Position Paper：The exploration of space efficiency

Typological research of flexible-use construction

Zizhe Ma
Student number: 4728270

1. Introduction

After the end of course I realized the importance of the research-methodological approach to real design project. Rather than finding examples and design solutions and simply putting these into design, research focus on how different architectural approach appears and how they change people's life. Normally solutions from existing building won't adapt another new building well if we just put same way to the project. Research, on the other hand, helps us to find the reason why existing solution is establish and how it works. By the output of research existing solutions can be transferred to new approach which is much more suitable for new project.

My choice of study promotes me to establish my main research question not only for paper in this course but also for my graduation design project. I took part in the investigation of typologies because I want to know how typology works in architecture. After group discussion and presentation I found that Typological approach often appears when people try to define new type of architecture or space. This way is supposed to be exploration of new architecture.

On the other side, typology becomes limitation sometime nowadays. The existing "type" of work or live often remains unchanged even in cities where they have to be changed. Nowadays the need of space has been a serious problem in metropolitan areas. The rent price in central area of New York, Tokyo or Hong Kong becomes extremely high. Even in Amsterdam, value of office buildings in Amsterdam increased the most of all cities in the world. In the third quarter of 2018 Amsterdam offices' value rose by 27.4 percent[1]. How to make full use of central area of these cities then becomes a valuable question. For architect, this question means to increase space efficiency, which means in same time more space is provided or more people is using the space; or the space can be used in more time during a day.

After the course series of research methods, I started to have doubt about the existing typology of work and temporary living space (hotel, hostel, small apartment, etc.). Central ports of metropolitan area often full of these typologies. But these typologies have been extremely developed and the space cannot adapt to other functions and possibilities. They are often used within a certain period during a day, which means the space is wasted in the rest time. It is ok for such waste in small cities or corner of big cities, but it is more and more unacceptable in central area of metropolis.

How to increase space efficiency in a typological way? The main research question then

comes out. If we solve well answer this question, central area of big cities like Amsterdam or even New York and Tokyo can provide more space and comfort for citizens. After this research part, my graduation project which locates in central area of Amsterdam is a good test field of research.

2. Research-methodological discussion

The research aims to establish new work and live typologies which are suitable for central area of metropolis. Typological research method helps me to extract and purify core aspects of space.

First, the research separates space efficiency into different types; each type is established by case studies. After analyzing the examples, sub-conclusions are made that explains the characters of each type are summarized to show the positive and negative aspects of them.

Based on data of examples, the paper establishes a list of potential connections of different typologies of work and lives. The final conclusion comes with new typologies that make full use of space.

3. Research-methodological reflection

3.1. Historical-theoretical context: The “waste” of space

To start with whole discussion, core questions have to be established. Did space is wasted in existing typologies?

Fig.1. Rudolf von Alt, Salon in the Apartment of Count Lanckoronski in Vienna (possibly 1869)

Fig.2. Z Wilhelm Bendz, Interior from Amaliegage with the artist's brother, 1829

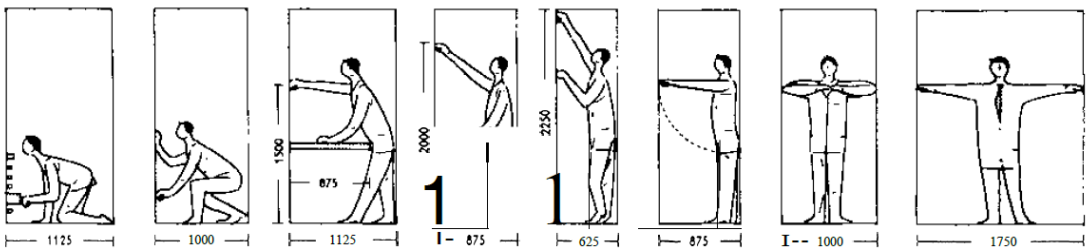
The painting above shows the living room in an apartment in Vienna. The space that people mainly stay occupies just half of the room. The other half is all for aisle. Also, the height of room is higher than nowadays' apartment room, all extra height is just for more paintings on

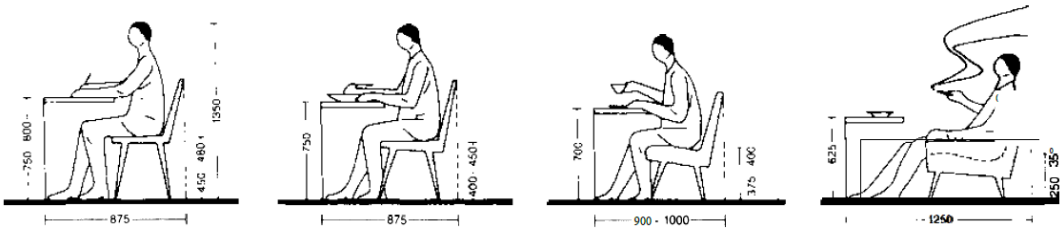
the wall or a big ceiling lamp.

While the other one show a room which is much smaller and also with more functions in Denmark. The height is much lower than the first one; the painting also shows a high table for standing people, which save some space. There is nothing on ceiling, rather than a huge lamp.

All of this can be seen as reflections of certain types of that age. It is not to say that the first one “wastes” something, but for building which has limited space, there are still possibilities to make the room be used more effectively. Before modern ages, the function and suitable of space still remain unclear. The building of different type of people usually has huge gap. The rich man’s room often occupies much space than normal citizens. On the other side, normal room has to adapt more functions and also provide standard live condition with limited space. So from different paintings in same period we can preliminarily find some attempts people did to increase space efficiency, though such phenomenon does not mean old nobility buildings waste space because the supply of space or them is much looser than now. Such limitation and people’s resistance to it always exist.

For this modern architecture typological studies now have given us more accurate data about all suitable space scale of human activity. For example, one book that I mainly refer is 《Neufert: Architects’ Data》[2].The book contains most type of architecture and detailed data about different type of buildings. The data of that book are even smaller than a normal apartment room in 19 century. Have such different promoted more effective use of space? Even if we have already fully realize these attempts, Is there still something missing of typologies that realize high space efficiency? Can we even put the result even further?





