Siheyuan: Refurbishing an Auckland childcare centre using traditional Chinese courtyard typologies.

Sida Chen

Master of Design (Spatial) May, 2019

Contents

Attestation of authorship

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the Acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."

Signature :

Acknowledgement

I would like to express my thanks and gratitude to my supervisor Dr Carl Douglas, who generously helped me with this project. He also gave me a lot of support and the confidence to do this project.

Thanks to AUT spatial design classmates for their valuable feedback on the practical stage of my research.

Thanks to my family always to support me.

Thanks also to Christine Gillen for proofreading the text.

And I also want to thanks to myself , for not forgetting my original research intention and insisting on completing the research project.

Abstract

Cities can be alienating places for children. In the fast processes of urbanization children are often deprived of the opportunity to be part of a local social environment. In this study, I use Chinese courtyard spaces as a model for redesigning a rooftop daycare centre in Durham Street, in Auckland CBD. I have developed and presented my design concept for a kindergarten in the form of a visual narrative. I employed a mixed methods approach drawing on aspects of the Design Thinking methodology and visual storytelling. The narrative comic book exhibited as the culmination of this project conveys the social world of children in the courtyard kindergarten, expressing life situations, instead of pure architectural design. This exegesis is divided into five chapters: an introduction, a discussion of *siheyuan* courtyards and contemporary kindergarten spaces, a discussion of my methodology and methods, an account of my design development, and a conclusion pointing to the outcomes of my research. I hope through this work to demonstrate first, the value of *siheyuan* for reimagining childcare spaces; and second, the value of narrative techniques for describing living spaces.

Chapter 1 Introduction

Chapter 1 Introduction

1.1 Research Overview

Figure 1. Sida,C. 2018, A *siheyuan* courtyard house, Beijing.

In this research, I product a contemporary courtyard kindergarten in city CBD by exploring and analysing the social-culture, material and spatial quality of the traditional Chinese *siheyuan* courtyard house typology. My research asks how this traditional typology, applied to the design of contemporary urban childcare spaces might create a counterpoint to the alienation of contemporary urbanization.

Cities can be alienating places for children. In the fast process of urbanization, the non-humanity property of city widens the distance between children's residence and entertainment space. Especially, children have been deprived of the opportunity to personally access the local environment in the city. [1] I use Chinese courtyard spaces as a model for redesigning a rooftop daycare centre in Durham Street, in Auckland CBD (Figure 2). Chinese courtyards are dynamic and relational spaces, and I want to make the daycare a place for children to live out their own magical stories and build new relationships. To realize this aim, I narrate the unique experience of children in courtyard space through a visual narrative book.

Figure 2. Sida,C. 2018, Lollipops roof kindergarten, Durham street west , Auckland City.

---

1. Christopher Spencer and Marc Blades. *Children and their environments: Learning, using and designing spaces*, (Cambridge: Cambridge University Press, 2006),108.

My personal growth background is the original intention of my research is from. As a researcher from China, I attempted to take *siheyuan* courtyard and children's space as research subjects, because my childhood memory of living in *siheyuan* is unique. In my childhood memory, it was a happy, natural and highly secure feeling. Unfortunately, when I saw most of the Chinese children are living in high cement nowadays, and current *siheyuan* is also confronted with a lot of existing problems. As a designer, this has aroused my sympathy, and I hope this project will convey to more people the unique experience of my childhood in the courtyard. In addition, this project also aims to call on more people to pay attention to the impact of urban alienation on contemporary children and appeals to more people on the charm of courtyard space. Therefore, that is the reason why I have the idea of choosing *siheyuan* typology as a friendly space for contemporary children.

For the past few years, architecture communication instruments and skills have been continually enriched by a great many sources including film, comic, photography as well as information graph. [2] Many architects combine architectural drawing with narrative to describe undervalued buildings and use them as a tool of architectural communication. To highlight the unique experience of courtyard design and emphasize the understanding of the courtyard space, I decided to use an architectural narrative cartoon as this research project design work. In my research process architectural visual narrative, as an important research method, helps me explore the potential of describing the relationship between people and space.

1.2 Challenges and Opportunities

There are three particular challenges in this research:

In this research project, the first and most important challenge is cultural background differences. The redesign project is located in Auckland CBD area, but *siheyuan* is a Chinese historical building. How do I apply a courtyard typology to a city with a different urban culture? How do I make the design relevant to people from different cultural backgrounds?

Secondly, this project site is located in the roof area of the fifth floor of a concrete building. I chose this area because the surrounding environment is a typical urban spatial structure. How can the open-air characteristics of the *siheyuan* courtyard be reasonably applied to the an interior refit under these conditions?

Thirdly, how do I envision the spatial experience of children in narrative ways?

2. Fabio Quici, 2017, "Architecture And Visual Narrative", *Proceedings* 1 (9): 1082, doi:10.3390/proceedings1091082.

Chapter 2 Contextual Review

Chapter 2 Contextual Review

2.1 The *siheyuan* typology

In Chinese, *siheyuan* means the term "quadrangle", *siheyuan* is a kind of classic courtyard house that was commonly found in north of China, most famously in Beijing and rural Shanxi.[3] As a classical quadrangle courtyard, *siheyuan* is a conventional form of architecture in North China, especially Beijing and Shanxi. The long-standing history of *siheyuan* may be traced back to Western Zhou Dynasty, approximately 2000 years from now. It fully reveals the prominent and fundamental architectural features in China.[4] Such native architectural style demonstrates intensive spatial and life features. To some extent, *siheyuan* is the landmark of Beijing by which people can have a better knowledge about the lifestyle of this famous city. Whether the home of ordinary people or "the Forbidden City" where Chinese emperors lived in the past dynasties, they all lived in this architectural form.

Siheyuan centered around a courtyard is composed of four parts, namely a main room facing southward, an opposite room facing northward, as well as another two rooms respectively in the eastern and western side. [5](Figure 4). Its architectural form reflects social and cultural values. For instance, the strict social hierarchy of ancient Chinese , the concept of "orderliness" advocated by Confucian culture and emphasizes *fengshui* (the Chinese traditional theory of geomancy).[6]

Figure 3. Top view of Beijing *siheyuan* , accessed March 22, 2019, http://kuaibao.qq.com/s/20190106A0XOW900?refer=spider.

To be specific, *siheyuan* is built in a symmetrical structure around the central axis. For sake of the privacy of residents, the courtyard is made as a closed space, simply with one gate connecting to the street for access. Free from the disturbance from outside world, it is very suitable for a whole family. Subject to the patriarchal system in ancient society of China, the head of a household lived in the main room, and the eldest son lived in the room in the eastern side. Other members in the family could only live in other rooms. This is affected by then hierarchy.[7] It reflects the orthodox concept of Confucian culture of "*The ruler rules, the minister ministers, the father fathers and the son sons."* [8] Besides, some researchers believe that this "closeness" is the weakness

3. "Siheyuan", 2019, En.Wikipedia.Org, accessed May 20,2018, https://en.wikipedia.org/wiki/Siheyuan.
4. Qijun Wang, 2019, *The Vernacular Dwellings Of China*, Ebook, 1st ed, China, http://www.cypressbooks.com/samples/9781784590154.pdf.
5. "Siheyuan Culture,The Culture Of Siheyuan", 2019, *Chinatourguide.Com*, http://www.chinatourguide.com/beijing/siheyuan_culture.html.

6. Ibid.
7. Ibid.
8. Mijung Park and Catherine Chesla,2007, "Revisiting Confucianism As A Conceptual Framework For Asian Family Study," *Journal Of Family Nursing* 13 (3): 293-311, doi:10.1177/1074840707304400.

of Confucian culture. However, this kind of building structure is very suitable for family living. Residents who lived there could enjoy the environment inside the courtyard without being disturbed by the outside world.
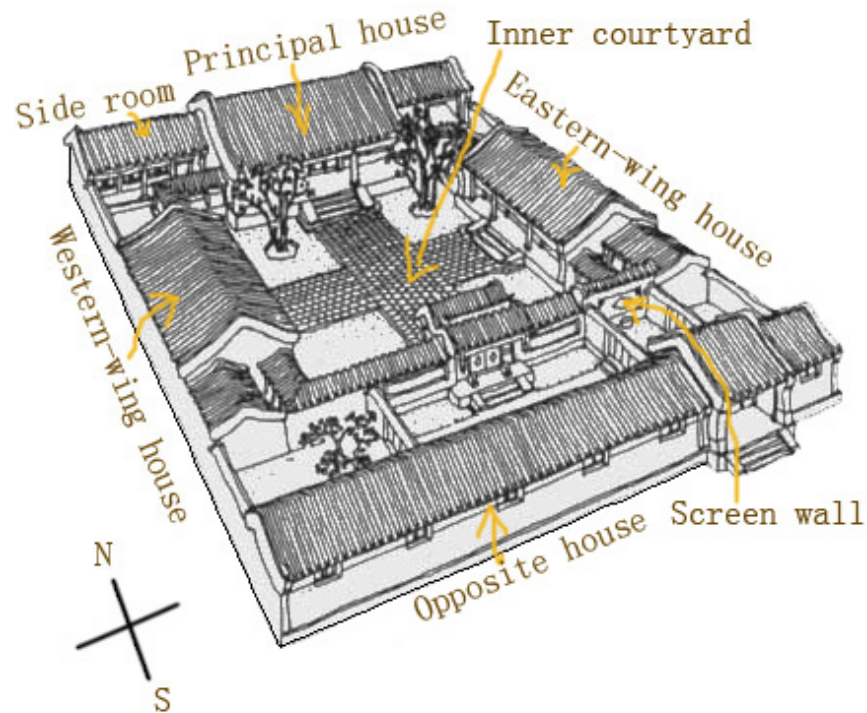
With the rapid development of urbanization in Beijing in the past 20 years, *siheyuan* as historical buildings are divided into two categories according to their functions: residential and non-residential. Nowadays, modern people seldom choose to live in *siheyuan*. One reason is that a few private *siheyuan* with better protection have been stirred up to a high price, which ordinary people cannot afford at all. The other reason is that most of the *siheyuan* are old and broken, which are too ruined to be suitable for modern people to live in. In non-residential *siheyuan,* most of them have been transformed into commercial space, and into courtyard restaurants and hotels in order to attract a large number of foreign tourists.[9]

Figure 5. Left, part of the *siheyuan* current situation in Beijing *Linjing* hutong, accessed October 1, 2018, http://news.163.com/14/0512/03/9S0VJ56A00014AED_mobile.html.

Figure 6. Right, part of the *siheyuan* current situation in Beijing *Linjing* hutong, accessed October 1, 2018, http://news.163.com/14/0512/03/9S0VJ56A00014AED_mobile.html.

