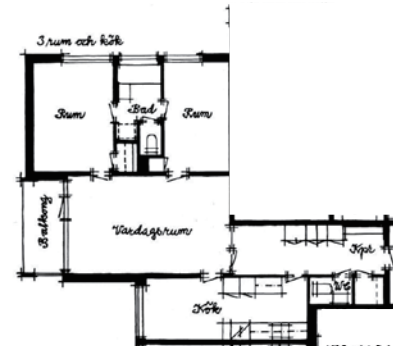
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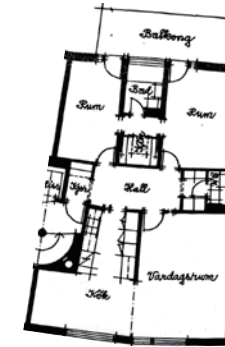
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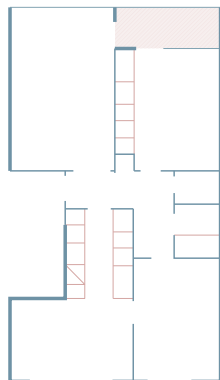
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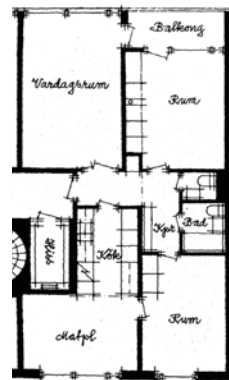
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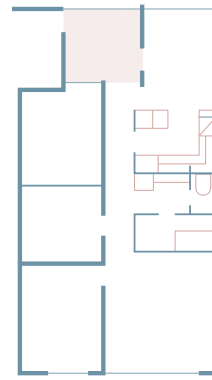
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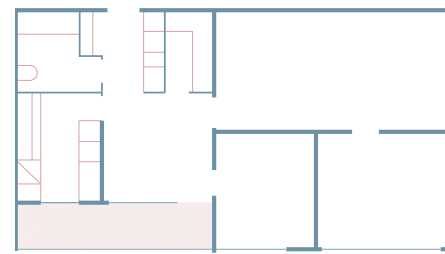
65-2



65-3



67-2



68-1



69-1

Appendix 5.3 Literature

Bopanel, S. (2017). Bostadsköpare i ny undersökning: "Det vill vi betala extra för på våra balkonger".

Mladenović, E., et al. (2017). Opportunities and Benefits of Green Balconies and Terraces in Urban Conditions. *Contemporary Agriculture* 66(3-4): 38-45.

Omrani, S., et al. (2017). On the effect of provision of balconies on natural ventilation and thermal comfort in high-rise residential buildings. *Building and Environment* 123: 504-516.

Tinglöf, L. (2017). Balkongliv för nytta och livsmening.

Skanska (2014). Balkongen avgörande för bostadsköpare.

Cowan, A. (2011). Seeing is Believing Urban Gossip and the Balcony in Early Modern Venice.

HANNA AHLSTRÖM, E. K. (2011). Balkongen i Staden.

Manum, B. (2006). Apartment layouts and domestic life; the interior space and its usability: a study of Norwegian apartments built in the period 1930-2005.

Hall, T. (2005). The Million Homes Programme: a review of the great Swedish planning project.

Nylander, O. (1999). Att återvända till tre projekt.

Caldenby, C. (2019). Rita bostäder.

Nylander, O. (2018). Svensk bostadsarkitektur : utveckling från 1800-tal till 2000-ta.

Egelius, M. (2018). BoStad : bostadsarkitektur och stadsbyggnad.

Vega, D. M. (2017). 99 years of the housing question in Sweden.

Oliver Heckmann, F. S. (2017). Floor Plan Manual Housing .

Chey, K. (2017). Multi-Unit Housing in Urban Cities-from 1800 to present day.

Ebner, P. (2010). Typology+ : innovative residential architecture.

Berger, T. (2007). Bostaden och kunskapen.

Schittich, C. (2004). High-density housing : concepts, planning, construction.