(13) Dimensions: work table

Dimensions: sitting and dining room chair

(15) Dimensions: small easy chair

(16) Dimensions: armchair

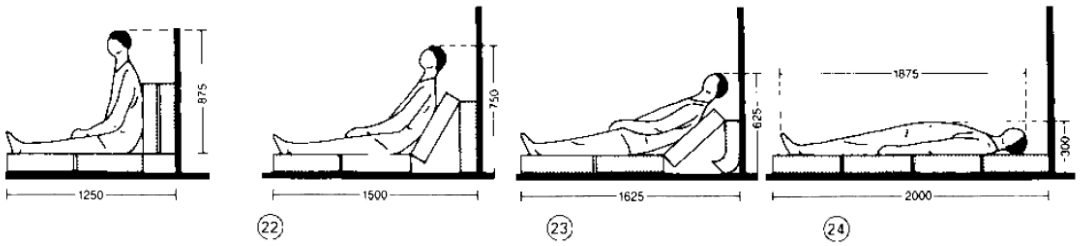


Fig.3. The space requirements of different body posture. Architect's Data, P17.

3.2. Explorations of typologies with space efficiency

The typical space contains three main aspects that related to space efficiency. First is the quantity of space, generally calculated in terms of floor area though occasionally volume may also be relevant; second is the number of users, both potential and actual; third is the amount of time the space is used.

Why these start to be a problem? In metropolitan areas where city have already a high density and land value, the quantity of space usually be limited. Also, the high rental price makes things harder. Because of this, new typologies to increase space efficiency from the other two aspects are needed.

How to research? According to the aim of research, new innovative typologies come with limited space situation and high land price. So one basic research condition is to improve space efficiency with fixed floor proportion (this does not include potential virtual space that more than human scale 2.2m_3).

To make things clearer I tried to use typology to explain current situation of exploration. We can explain all examples that try to increase space efficiency in two main ways. One is reducing personal space consumption, which makes same space contain more people; people also get lower cost for they occupy less space. This contains two solutions: Compression and Simplification. The other is increasing the use time of the space, which decreases the special waste and reduce price. This is also followed by to detailed practices: Horizontal and Vertical.

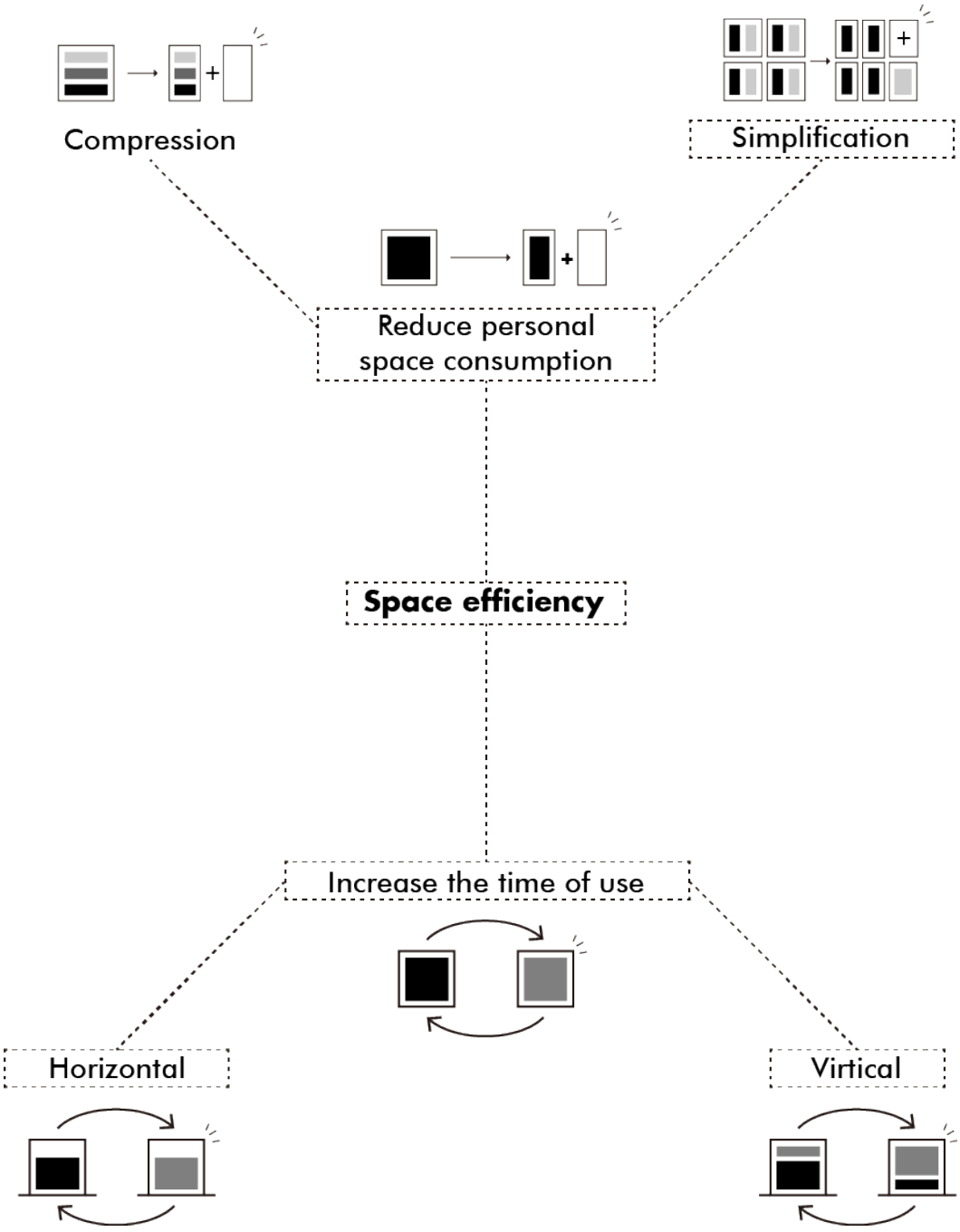


Fig.4.Illustration of space efficiency in typological way

3.2.1. Reduce personal space consumption

Make people use less space and make space contains more people is a common way to increase space efficiency in metropolitan areas. This type can be divided into Compression and Simplification according to the strength of action.