Figure 4. The sketch map of a small *siheyuan* ，accessed September 10, 2018 ，
http://www.chinatourguide.com/beijing/Siheyuan_Culture.html

9. Qian Guo and Yuan Ping Liu, 2014, "Study On Beijing'S Hutong And Siheyuan: Renovation And Development", Advanced Materials Research 1065-1069: 312-316, doi:10.4028/www.scientific.net/amr.1065-1069.312.

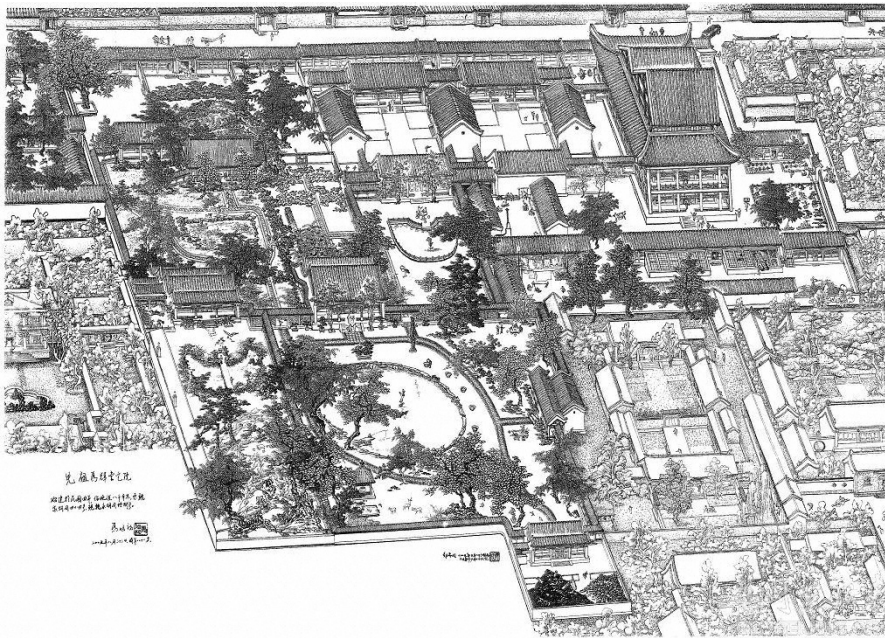## 2.2 The Chinese Courtyard Garden typology

Figure 7. Xicheng Zheng, *the sketch of No. 18 House in Weijia Hutong,* 2012, Hometown draw Yi Series: Old Beijing's Courtyard Houses (Academy Press).

Linked to the *siheyuan* typology is the Chinese courtyard garden. In the past, people who could build private gardens in the *siheyuan* , mostly depended on their money and interest. In the "Beijing *Siheyuan*" listed in the Qing Dynasty Beijing House Garden, there are 114 *siheyuans* with private gardens. [10]The private gardens in Beijing are influenced by the gardens in the south of the Yangtze River, but they had their own style. The *siheyuan* with private gardens has a perfect structural building system, and thus that people could cultivate their sentiments at home. More importantly, it also could bring people a sense of returning to nature. As a Chinese researcher, I

know the importance of these gardening techniques adopted by most designers in today's Chinese design circle.

Chinese famous scholar Lin Yutang mentioned that "Art is to make full use of the limited things and to give full play to human imagination." This sentence can be used to describe the private garden in the *siheyuan*. The idea of "天人合一" "*harmony between man and nature*" is an important theme in the design of private gardens. Even using the mountains (sometimes just a small mound of soil, sometimes just stacked pieces of Taihu Stone), water (a very small area of pond water and short "stream"), trees, pavilions, bridges and others. Those are basic components to create the landscape in garden.

---

10. "北京四合院中的私家花园_北京旅游网", 2016, *3G.Visitbeijing.Com.Cn,* accessed July 21, 2018, http://3g.visitbeijing.com.cn/a1/a-XCBLA8E4227FB0B448F2FD.

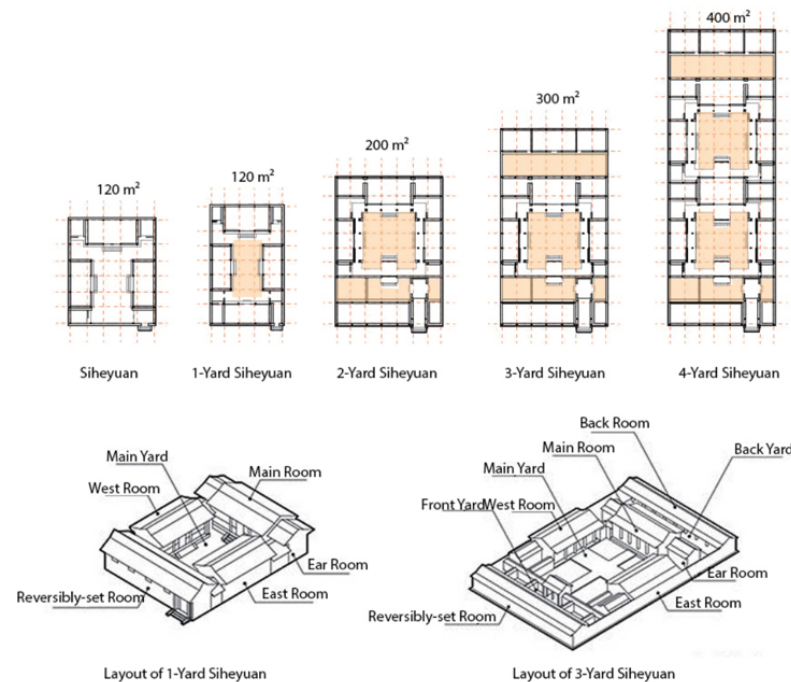## 2.3 Summary of Key Features of Chinese Courtyard Typologies

Figure 8. Lan Ma, *Example of siheyuan layouts,* 2014, An analysis of Beijing's hutongs and siheyuans: an urban tree approach, accessed March 12, 2019, https://etda.libraries.psu.edu/catalog/22841.

I have identified three important characteristics of the *siheyuan* to be relevant to my future design.

1.Symmetrical enclosed rectangular space

The biggest feature of the *siheyuan* is the enclosed central space open to the sky. Its overall structure is symmetrical and enclosed by walls in all directions ensures high privacy and confidentiality. Moreover, as it is simply connected to the outside world by a gate outward, it is very suitable for a big family. Thus, it can be seen that such architectural structure fully shows the typical introverted and implicit personality of Chinese people. [11]

The central axis layout reflects a major feature of the *siheyuan*. The main room is always on the central axis, also explaining why the varied activities all opening into a central open courtyard space. The types of *siheyuan* are multiple (Figure 8). It is always composed of basic units. A standard *siheyuan* is consolidated by four houses, which is the basic unit of the courtyard. There also have two-yard *siheyaun*, three-yard *siheyuan* and so on. In Beijing, the large *siheyuan* can be as many as seven or nine into the courtyard. In addition to the main courtyard of the middle road, there are East-West cross-courtyard on both sides, which can be called "deep house courtyard".[12]

2 . The central trees and landscape
The second key feature of *siheyuan* is that there must be trees in the standard courtyard. The main reason is that Beijing is situated in the humid continental climatic region. Affected by monsoon, the city is very dry and seriously threatened by water shortage problem Back to then Qing Dynasty, only royal gardens or noble private courtyards enjoyed the privilege to build a large garden inside their *siheyuan*. [13]

11. "Siheyuan Culture,The Culture Of Siheyuan", 2019, *Chinatourguide.Com,* http://www.chinatourguide.com/beijing/siheyuan_culture.html.

12. Lan Ma, 2014, "An analysis of Beijing's hutongs and siheyuans: an urban tree approach", *The Pennsylvania State University.*
13. Ibid.

Figure 9. Mei Chen, *Yueman Qing Tour Map*, 1738, Silk scroll painting, The Palace Museum, Beijing, https://www.dpm.org.cn/collection/paint/228746.html?hl=

such a fundamental spatial layout, most of such multi-courtyard *siheyuans* are simply enriched by more trees. As a general rule, traditional one-courtyard *siheyuan* has two or three small yards, in which one or two trees are grown before the main house and the others before the gate. In terms of two-courtyard *siheyuan*, there will be three or four trees before the main house. Other trees are grown in the front yard. For three-courtyard *siheyuan* and four-courtyard *siheyuan*, there will be five to eight trees before the main house and likewise. Other trees are still grown in the front yard by that analogy. [14]

With such a special courtyard structure inside the complex, *siheyuan* successfully ensures the normal ventilation, lighting, drainage and circulation functions of all rooms. This is totally irrelevant to its outdoor spatial environment. [15] Therefore, trees and micro-landscapes gather in the family center, allowing residents to stay close to nature without leaving home.

Trees in the courtyard allowed residents to communicate and feel natural in the public space of their homes, which is one of the greatest charms of the courtyard. In historical documents, lots of Chinese art works of all dynasties used scenery to express their feelings and describe the pleasant life who lived in courtyard. The collection of Yueman Qing Tour Pictures in Beijing Palace Museum currently depicts the 12-month life of Royal concubines in the deep palace(Figure 9).