Nylander, O. (2002). Architecture of the Home.

architecture, W. (1986). Den nya goda bostaden i kompletteringsbebyggelse.

Lundevall, O. H. s. r. (1981). HSB : projekt från en tjugofemårsperiod, 1955-1980.

Arkitekturmuseet (1980). Funktionalismens genombrott och kris : svenskt bostadsbyggande 1930-80.

Olsson, A. (1954). HSB-30 År : Hyresgästernas Sparkasse- och Byggnadsföreningars Riksförbund.

Ålund, S. B. o. S. (1950). Fyrtiotalets Svenska Bostad.

Appendix 5.3 Image

All images taken by the author if no reference is given.

Fig.17 <https://www.stadshem.se/till-salu/>

Fig.18 https://www.erikolsson.se/bostader-till-salu/OBJ13710_1698070124

Fig.19 Nylander, O. (2018). Svensk bostadsarkitektur : utveckling från 1800-tal till 2000-ta.

Fig.20 <https://www.hsb.se/goteborg/sok-boende/projekt/?projektlan=vastra-gotaland&projektkommun=molndal&projektnamn=rosendahl>

Fig.26 [http://www.hausbiografien.arch.ethz.ch/pdf/090908_K5_PLOTT_length\(170\).pdf](http://www.hausbiografien.arch.ethz.ch/pdf/090908_K5_PLOTT_length(170).pdf)

Fig.27 <http://blancallego.com/es/architecture-culture/>

Fig.30 <https://www.gmuergeschwentner.ch/bauten/paul-clairmont/>

Fig.31 <https://www.archdaily.com/777567/carre-lumiere-lan-architecture/564fe3dde58ece7a69000064-carre-lumiere-lan-architecture-imag>

Fig.32 <https://www.bjurfors.se/sv/tillsalu/vastra-gotaland/molndal/krokslatt/bergskroken-45/>

Fig.34 Egelius, M. (2018). BoStad : bostadsarkitektur och stadsbyggnad.

Fig.35 <https://www.bjurfors.se/sv/tillsalu/vastra-gotaland/goteborg/centrala-hisingen/kvillegatan-7/>

Fig.36 <https://www.archdaily.com/785397/vastra-kajen-housing-tham-and-videgard-arkitekter>

Fig.38 <https://www.archdaily.com/870459/mfh-dali-rain-dolmus-architekten>

Fig.39 <https://www.gmuergeschwentner.ch/bauten/paul-clairmont/>

Fig.41 <https://www.archdaily.com/902790/klencke-nl-architects>

Fig.42 <http://ruimpnunes.com/blog/?p=1905>

Fig.43 <https://www.archdaily.com/15022/mountain-dwellings-big>

Fig.45 <https://www.archdaily.com/915431/transformation-of-530-dwellings-lacaton-and-vassal-plus-frederic-druot-plus-christophe-hutin-architecture/5cb8950f284dd1a8120000cd-transformation-of-530-dwellings-lacaton-and->

[vassal-plus-frederic-druot-plus-christophe-hutin-architecture-photo](#)

Fig.46 <https://byggnadsvard.se/miljonprogrammet-ett-vardpaket/>

Fig.49 <https://www.archdaily.com/800832/skyville-woha/58453a18e58ece8fdb0003c4-skyville-woha-section>

Fig.50 <http://blancallego.com/en/mirador-building-celosia-building-vivienda-total-actar-bcn/>

Fig.51 <https://www.archdaily.com/627887/the-interlace-oma-2>

Fig.52 <https://www.mvrdv.nl/projects/mirador/>

Fig.53 Architecture no. 2 2019

Fig.54 <https://www.archdaily.com/627887/the-interlace-oma-2>

Fig.56 <https://www.kanozi.se/projekt/kvtrevnaden/>

Fig.57 <http://domus.dk/node/39>

Fig.59 Oliver Heckmann, F. S. (2017). Floor Plan Manual Housing

Fig.61 <https://www.edouardfrancois.com/projects/panache>

Fig.62 <https://www.archdaily.com/901363/tianhe-youth-commune-o-office-architects>