Compression

Space compression means that although the size of space is smaller, but the user of each space remains unchanged. In other words, a private space will still be private after compression. Every kind of space has its minimum size, so such approach also has physical limitation. On the other side, the level of space comfort also decrease by the compression. As a result, different degrees of compression create space with different character. Case studies with this different level are showed and analyzed to find the detailed influence of this approach.

When the level of space compression is not high, then the core quality of space can almost remain high by taking some remediation. Such way of design often appears in central urban area. The case study CitizenM hotel besides The Tower of London is a clear example of this type.

Fig.5. Room's interior of CitizenM.

Source:

https://www.architectsjournal.co.uk/buildings/shared-space-14sqm-bedrooms-sheppard-robsons-hotel-for-millennials/10014602.article

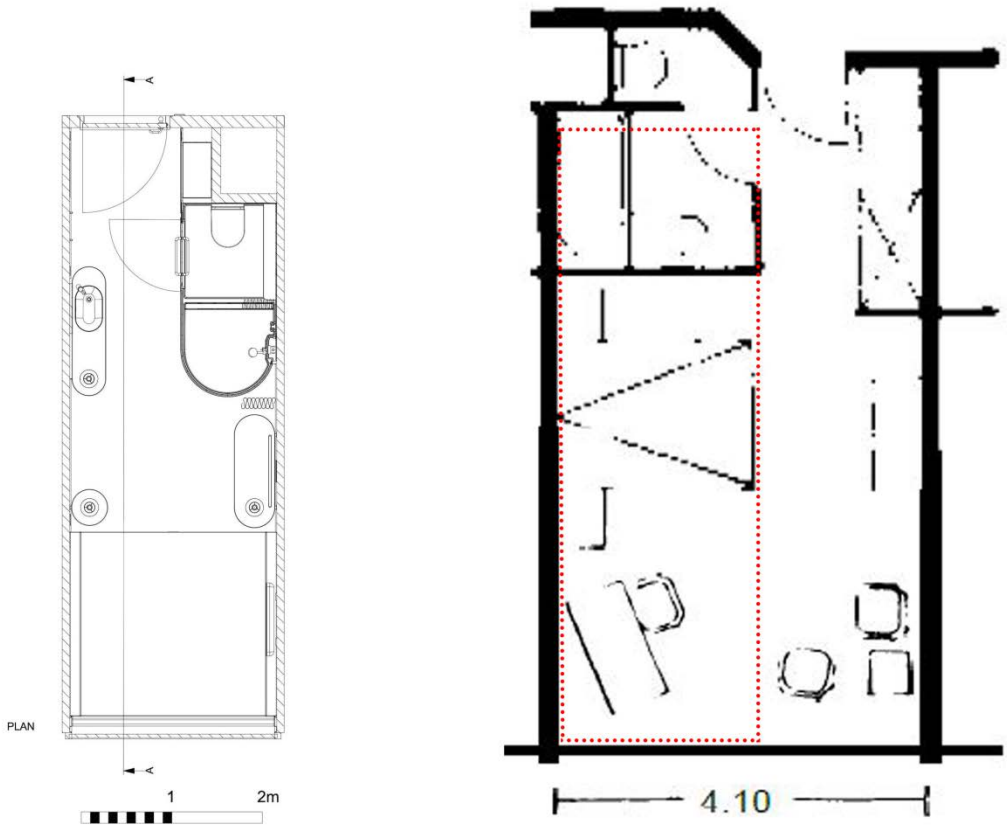


Fig.6. Illustration: The comparison between the room of CitizenM and standard hotel room

Source of left plan:

https://www.architectsjournal.co.uk/buildings/shared-space-14sqm-bedrooms-sheppard-robsons-hotel-for-millennials/10014602.article

Source of right plan: Architect's Data, P465.

The illustration above shows the plan of a standard room of CitizenM and standard hotel room according to the Architect's Data. The CitizenM's room remains all of normal room functions, from toliet, wash tap, shower room to cabint, table and chairs. The core reason why it keeps all functions but only occupies less than 2/3 of a standard room is compression. The room cut most of walkway. First, the room combines toliet's all walk space with main corridor in room, to realize this functions in toliet are separated into the room. Space for people to go on bed also be halfed and integrated into main corridor. Closet space is also halfed. Work and rest zone still exist but they are put together and can be transferred to each other.

Such type of design of course same space to contain more rooms. On the other side, it also limited aim user. It mainly for visiters and young people with short stay. The king-size bed just have one direction to go on, which is inconvenient for user to gst in and off of bed. The corridor is nerrow and it maybe harder for disabled people to turn and place their wheelchair. The work zone is also not enough to work comfortablely, etc.

In conclusion, such type of space increase space efficiency by compress space of every function, at the same time the arragement of room make it harder for people to stay longer

during a day, and limited aim user. Such space is suitable for tourist to have good rest during night, but they normally won't stay during day time.

Simplification

When the limitation of total space is even bigger, some private space can be cut and transfer into public space. At last all private space for a person will be compressed to extreme size. Building that is arranged in this way usually face with more limited space or more demands.