The number of trees in the courtyard is determined by the number of courtyards in one *siheyuan.* In general, most courtyards inside *siheyuan* will be paved with cross paths which exactly separate the whole space into four small sections. However, these sections are usually decorated by trees, flowers, artificial hills and even ponds at times. There is nothing special for those *siheyuans* with more courtyards. On the basis of

---

14. Lan Ma, 2014, "An analysis of Beijing's hutongs and siheyuans: an urban tree approach", *The Pennsylvania State University.*
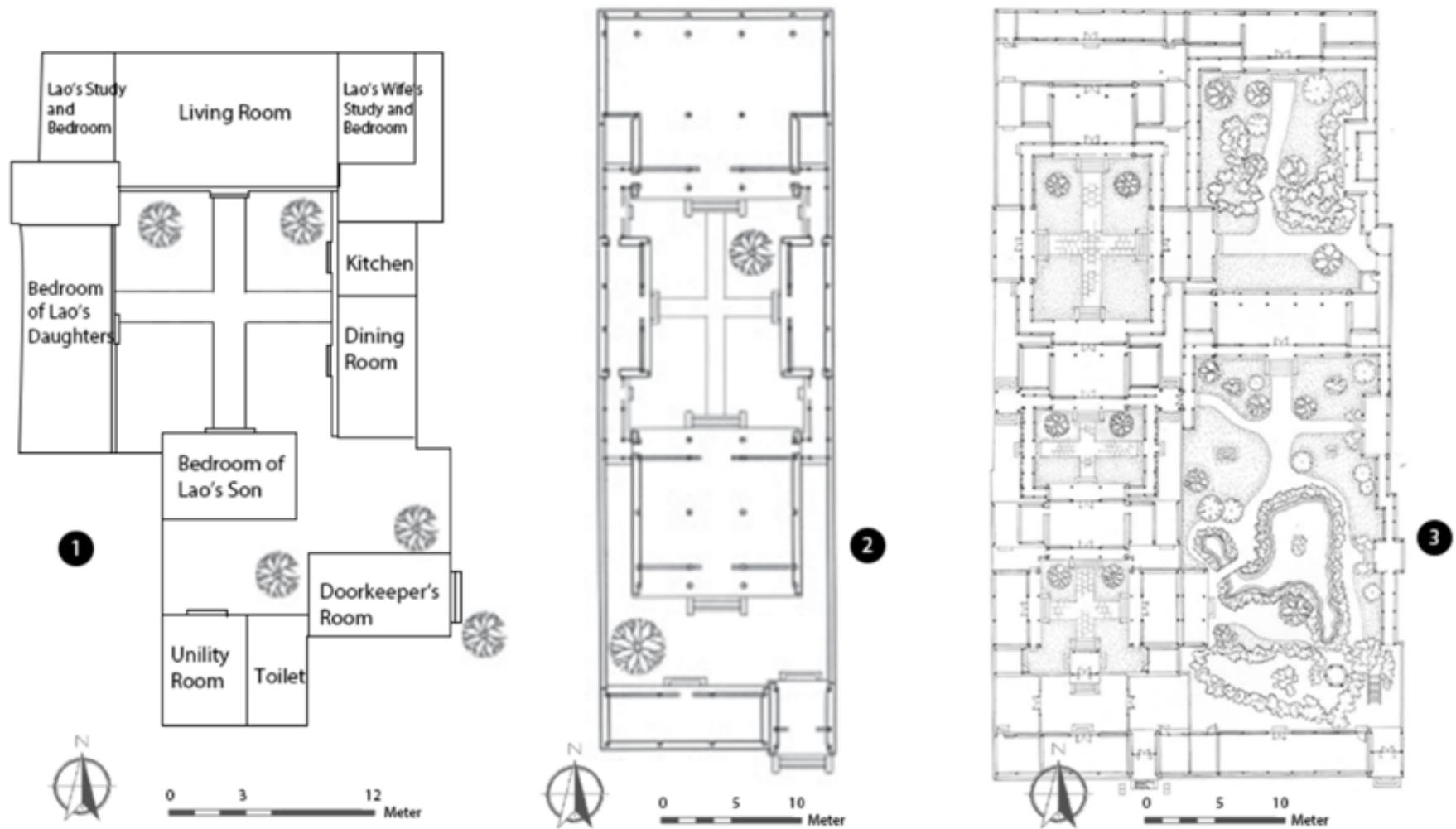
15. Ibid.

Figure 10. Layout of a Siheyuan. (1) Layout of Laoshe's Siheyuan; (2) Layout of Yuewei Studio; (3) Layout of Ke Garden, 2014, An analysis of Beijing's hutongs and siheyuans: an urban tree approach, accessed March 12, 2019, https://etda.libraries.psu.edu/catalog/22841.

3. The presence of multi-generational families

Siheyuan has strict regulations on the living arrangements of family members, reflecting the traditional concept of hierarchy and the traditional requirement of orderly growth and childhood in feudal society of ancient China. For one thing, the elders live in the main room, while the younger generation, such as the eldest son and the eldest daughter-in-law, live in the side or ear room. A family of multi-generational families distributes their rooms according to their generations.

Against the historical background of Anti-Japanese War, Chinese writer Lao She wrote a famous work titled *Four Generations under One Roof* in the year of 1944. 5 (abridged English version The Yellow Storm, Ida Pruitt, 1951)[16]. Mr. Laoshe's writing is exquisite and vivid. The novel about a common and quiet courtyard in Xiaoyang Hutong, peiping City, where a group of ordinary Peiping people live. After the Japanese occupied Peiping, their original life trajectory began to change. In that era of no human nature, ugliness is undoubtedly revealed, and goodness is also very precious. Though describing the lives of these four generations living in the *siheyuan*. I still feel a strong sense of drama, which may be one of the characteristics of Mr. Lao She's writing. From different perspectives, it embodies a major feature of the *siheyuan* "The presence of multi-generational families.

Figure 11. Xiao Ding, The comic drawing of *Si Shi Tong Tang*, accessed April 5, 2019, http://blog.sina.cn/dpool/blog/s/blog_49baf0b00100cvlm.html

16. "四世同堂（老舍著长篇小说）_百度百科", 2019, *Baike.Baidu.Com*, accessed June 22, 2018, https://baike.baidu.com/item/%E5%9B%9B%E4%B8%96%E5%90%8C%E5%A0%82/5388452.

4. Scenography

The following principles of the Chinese Courtyard Garden are drawn from "Discussion on Application of Landscaping Techniques of Chinese Gardens to Modern Interior Design, Jiang Liyuan. [17]

- o **Obstructive scenery**: It adopts some artistic methods to block the scene at the entrance of a garden.
- o **Enframed scenery:** The doors, the windows and the holes will often enframe the views after into a very beautiful picture.
- o **Adding view :** When a scenic spot is a little bit far from the viewer, kinds of flowers, trees, or other plants will be planted in the middle or near to the observers as a kind of transition.
- o **Borrowed scenery:** Designers may try to take advantage of peripheral environment, like remote hills or nearby trees in the park, to create visual illusion and virtually expand the space. It is a commonplace decorative means in typical Chinese gardens where designers often resort the scenery in other scenic spots. In this way, they not only trigger the curiosity of residents but also expand former closed space.[18]
- o **Leaking through scenery:** People will have a view from the hollow windows

Obstructive Scenery

Enframed Scenery

Borrowed Scenery

Adding view
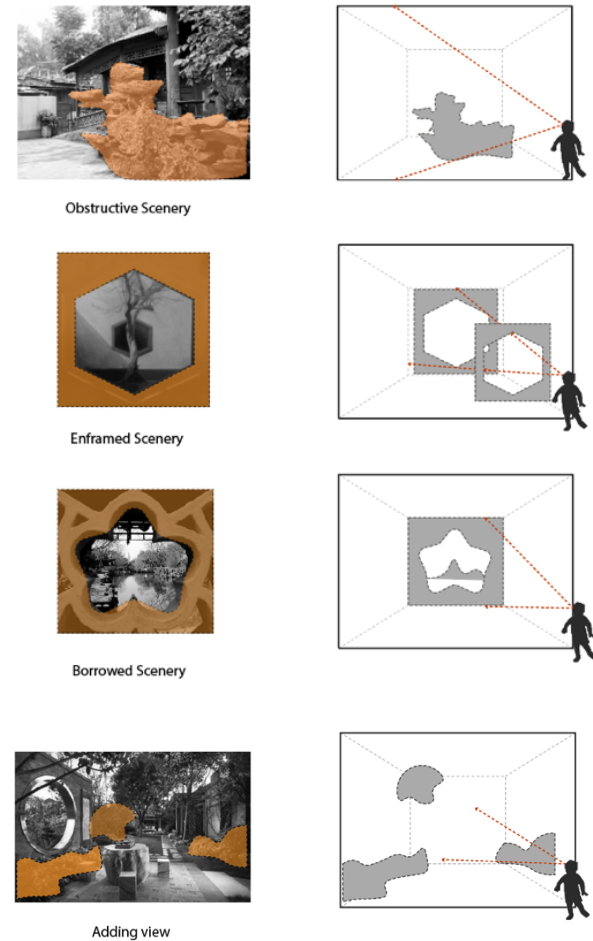
Figure 12. Sida,C. 2019. An analysis of Chinese courtyard garden design principles.

17. Liyuan Jiang, 2013, "Discussion On Application Of Landscaping Techniques Of Chinese Gardens To Modern Interior Design" 现代装饰理论 (5), http://www.qikan.com.cn/.

18. 2019, Allchinanet.Com, http://www.allchinanet.com/chinese_garden/chinese_garden_design_borrow.shtml.

2.4 Contemporary Case Study 1: Split Courtyard House by Trace Office

Figure 13. Split Courtyard House, accessed March 15, 2019, http://www.t-a-o.cn/split-courtyard-house.

There continue to be contemporary versions of *siheyuan* which exemplify some of these features. Split Courtyard House by Trace Architecture Office (TAO), this project is situated in a Beijing Hutong near to the Pagoda Temple, also known as Baitasi built in 1279AD. Actually, the site has been listed by Beijing city as one of the 33 historic conservation districts.   In this area full of historical deposits, people can fully experience the leisurely and relaxing Hutong lifestyle while seeing gray tiles, trees, pigeons, electric wires, bikes, etc. The site is adjacent to an intensive financial zone in the south, lined with office buildings and modern hotels.

Figure 14. The interior of Split Courtyard House, accessed March 15, 2019, http://www.t-a-o.cn/split-courtyard-house.
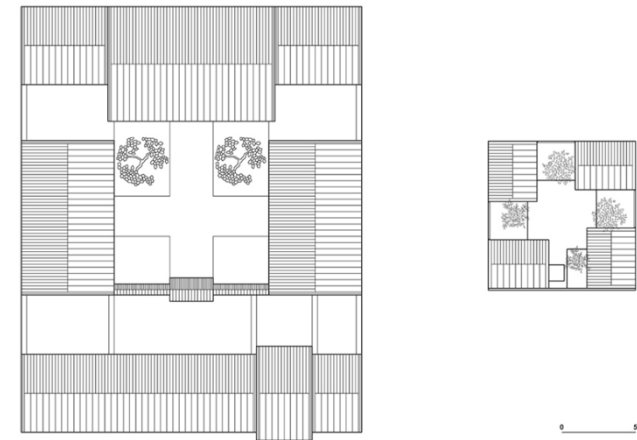
Figure 15. Comparison of scale between traditional courtyard house and Split Courtyard House, accessed March 15, 2019, http://www.t-a-o.cn/split-courtyard-house.

Figure 16. The corner of Split Courtyard House, accessed March 15, 2019, http://www.t-a-o.cn/split-courtyard-house.

The courtyard in the middle of the traditional *siheyuan* is the center deserved and all the rooms are facing it. However, TAO architect believes that this spatial layout corresponds to the traditional family life and no longer fits the personal lifestyle of today's young people. The idea is to divide the site into four groups of spaces and each consists of a room and a private courtyard, which are oriented in different directions, and eventually form a windmill-like layout. In this way, the privacy of each room and yard can be protected. Compared with traditional courtyard, this project is called Split Courtyard House that indicates the change from "harmony" to "division" revealing the change of social structure and living mode in housing.[19]

While I was inspired by this contemporary adaptation, splitting the courtyard into four parts undermines its social function. I hope, in my own adaptation using the key features outlined above, to maintain the courtyard as the core of people's lives.