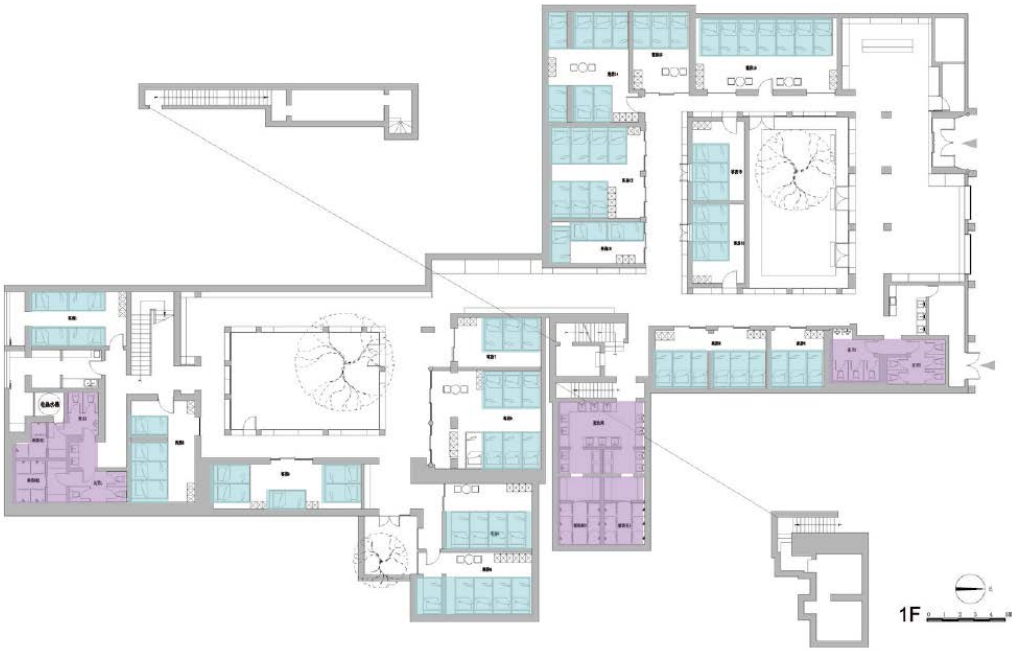


Fig.7. Illustration of floor plan of Xiezuo Hutong Capsule Hotel, Beijijng

Source of floor plan:

https://www.archdaily.com/886515/xiezuo-hutong-capsule-hotel-in-beijing-blue-architecture-studio?ad_medium=gallery

The project located in central area of Beijing, the main form around the hotel is Siheyuan, which are normally one floor traditional courtyard residences. The site occupies two courtyards. Such site condition means that new design cannot excess the height of existing building. Even compressed room may not suitable for this limited space.

In this type, private toilet, shower room and storage (purple part of the illustration) are simplified and transferred into public zones. Rooms for sleep then fully occupied by bunk bed.

Types of simplification does gain space efficiency by include more people in limited space, it also cost. The scale of sleep room protects people from using during day time. The "privacy space" of a person is simplified from whole room to just a bad, the scale and space of the bed then only suitable for people to sleep (they will even be influenced by other people on bed

during sleep time).

All functions for work and communication in a normal room are also transferred to open space. Such type of design usually provides more public space for people to stay.

3.2.2. Increase the time of use

Every function works in a certain period, which means same space can be used as different aim in different time. This series of types contains two aspects. The first one is to make horizontal space more effective, such space includes the height that under human scale ($2.25m_4$). This aspect has close relation with human activity and the arrangement of space can be changed by people's hands. The other aspect is to make use of space that people cannot reach: vertical space beyond 2.25m. Approaches then become structural or machine-powered.

Make use of horizontal space

Limited space normally does not have enough space to storage facility for different functions. As a result, this way often works with flexible furniture. Most of furniture are arranged under the height that human can reach. At the same time, different functions work with different furniture. When the purpose of limited space changes from one to another, changeable furniture makes this possible.

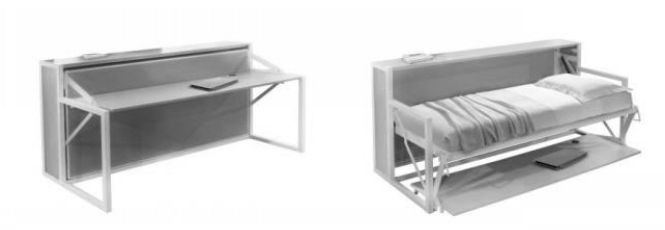


Fig.8. A flexible furniture that can be transferred from desk to bed.

Source: http://homedesg.co/images/

The illustration above shows about how this proposal increases space efficiency. In limited room the space for bed and desk can be transferred from one to the other.

This way increases space comfort by provide more functions and free zone in limited room. Normally a small room with bed and desk give people less space to move or stay. When the bed and desk can transfer from on to the other, extra space will appear and it can either be used as free space or be arranged new function.

But normally the user usually remains unchanged in such proposal, which means the space has its privacy and it is hard to be used by different people.

Make use of vertical space

Sometimes room gets extra height but not enough to have extra floor. Such space exists but it is also hard to use because people cannot reach. To make full use of vertical space lift machines are designed and used.

Fortunately there is an example of apartment that uses similar design approach to gain more usable space. The project is for a young couple in Beijing, who need to renovate their small apartment. This is a very small room with limited height and space which has no any further extension. The ventilation and daylight condition is terrible.

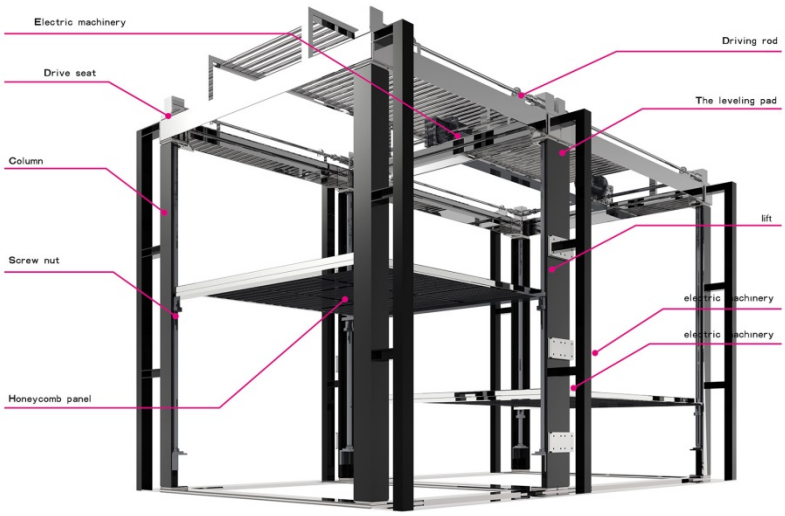


Fig.9. Exploration of flexible floor with lifting structure

Source: https://www.gooood.cn/renovation-by-zhang-haiao.htm

Such design proves that it is possible to use lift structure to form flexible floor for normal room, and it does make same floor space be used during whole day with different functions. The height of space is 3.4m, which is not enough to have two normal floors. Original height of living space under bed space is only 1.9m, while height of sleep space leaves 1.5m. These conditions provide uncomfortable environment. All different kinds of function are missing from the space. New design creates different height by involving movable mechanics floor plate. Folding furniture is designed and they could be transformed to different functions, which are living room, gym, movie theaters, bedroom, multiple living and study room. One can transfer the layout according to different functions.

On the other hand, although this type makes a small room possible to be used during whole day, the character of the room (apartment) ties its user and it cannot be used by other people.

4. Positioning

By analyzing different types, all of them have their merits and demerits. Increasing users in same space and increasing using time in same space seems to have huge different between each other. The characters of two main aspects of exploration somehow are complementary to each other, which mean there are possibilities to make better options by combining them together.

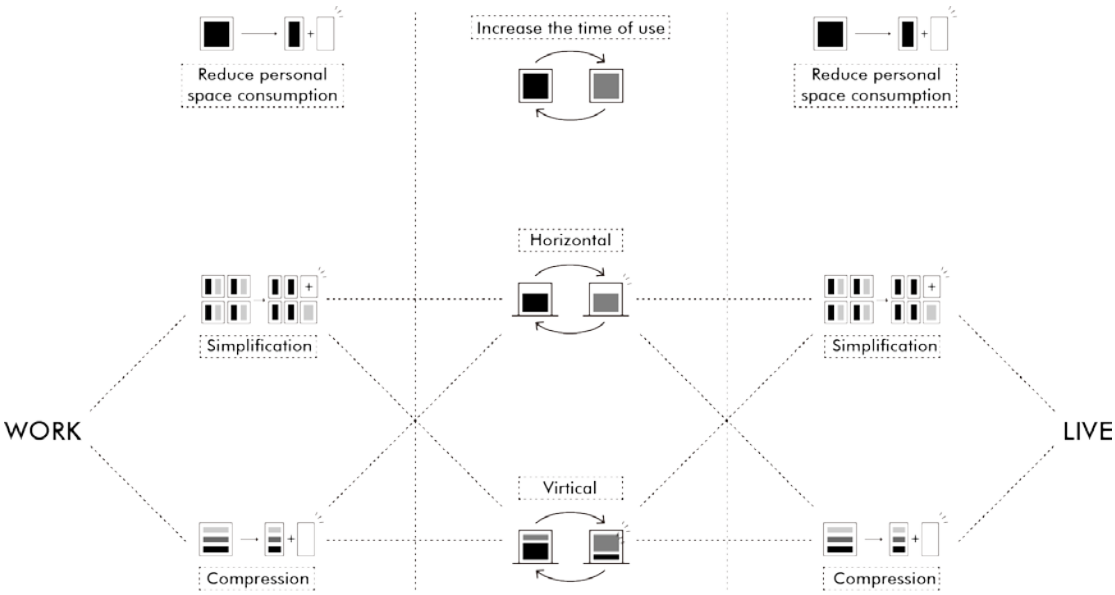
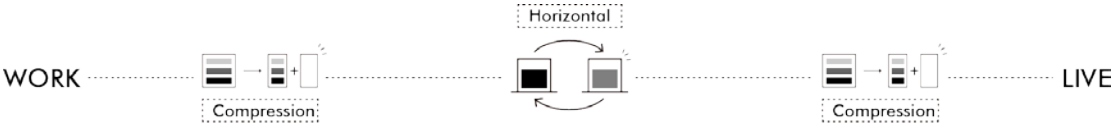


Fig.10. Illustration: new connection between different elements

For main research proposal, both live and work can have certain period by defining the detailed type. Of course there are always examples that cannot be arranged like this, but for further exploration and low rent price in central area of metropolis, the future vision will choose suitable type that adapt research proposal. By combing two main aspects and two main function series (live and work), eight prototypes with different character appears. These possibilities suits with various type of live and work, they also aim for different target population.

All outputs are also designed in typological way to make sure they have enough possibilities to adapt different conditions.

4.1



The Type 1 combines work and live in both compressive way, work space still has normal working space, meeting space storage and toilet. On the other side, whole space can transfer to standard hotel room, which contains toilet, beds, sleep space and living space. All these are realized in horizontal way by using changeable furniture.

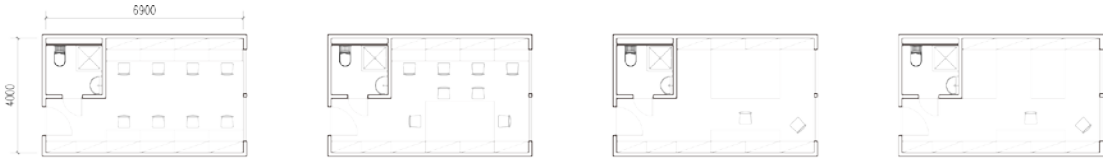


Fig.11. Illustration: plan with work (left two) and live(right two) of Type 1

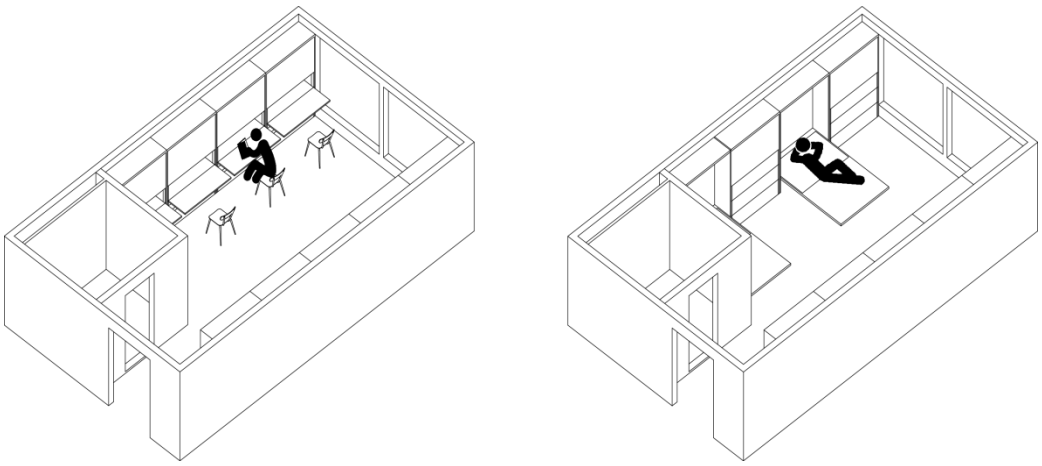
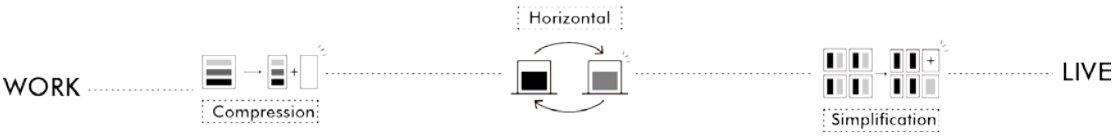