19. Ibid.

2.5 Designing Learning Spaces for Preschool Children

The experience of preschool children is very important for their physical and mental development. [20] (Shonkoff 2009) claims that the foundation of a successful society is laid in the process of early childhood development. He is emphasized that children have access to quality education programs in early childhood, and they will have greater opportunities to become healthy and successful adults in society. [21] I believe that it is also important to have good childhood memories, and links to culture and traditions. Most regrettably, due to the impact of urbanization, many of these personal experience opportunities are missing for current children.

As shown by the research of (Olds 2001), an elaborately designed preschool activity program can effectively instruct children to observe and use materials properly. [22] As a matter of fact, the ultimate purpose of preschool environment, either indoor or outdoor, is to create a diversified and colorful space for children of school age. Moreover, as pointed out by (Campbell 2013), an appropriate childcare space should give enough chances for children to learn and discover more secrets. [23]And I really agree with that.

In the report made by Heidi Campbell and Evergreen , they suggested that in order to create an environment to promote the development of children, the following goals should be combined in the design of kindergartens:

• Safeguard and improve children's health and well-being
• Increase the diversity of natural features and play opportunities
• Enhance the use of the outdoors for inquiry- and play-based learning[24]

These goals express a vision that is particularly important in today's urban environment, in which children's experiences are changing rapidly while proving once again that today's opportunities for young children to connect with nature are limited. Previously, due to I focused on the knowledge field of *siheyuan*, I did not realize the importance of activity space for children's physical and mental development in kindergarten design. This led me to rethink about designing the courtyard as a space for discovery, development, play-based learning and roleplaying as well as intergenerational relationships.

2.6 Contemporary Case Study 2: Ouchi Kindergarten by Youji no Shiro

Figure 17. The interior of Ouchi kindergarten, accessed September 27, 2018, https://www.archdaily.com/805591/ks-kindergarten-hibinosekkei-plus-youji-no-shiro-plus-kids-design-labo.
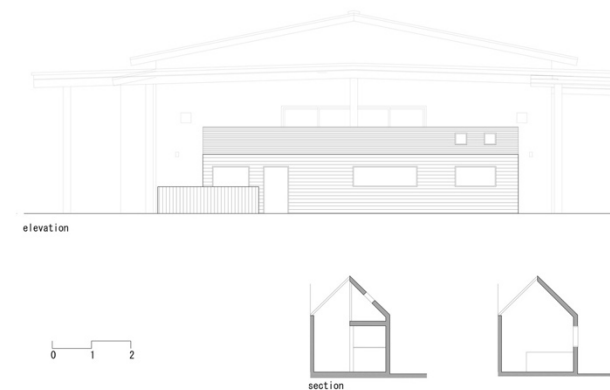
20. B. Ece ŞAHİN and Neslihan DOSTOĞLU, 2016, "INDEPENDENT ATELIER MODEL: SUPPORTING PRESCHOOL EDUCATION AND FUNCTIONAL REQUIREMENTS", *INTERNATIONAL REFEREED JOURNAL OF DESIGN AND ARCHITECTURE*, no. 9: 35-35, doi:10.17365/tmd.2016922561.

23. Jack P Shonkoff , 2014 , "Changing The Narrative For Early Childhood Investment" , *JAMA Pediatrics* 168 (2): 105. doi:10.1001/jamapediatrics.2013.4212.

24. Tim Olds，2001，"Modelling Human Locomotion"，*Sports Medicine* 31 (7): 497-509，doi:10.2165/00007256-200131070-00005.

23. Heidi Campbell, 2013, Landscape And Child Development, Ebook,1st ed, Evergreen.

26. Ibid.

Figure 18. The interior of Ouchi kindergarten, accessed September 27, 2018,
https://www.archdaily.com/805591/ks-kindergarten-hibinosekkei-plus-youji-no-shiro-plus-kids-design-labo.

Ouchi Kindergarten, by Youji no Shiro includes a small playhouse, with a total area of 15.16 sqm, constructed in wood. Youji No Shiro expects to deviate from conventional design of toys and childcare centers and release a role-play space where children can interact with their parents in the physical world. The small space is equipped with a variety of facilities, including kitchen, table, laundry and even wood furnace. Therefore, children can experience the lifestyle of grown-ups by doing cooking, decorating the table, washing kitchenware, switching on the heater and even doing the laundry. This concept believes that it is essential to permit children to explore the ‘ouchi’   with full freedom and less direct interference from teachers. My research is greatly inspired by his conception, for the reason that it presents a totally novel mode of education. [25] Additionally, his work helps me imagine the spaces that connect to the courtyards.

25. "Ouchi / HIBINOSEKKEI + Youji No Shiro + Kids Design Labo", 2018, Archdaily, accessed September 27,
https://www.archdaily.com/805591/ks-kindergarten-hibinosekkei-plus-youji-no-shiro-plus-kids-design-labo.

Figure 19. Ouchi kindergarten, accessed September 27, 2018, https://www.archdaily.com/805591/ks-
kindergarten-hibinosekkei-plus-youji-no-shiro-plus-kids-design-labo.

elevation

0   1   2

section

Figure 20. The elevation of Ouchi kindergarten, accessed September 27, 2018,
https://www.archdaily.com/805591/ks-kindergarten-hibinosekkei-plus-youji-no-shiro-plus-kids-design-labo.

2.5 SUMMARY

In this contextual review, I have carried out a multi-angle study of the *siheyuan* courtyard, and identified a number of key features that make it particularly suitable for designing spaces for children to learn through play. (I have been selective. There are more characteristics of the courtyard which I have not considered, such as *feng shui*). In the following chapters I will show how the selected characteristics have informed both my development of the kindergarten itself, and my visual approach to describing it.
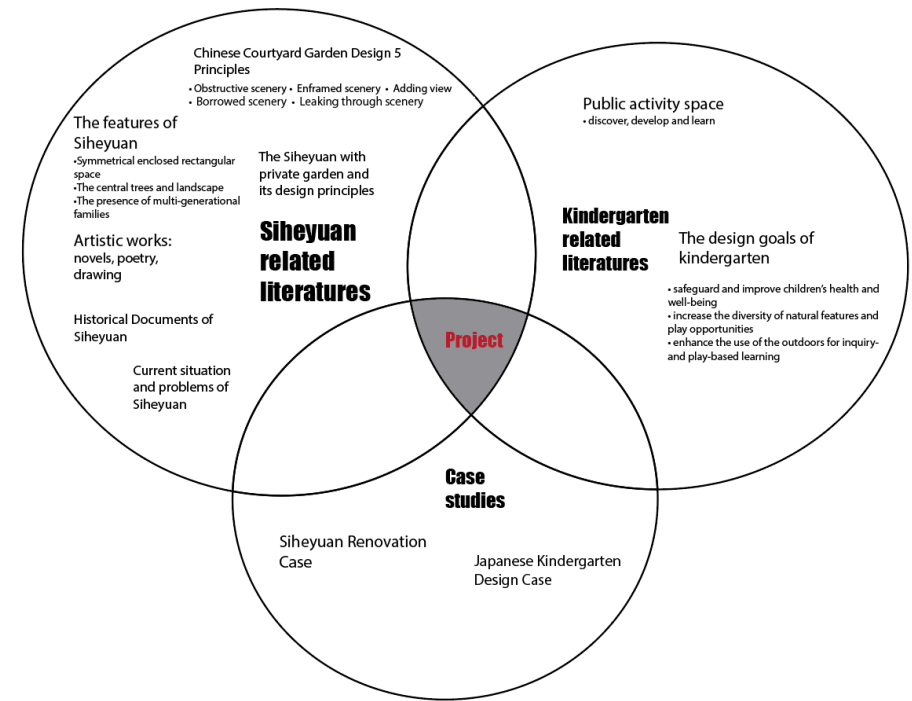
Figure 21. Sida,C. 2019, Contextual Review Mapping.

Chapter 3 Methodology

Chapter 3 Methodology

This project aims to develop a design concept for a kindergarten in the form of a visual narrative. The project is designed for an actual location (see Chapter 4), but does not respond to a specific client-led brief. This is why I can take a fresh approach to imagining what an educational space might be, without being locked into existing educational models. I have been influenced by the Design Thinking model, particularly its emphasis on empathising with users and a problem-finding approach. The project has been developed iteratively using digital modelling and the production of digital and hand-drawn image sequences. This emphasis on visual storytelling helps me to focus on the first-person experiences of children, and observes the spaces in the context of daily life.

3.1 Design Thinking
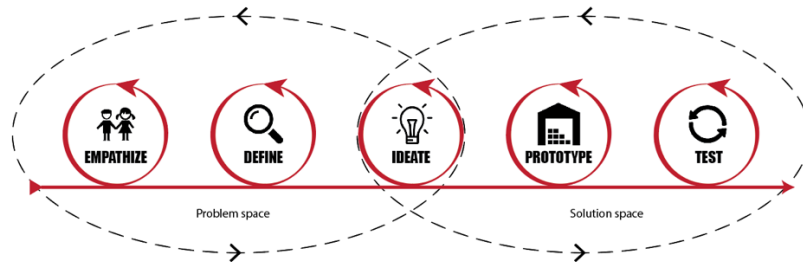
Figure 22. Sida,C. 2019, The Design Thinking Process.

The design thinking is to find an optimal solution for users beset by tough problems. This implies that the design project does not aim to solve problems, but to create a beautiful future by problem-solving procedures. By virtue of logic, imagination, intuition and reference, this project explores the possibility of things and pursues results

favorable to users.[26] Design Thinking draws upon logic, imagination, intuition, and systemic reasoning, to explore possibilities of what could be—and to create desired outcomes that benefit the end user.[27] This methodology has effectively guided my research project to be innovative are under reasonable logic , rather than all the ideas coming from imagination. In my research process I am focusing on the first phase : (empathise, define, ideate) testing are outside the scope of this project.

 I have researched the social, historical and cultural background of *siheyuan* by contextual review, built a model around the relevant features of *siheyuan,* and determined that urbanization would cause changes in children's living environment today. The idea of creating opposition points for urban alienation needs to be met by visual narrative methodology, which design thinking process to establish standards for the project.

In my research, I have worked to develop empathy for preschool children.   I visited a working childcare centre, and found that whether in Auckland or Beijing, some of the children have to face the limitations of urbanization. This situation recalled my own free and happy childhood. I also watched a movie that young children as the main characters who lived in courtyard kindergarten called *"Little Red Flowers".* In order to understand the Kindergarten under the background of Western education, I asked people at an exhibition of work-in-progress to write down their memories of childhood and tried to describe my narrative story from the perspective of children. All of the works has helped me understand the "children's inner world" more comprehensively and reminded of my responsibility as a designer, hoping to make some changes for children in kindergarten design.

During the Define stage, I put together the information and gathered during the Empathise stage. In this stage , it should seek to define the problem as a problem

26. Linda Naiman, "Design Thinking As A Strategy For Innovation", *Creativity At Work,* accessed May 21, 2018, https://www.creativityatwork.com/design-thinking-strategy-for-innovation/.

27. Ibid.

statement in a human-centred manner.[28] Because the Define stage will help the designers in team gather great ideas to establish features, functions, and any other elements that will allow them to solve the problems or, at the very least, allow users to resolve issues themselves with the minimum of difficulty.[29] In fact, I confront a lot of problems at this stage, but I think the following questions are the most important ones.

- How might I apply a courtyard typology to a city with a different urban culture?
- How might I let children experience traditional courtyards?
- How might I make the design relevant to people from different cultural backgrounds?
- How might the open-air characteristics of the *siheyuan* courtyard be reasonably applied to the rooftop building?

The ideate stage can start to "think outside the box" to identify new solutions to the problem statement I have created and I can start to look for alternative ways of viewing the problem.[30] I understand that as a student of spatial design, modelling is a very important method, and it is also a process of trying many ideas. Therefore, I have done a lot of model design in this stage. For example, in order to avoid the "serious stereotype" conveyed by the traditional courtyard, influenced by the case analysis, I tried to use the "curve" to practice. After reading the literature, I got some inspiration from the design of children's scale and garden design principles and practiced their shapes with the visual height sketches of children aged 3-6. The most important idea was that I decided to express my work in a new way : a visual storytelling book.

3.2 Visual storytelling

At the beginning of the study, my idea was just to make a conceptual design of a courtyard kindergarten architecture. However, as the research progresses, in order to emphasize children's experience of traditional courtyard space , I found that it is more important to show the interaction between people and architecture.

A visual narrative methodology helps me explore how children will see and experience the space I am designing. "Architectural Visual storytelling has been up until even just recently, of understanding architecture and communicating its value; rather it is a new, expanded way of perceiving it, where architecture becomes, in itself, part of communication, a tool of and for communication. "[31] Storytelling drawing is thus an important component and form of expression within this project. This idea comes from the early reading of "Made in Tokyo" [32]and " a little bit of Beijing" [33] narrative architectural atlas, as well as the famous American cartoonist Chris Ware's "Building Stories".[34]
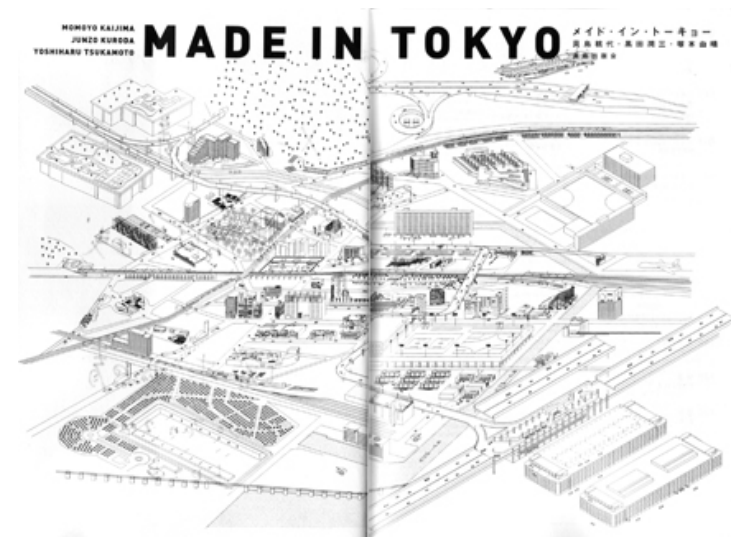
Figure 23. Atelier Bow-Wow, *A fabric of urban* deviance, Made in Tokyo, (Kajima Institute, 2001).

28. Sumeet Rikhy, 2018, "5 Stages In The Design Thinking Process", ALLAVANCE, accessed March 8, 2019, http://www.allavance.com/blog/5-stages-in-the-design-thinking-process/.
29. Ibid.
30. Ibid.
31. Fabio Quici, 2017, "Architecture And Visual Narrative", *Proceedings* 1 (9): 1082, doi:10.3390/proceedings1091082.

32. Momoyo Kaijima, Junzo Kuroda, and Yoshiharu Tsukamoto. 2012. *Made In Tokyo*. Tokyo: Kajima Inst. Publ.
33. Han Li and Yan Hu, 2013, *A Little Bit Of Beijing*, Tongji University Press.
34. Chris Ware, 2012, *Building Stories*, New York: Pantheon Books.

Figure 24. Li Han and Hu Yan, *Dashilar*, A Little Bit of Beijing, (Tongji University Press, 2013).

In the book "Made in Tokyo", the purpose of this guide book is basically to show an alternative method to understand the urban environment and even show a progression in time of an urban environment. [35]Within various drawings, the author Atelier bow wow like to show or present various attractions or even purpose-built constructions in which may seem very odd to be together. This oddness or even strange concept shows things like a carpark and shopping centre together or a highway through a mountain. He likes to portray this with a very simple map like drawings showing things together that create a new or different urban concept. And in the graphic book "A Little Bit of Beijing · *Dashilar*" drawn by the Li Han and Hu Yan. The design of this comic book was demonstrated ten cases selected from *Dashilar* Project. [36] Through the author's graphic novels, I have a new understanding of the relationship between drawings and the city. Those authors use the techniques of narrative illustrations to show architectural forms rather than architecture renderings. Those two books visual storytelling method break my understanding of traditional architectural drawings： Traditional models are shown in their works by the plan, elevation, section, and axonometric drawings. Not only that but also many details of life, such as interior decorations, characterization, and animals, need more attention in visual narration.

35. "Made In Tokyo: 15Th Year Update - Lys Villalba", 2019, *Lysvillalba.Net,* accessed May 5,2019, https://www.lysvillalba.net/Made-in-Tokyo-15th-Year-Update.

36. JOSÉ JUAN B, 2015, "A Little Bit Of Beijing · Dashilar, By Li Han And Hu Yan | The Strength Of Architecture | From 1998", *Metalocus.Es,* https://www.metalocus.es/en/news/a-little-bit-beijing-dashilar-li-han-and-hu-yan.

Figure 25. Chris Ware, *Fourteen printed works,* Build Stories, (Pantheon Books Press, 2012).

Chris Ware's works mainly discuss social isolation, emotional torture and depression. However, he would choose to use vivid palettes and vivid, detailed details.[37] Especially the work: "Building Stories" This graphic novel is a more novel narrative work, which is composed of 14 different works (flip book, newspaper, small book) in a game box. The buildings in the story are the main characters - they have souls, consciousness, and they witness life in their walls.[38] Ware mentioned that "it sounds crazy but if you start thinking about a building it can almost start to seem like a living organism through time." [39]His visual storybooks "building stories" make people feel empathy and compassionate for buildings –because the building is what people have experienced throughout the generations.

Figure 26. Sida,C. 2018, Looking outside from children's perspective in lollipops kindergarten, Durham street west , Auckland City.

Therefore, I decided to attempt to write my own story. I started by observing, and recording the environment around the site through photography and painting. I tried to see the city from the perspective of a child. To enable people from all cultural backgrounds to understand the original intention of my project, I found the differences between eastern and Western kindergarten life through comparing personal growth experience and collecting childhood memories of my Western classmates. I associate my own experience (eastern cultural background) with western memory to create an easy story plot. More importantly, narrative drawing also shows the unique characteristics of the courtyard.

37. "Chris Ware", 2018, En.Wikipedia.Org, accessed May 4, https://en.wikipedia.org/wiki/Chris_Ware.
38. "Object Empathy", 2019, *Flyleaf Graphic Design*, accessed May 5, 2019, http://flyleaf.studio/blog/object-empathy.
39. Ibid.

As a type of medium, cartoons even can spread serious contents, such as design suggestions, which can be found even in books of architectural history. [40]From the representative of radical movement in the 1960s and 1970s to the initiator of contemporary architecture, cartoons have become real tools of communication. Generally, cartoons are a type of low-resolution medium, making them become a high-participation expression form. Therefore, as they can contact with extensive audiences, they are used strategically.

It is a new attempt for me to draw a narrative cartoon. In the course of this study, I explored the potential of visual narration to describe relations between people and space and found that, as a type of medium tool, visual narration could express the spatial experience expected by a designer directly and profoundly. As Fabio Quici mentioned that architectural drawings always lacked "time",[41] I added "timeline" and constructed a simple plot. Consequently, I could deeply realize dynamic perception of space, temporality of interior design and furniture and people's life and traces in buildings, for all of these required time factors. In the present study, the most intuitive manifestation was that I described scenes of children living in courtyards through architectural narration.

40. Fabio Quici, 2017, "Architecture And Visual Narrative", *Proceedings* 1 (9): 1082, doi:10.3390/proceedings1091082.

41. Ibid.

Figure 27. Top, Sida,C. 2018, Street environment, Durham street west , Auckland City.
Figure 28.. Bottom, Sida,C. 2018, Lollipops roof kindergarten, Durham street west , Auckland City.

Figure 29. Top, Sida,C. 2018, Lollipops roof kindergarten, Durham street west , Auckland City.
Figure 30. Bottom, Sida,C. 2018, Lollipops kindergarten lunch time, Durham street west , Auckland City.

Chapter 4 Concept and Design Development

Chapter 4 Concept and Design Development

4.1 Site Selection and Analysis

Regarding the site, this project kindergarten is located at the rooftop of a commercial building on Durham Street, CBD, Auckland. With the permission of the kindergarten staff, I made detailed observations. (see figure.17). According to simple measurement of actual sites, original sites include a 40m x 23m rectangular roof on the fourth floor and a 12m x 12m square room on the third floor. The space does not cover an entire floor and is surrounded by tall commercial buildings (figure 18).

The main floor of the kindergarten concentrates on the roof of the fourth floor, while the elevator entrance of the third floor is a small part of the kindergarten. This kindergarten is very representative and many commercial shops are gathered around it. For my project, this is a very typical example of City kindergarten. Meanwhile, as a researcher from China, I feel very much for this kindergarten located in the commercial building, because this kindergarten situated in the commercial building is very common in China.

Observing and recording the surrounding environment is the beginning of my creation. Through field trip, it was clearly seen that the urbanization of the surrounding environment of kindergartens obviously, and there was large parking below the kindergarten. Every day when children go to kindergarten, they have to cross busy streets and squeeze into a narrow staircase to wait for the elevator. In kindergarten, I tried from the children's perspective, there are many tall buildings in front of me. Looking up was a huge plastic shed.