Fig.12. Illustration: different use of space during whole day in Type 2

4.2



The Type 2 focus on compressed working space with complete functions and simplified co-living space with shared facilities. The work space can be used as normal office for small company, while the living space can be used as hostel.

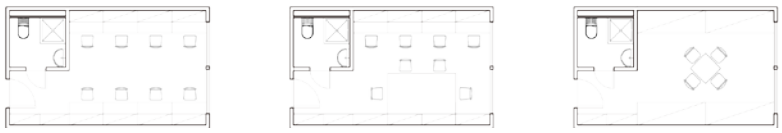


Fig.13. Illustration: plan of Type 2

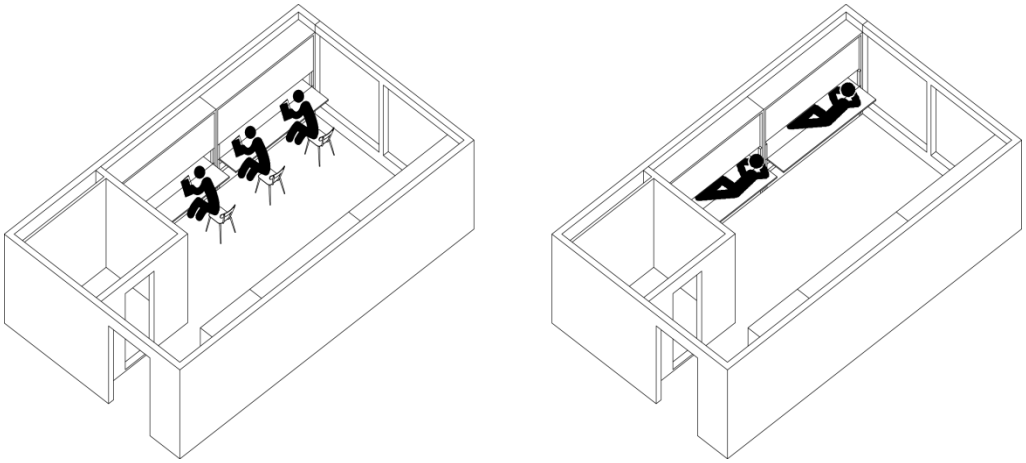
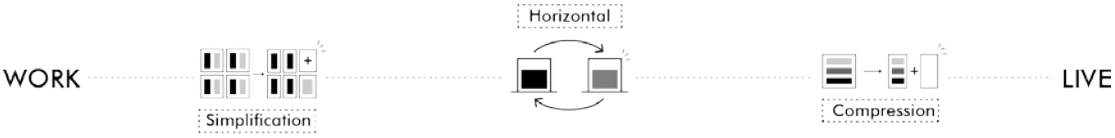


Fig.14. Illustration: different use of space during whole day in Type 2

4.3



The Type 3 contains with simplified work space and compressed living space. The whole space can be used as small apartment for young innovators. Same space provides not only co-working potential for them and their workmates but also comfortable living condition.

Fig.15. Illustration: plan with work (left) and live (right) of Type 3

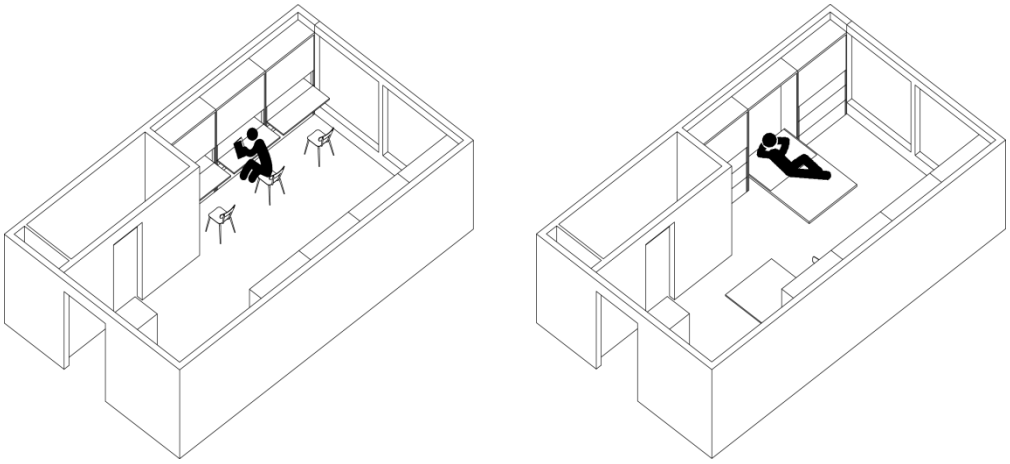
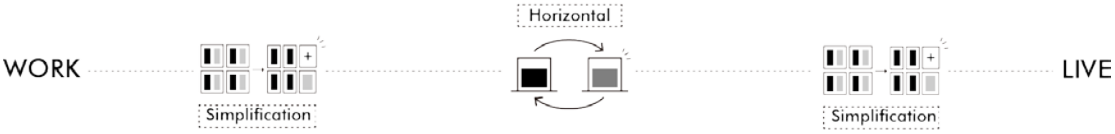


Fig.16. Illustration: different use of space during whole day in Type 3

4.4



The Type 4 combines simplified work and living space, making same space contains more users. Flexible furniture makes functional transition possible. Some functions are cut and transferred from private to public, like toilet, meeting space, storage.