Figure 31. Top, Sida,C. 2018, Looking outside from children's perspective in lollipops kindergarten, Durham street west , Auckland City.
Figure 32. Bottom, Sida,C. 2018, Looking outside from children's perspective in lollipops kindergarten, Durham street west , Auckland City

4.2 Iterative Concept Development

The practice of building models is the most effective and visual design method for me. The attempted was conducted using the software Sketchup. Figure 19 presents an overview of this development.

In the first stage, I confined my thought to design of a single courtyard. I pursued unified holistic space from the very beginning. Later on, I tried to divide the third and fourth floors into two courtyards and build irregular classrooms. However, I found that two courtyards could not meet the optimum scale. According to my personal experience of living in *siheyuan*, I designed 25-30-square-meter courtyards, which can arouse a courtyard sense of me surrounded by rooms. In the second stage, I rotated the inner courtyard 45° clockwise. This broke the axial symmetry and balance of traditional courtyards. The model in the last stage is a satisfying scheme for me. The overall space follows axial symmetry of *siheyuan* and there is a big tree in each courtyard. I embodied spatial flexibility through different patterns and sizes of rooms and windows. The overall scheme becomes like a village or neighbourhood.
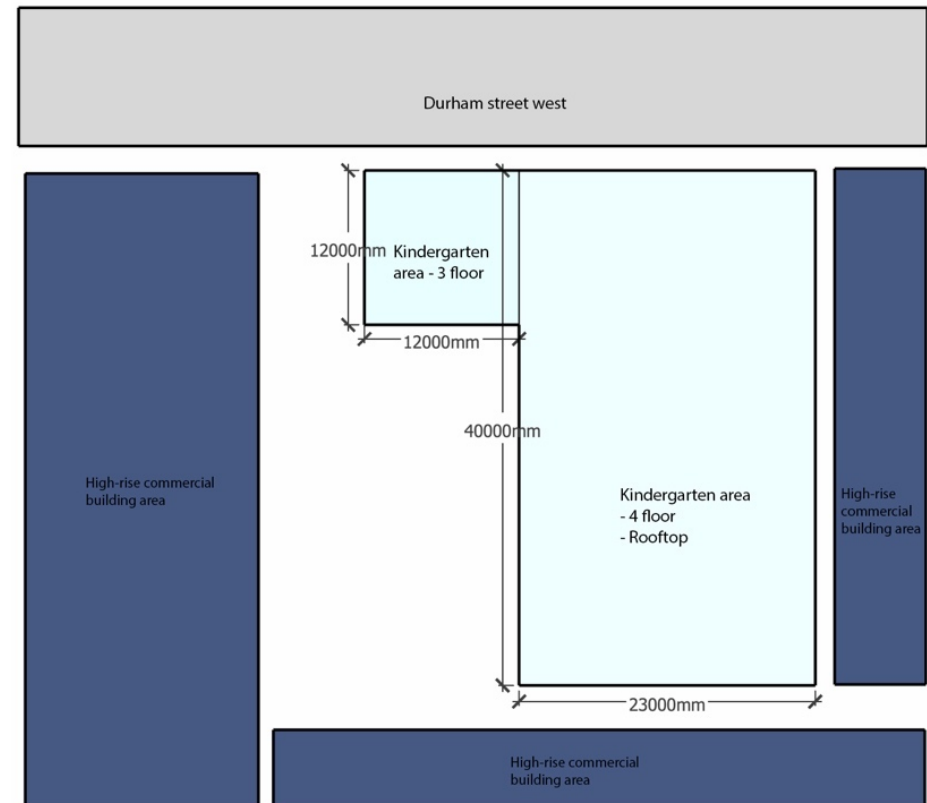
Figure 34. Sida,C. 2019, Original ground plan.
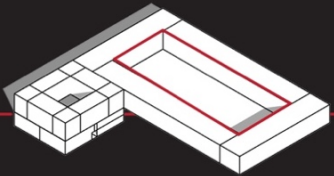
BUILD 1

1-Yard

1-Yard
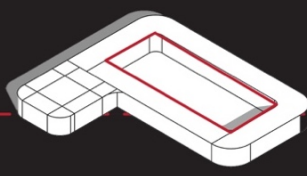
● Attempted to design the whole space as a curvilinear courtyard

1-Yard
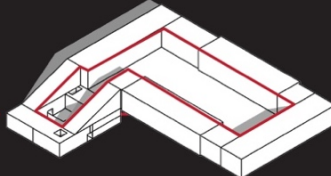
● Attempted to connect the two layers of space and turn it into a height difference courtyard space

2-Yard
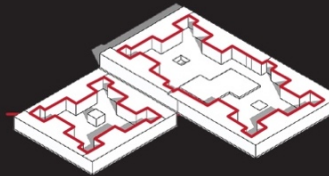
● Tried to divide buildings into irregular shapes to make space more active.

2-Yard
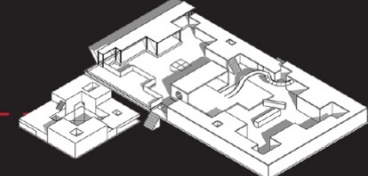
Due to the original site occupies a large area, I was afraid that too large yard design would lose the sense of space enclosed by the traditional yard, the number of yards has been adjusted. It was decided that three courtyards would be the best choice.

BUILD 2

3-Yard
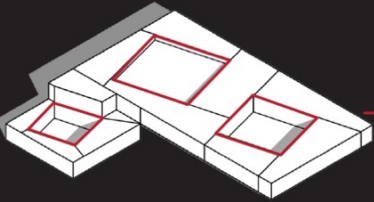
● Tried to rotate the 3 inner courtyards 45 degrees. ◢

3-Yard
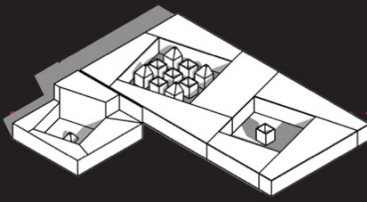
● Tried the idea of amini houses

3-Yard
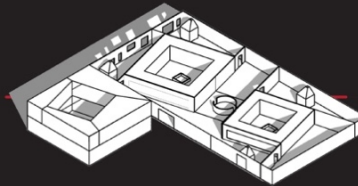
3-Yard
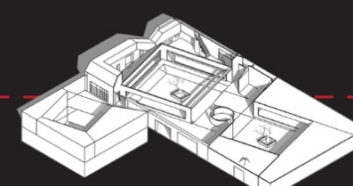
The second stage of modeling was a relatively bold attempt and deep modeling. However, from my own experience, although the modeling was innovative, it did not evoke my childhood courtyard memory.

BUILD 3

The central trees

Garden design principles

Stone animals at the entrance

Hutong

Figure 35. Sida,C. 2019, The overview of modeling development
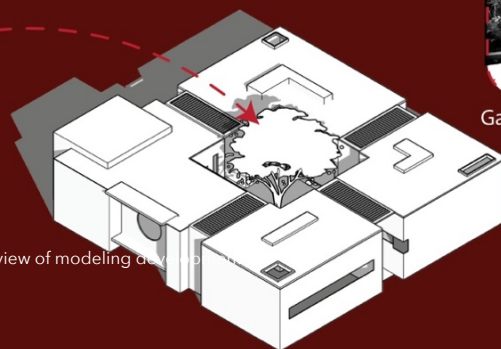
the unit yard
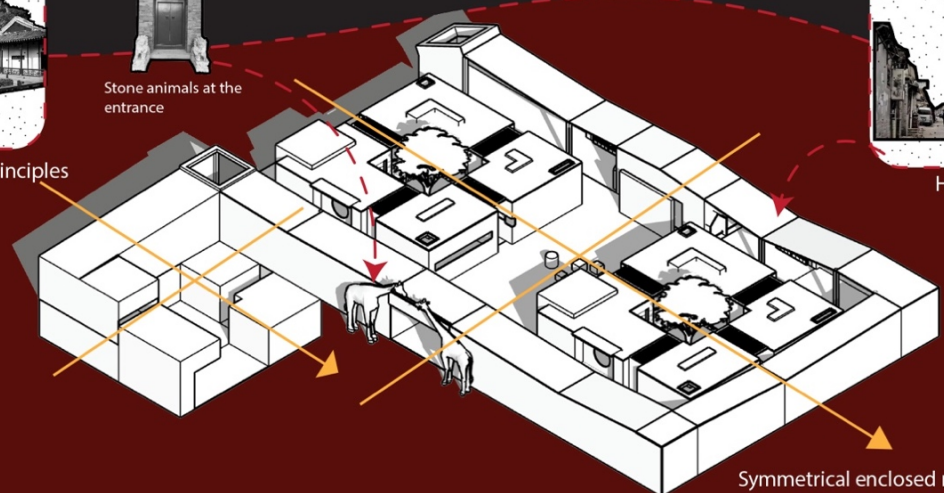
Symmetrical enclosed rectangular space

4.3 Design and development of Visual Narrative

While working on my design in Sketchup, I was also developing my
visual narrative techniques for conveying interaction between people
and architecture, and expressing life situations, instead of pure
architectural design.
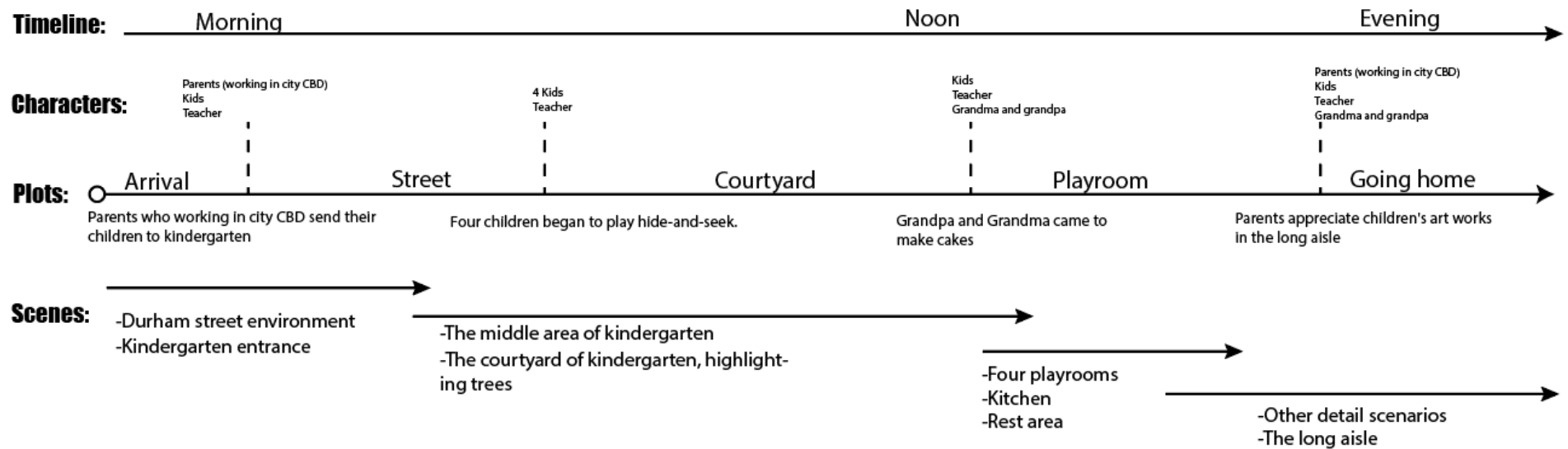
Figure 36. Sida,C. 2019, Story plots line.
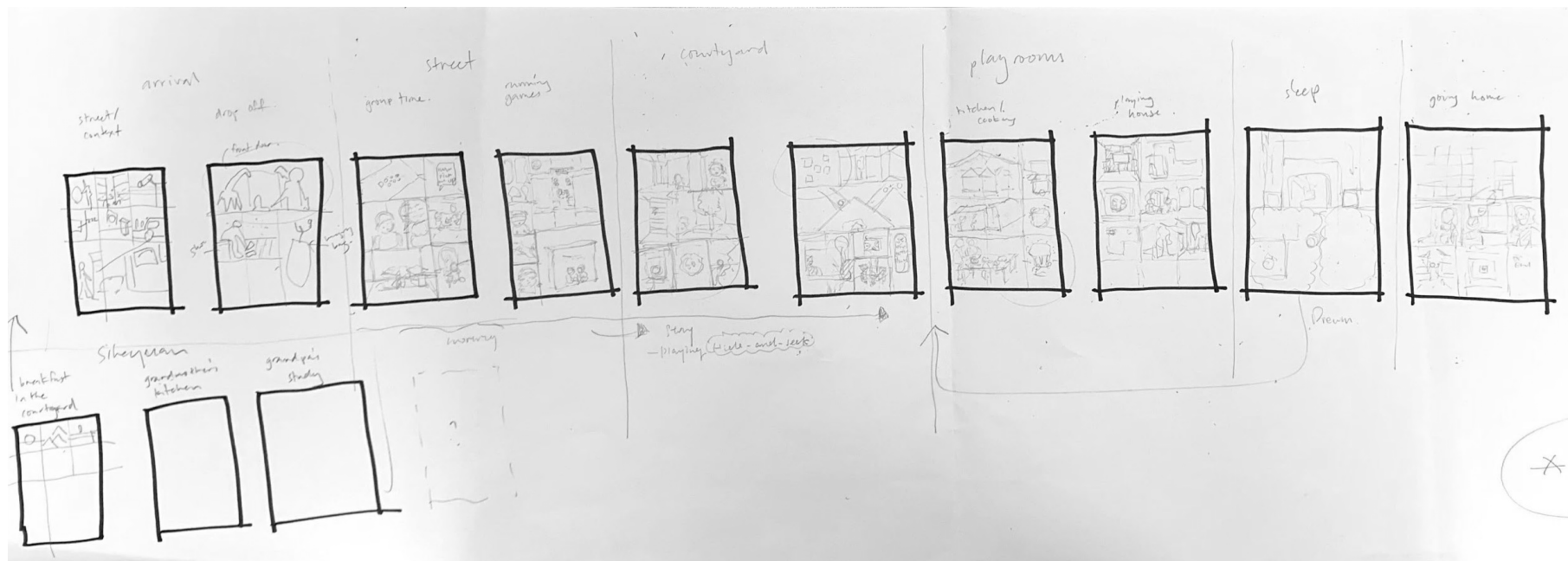
Figure 37. Sida,C. 2019, Narration board drawing

In developing my narrative, I set up a narration board to pre-design the whole story scenes (Figure37). The story is about a day in the courtyard kindergarten, where the layout of long shots, mid-shots and close shots of comic scenes should be considered.

In the early stage of drawing, I did some scene exercises, mainly through the software Adobe Illustrator and sketch up. Through drawing, I was trying to find my favorite conic style.
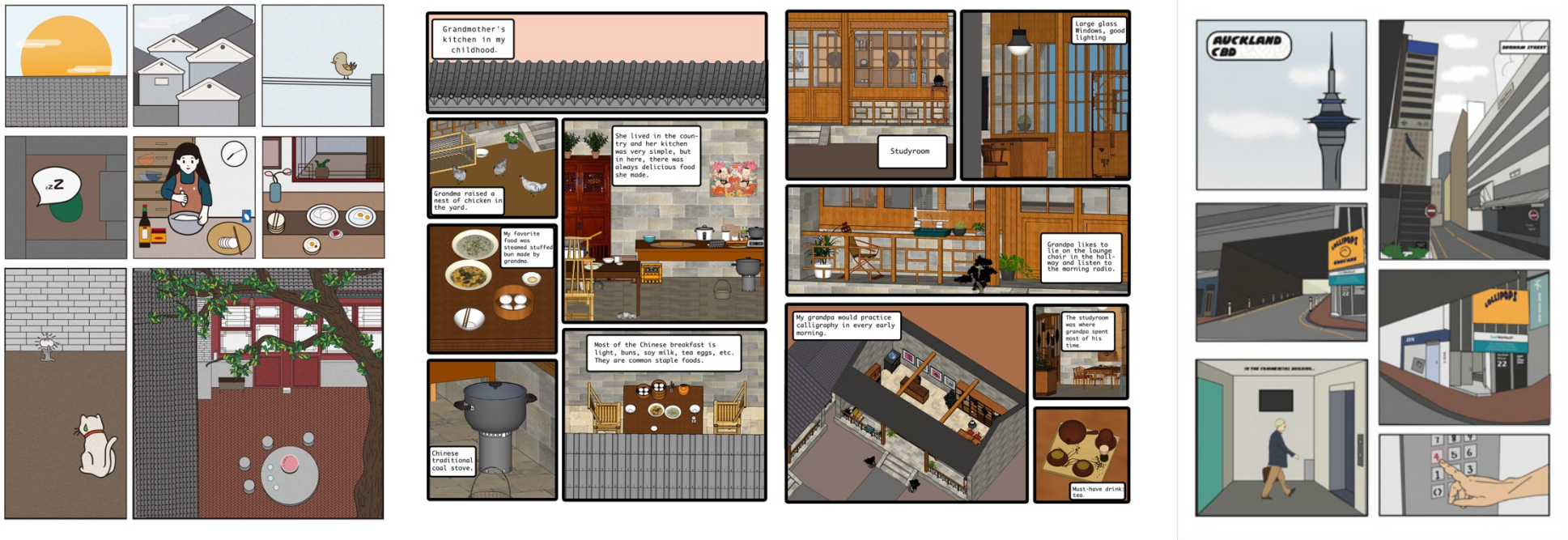
Figure 38. Left, Sida,C. 2018, Early narratives: my childhood memory of *siheyuan*.
Figure 39. Middle, Sida,C. 2018, Early narratives: my childhood memory of my grandfather's study room.
Figure 40. Right, Sida,C. 2019, Early narratives: Street environment.

Figure 41 Shows a draft page of my visual narrative. Here are four children as the heroes of the story. In order to show the whole space coherently, I created a hide-and-seek plot. Through the storyline of the little girl looking for other little friends, I tried drawing the courtyard and playrooms from different perspectives are presented to the audience. In addition, the tree in the courtyard is the important feature which I want to emphasize. The reason is that my personal childhood experience let me believe that the center of the courtyard has a tree that can increase the fun of children's activities. In this project, there are many scenes of children moving around the tree, which can help people deepen the impression of the characteristics of the courtyard.
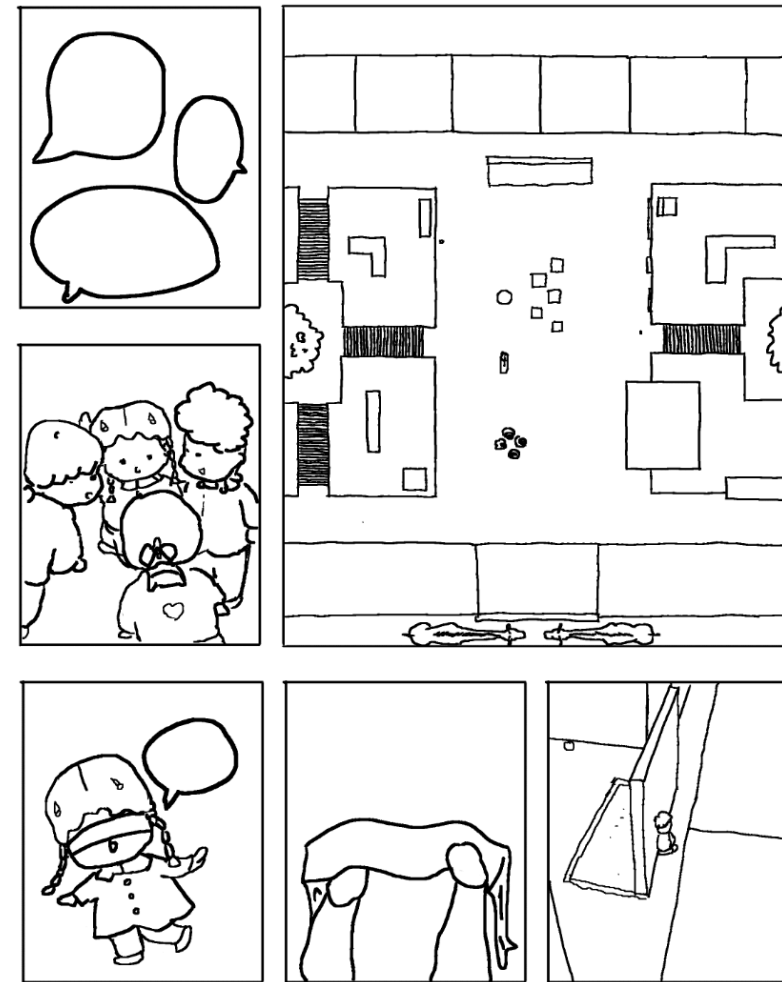
Figure 41. Sida,C. 2019, A draft page of visual narrative.