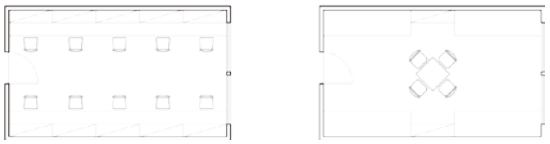


Fig.17. Illustration: plan with work (left) and live (right) of Type 4

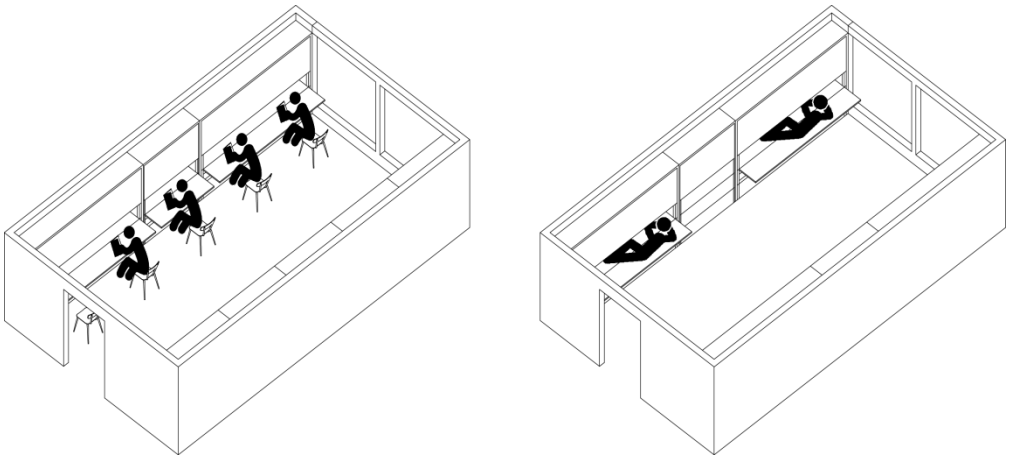
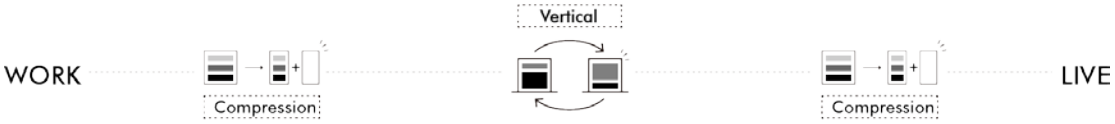


Fig.18. Illustration: different use of space during whole day in Type 4

4.5



Rather than Horizontal which makes use of space under human scale, the Vertical focus on space out of human scale. Mechanical lifting structure is needed to realize the aim. The Type 5 make same room used as both compressed working space during day and standard hotel room during night.

Fig.19. Illustration: plan with work (left) and live(right) of Type 5

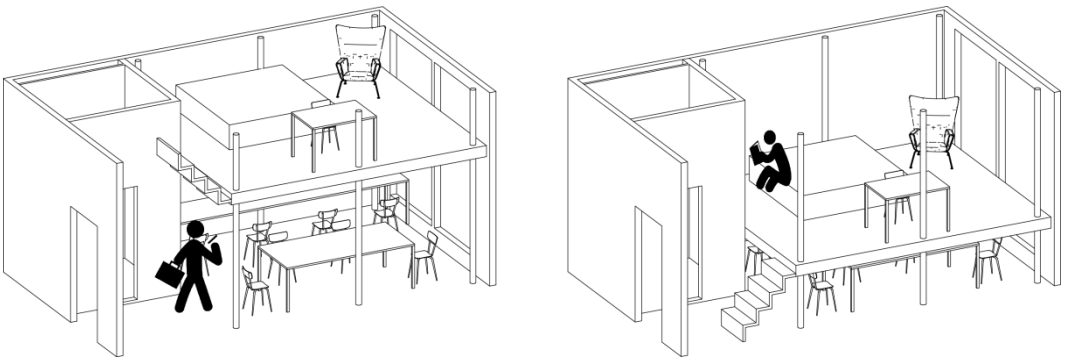
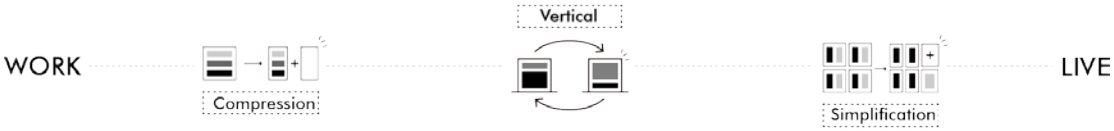


Fig.20. Illustration: different use of space during whole day in Type 5

4.6



The Type 6 combines compressed working space and simplified living space. The working space is suitable for small companies that have fixed work time, they can keep their stuffs inside the space. The living part can be used as hostel.

Fig.21. Illustration: plan with work (left) and live(right) of Type 6

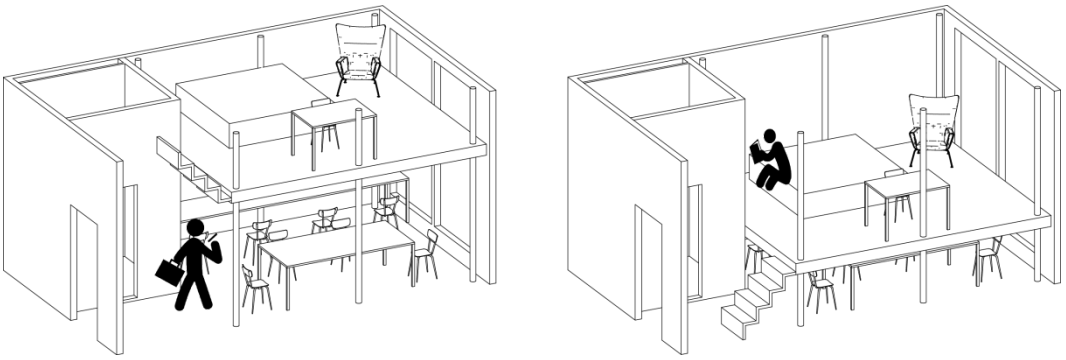
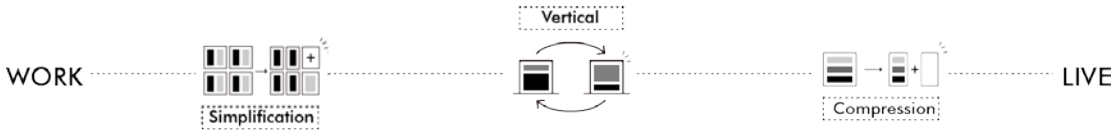


Fig.22. Illustration: different use of space during whole day in Type 6

4.7



Type 7 formulates another small apartment that contains co-working space and complete living space. Yong innovators can live and work with both comfortable environment and affordable price. It is a good place to start their career.

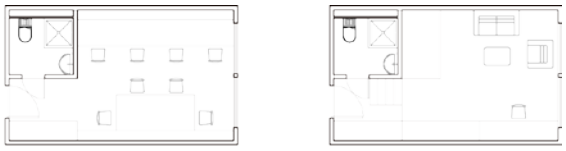


Fig.23. Illustration: plan with work (left) and live (right) of Type 7

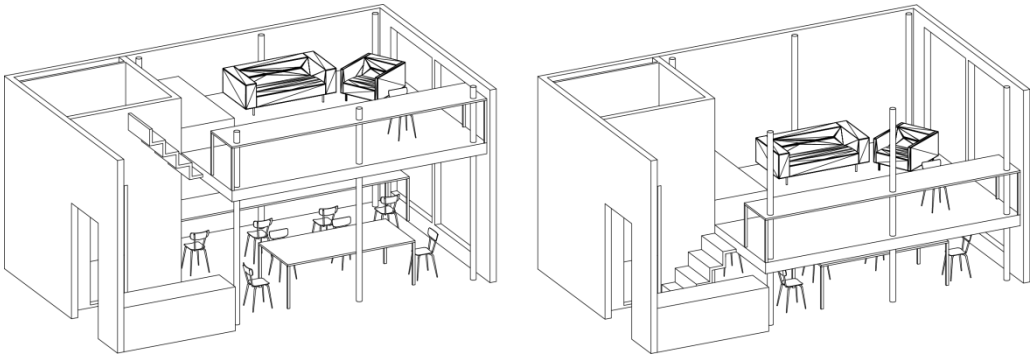
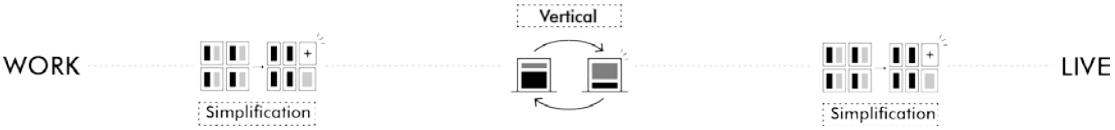


Fig.24. Illustration: different use of space during whole day in Type 7

4.8



The last type includes simplified working and living space by using flexible floor. Such type contains same users by smaller space or contain more users in same room.

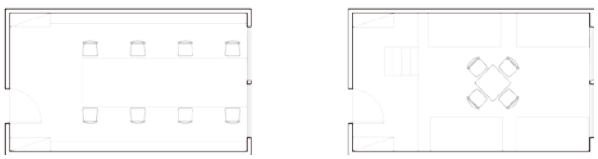


Fig.25. Illustration: plan with work (left) and live (right) of Type 8

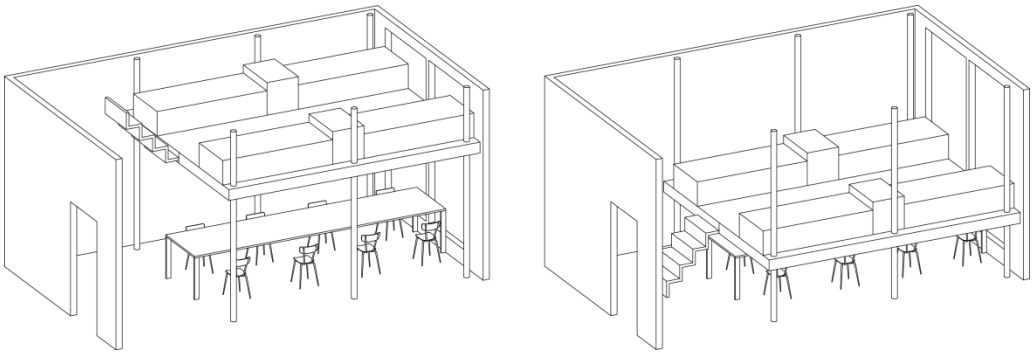


Fig.26. Illustration: different use of space during whole day in Type 8

Note:

1. The data is from Sprekende Cijfers Kantorenmarkten medio 2018.
2. The paper refers the third edition of Atchitects' Data.
3-4. The data is from P16 of Architects' Data, which shows universal standard human scale.

Bibliography

Neufert, E. and Neufert, P. and Baiche, B. and Walliman, N. (2002.). Architects' Data

McNeill, D. (2008). The hotel and the city. Progress in Human Geography, 32(3).

Vilnai-Yavetz, I., Rafaeli, A., & Yaacov, C. S. (2005). Instrumentality, Aesthetics, and Symbolism of Office Design. Environment and Behavior, 37(4).

MACDONALD, R. (2000). Urban Hotel: Evolution of a Hybrid Typology. Built Environment (1978-), 26(2), 142-151. Retrieved from http://www.jstor.org/stable/23288854

Beorkrem, Christopher. 2013. Material Strategies in Digital Fabrication.

Hebel, Dirk. 2014. Building from Waste : Recovered Materials in Architecture and Construction.Ba: Birkhäuser.

Sandaker, Bjørn Normann. 2008. On Span and Space : Exploring Structures in Architecture.London: Routledge.

Brennan, A., Chugh, J. S., & Kline, T. (2002). Traditional versus Open Office Design: A Longitudinal Field Study. Environment and Behavior, 34(3).