Figure 42 shows another draft page of my visual narrative. Parents in Western kindergartens are more participatory than I experienced in China. In order to embody the characteristics of three generations of the courtyard, in addition to the "parents" who work every day, I added "grandparents" to the story creation. When I was young, my grandparents grew up with me in the yard. I do not want to miss this part of memory. Thus, the picture of grandparents and children making small cakes together is added to the story.
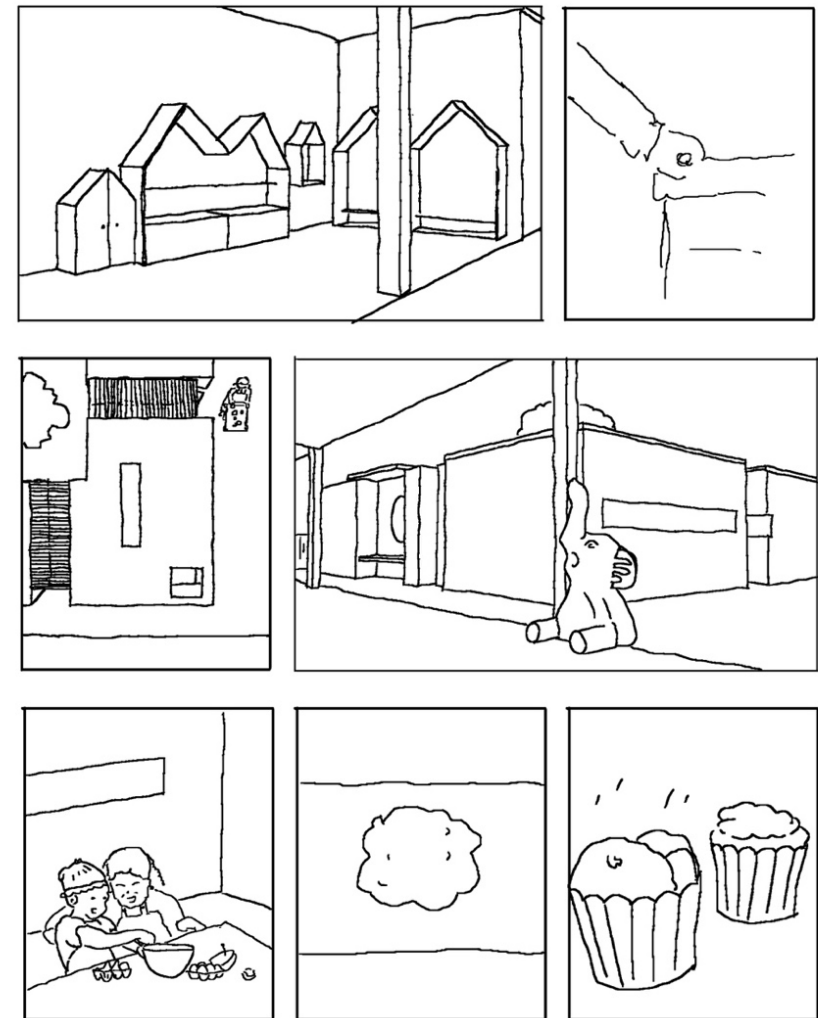
Figure 42. Sida,C. 2019, A draft page of visual narrative.
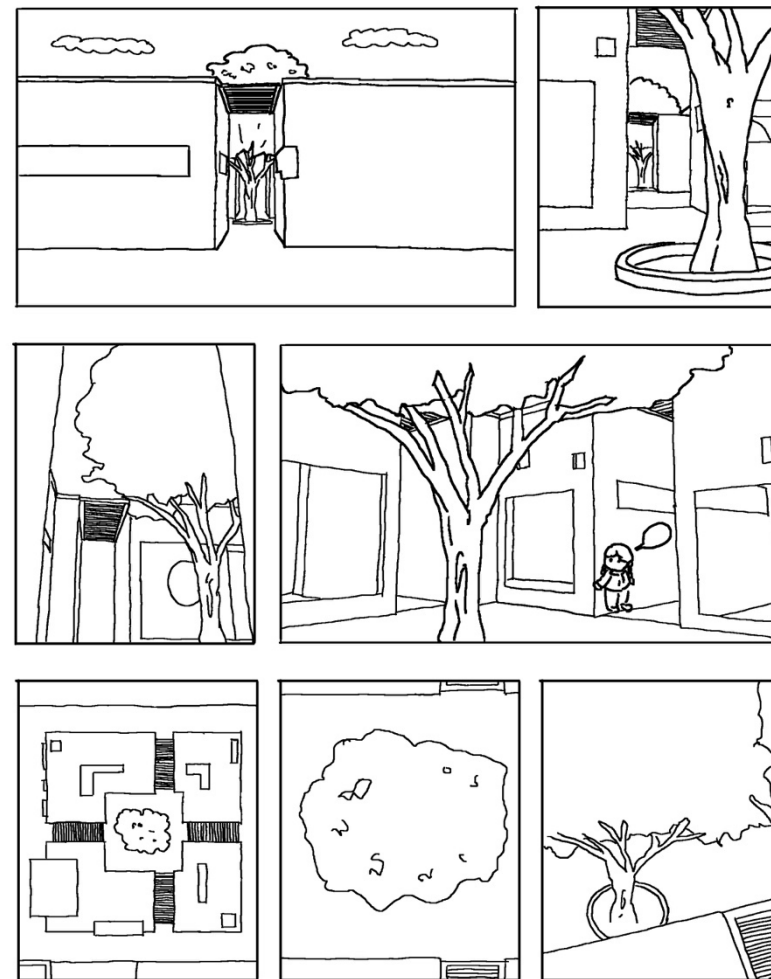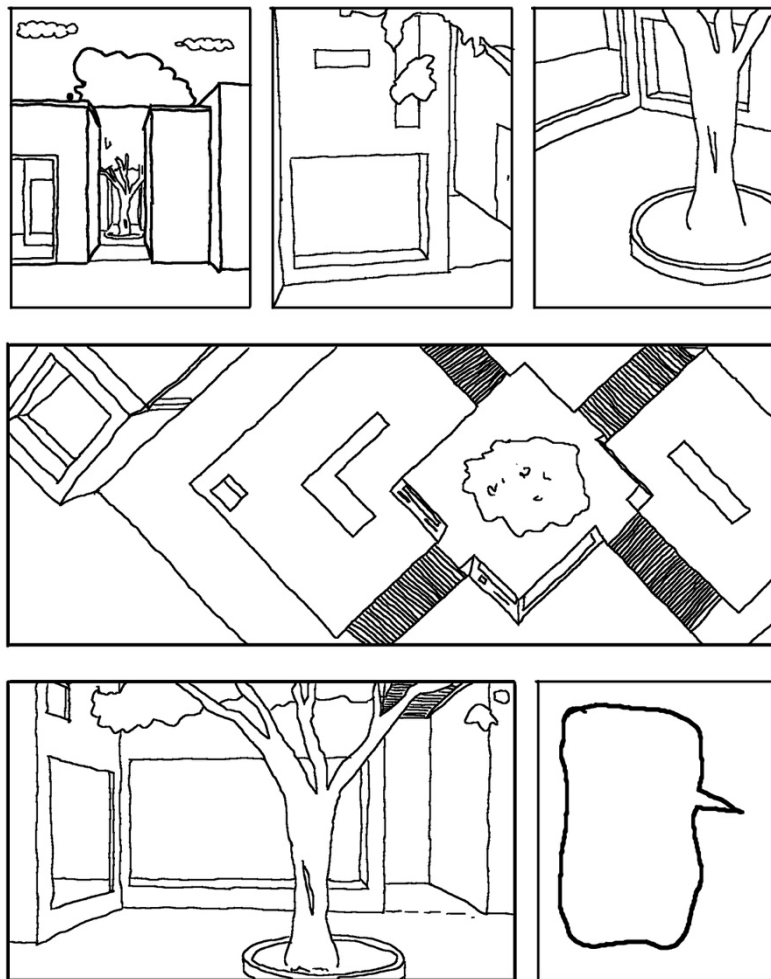
Figure 43. Left, Sida,C. 2019, A draft page of visual narrative environment.
Figure 44. Right, Sida,C. 2019, A draft page of visual narrative environment.

Chapter 5 Projected Outcome

Chapter 5 Projected Outcome

Design value of *siheyuan* in modern educational buildings

This research helped me understand Chinese *siheyuan* comprehensively. Through analyzing *siheyuan* from multiple angles, I obtained new understandings relating to its historical background, spatial characteristics, materials and status etc. There exists obvious difference between Chinese and Western courtyard designs. Ancient Chinese courtyards were often surrounded by buildings, while European courtyards often encircled buildings. Though the courtyard of *siheyuan* is an outdoor open space, it is inside the architectural complex. Hence, it is an indoor living area for family members.[42] The experience of traditional history brought about by *siheyuan* is rare in modern design.

Through this study project, I found that courtyard space of *siheyuan* can provide important reference for design of modern urban residential space. I hope that people can pay more attention to application of courtyard space to modern cities. As a space designer, I think that my selection of *siheyuan* as the prototype provides reference value for future urban educational space, commercial space, public space. Specifically, this study created new design thought to help designers of preschool education space and offer design reference for present kindergartens or day nurseries.

The idea of "courtyard and trees" can benefit some urban children contact with nature. The courtyard kindergarten can be a design new way to help children contact with nature. Meanwhile, it can satisfy children's needs of public activity space and the building enclosure can ensure safety of children. It is worth pondering that courtyard space is restricted by objective environment factors in spite of its significant advantages. However, its applicability to tall buildings and open-air space and operability still require further research.

Modern application of design techniques of Chinese garden

During design of a kindergarten, the designer should consider meeting exploration, development and learning needs of children. The five principle of Chinese garden design can offer new ideas to designers. Instead of applying Chinese elements to modern design, the design technique enriches spatial levels and connotations to avoid a single relation of space.

In the current study, I applied the principles to playroom space division and window layout neatly, resulting in layering and exploratory space. Due to a history for hundreds of years in China, these techniques are mature enough to provide reference for modern designers and of great research value.

Manifestation of architectural narration

As a type of medium, cartoons even can spread serious contents, such as design suggestions, which can be found even in books of architectural history. From the representative of radical movement in the 1960s and 1970s to the initiator of contemporary architecture, cartoons have become real tools of communication. Generally, cartoons are a type of low-resolution medium, making them become a high-participation expression form. [43]Therefore, as they can contact with extensive audiences, they are used strategically.

It is a new attempt for me to draw a narrative cartoon. In the course of the present study, I explored the potential of visual narration to describe relations between people and space and found that, as a type of medium tool, visual narration could express the spatial experience expected by a designer directly and profoundly. As Fabio Quici mentioned that architectural drawings always lacked "time", I added "timeline" and constructed a simple plot. Consequently, I could deeply realize dynamic perception of space, temporality of interior design and furniture and people's life and traces in buildings, for all of these required time factors. In the current work, the most intuitive manifestation was that I described scenes of children living in courtyards through architectural narration.

---

42. Fabio Quici, 2017, "Architecture And Visual Narrative", *Proceedings* 1 (9): 1082, doi:10.3390/proceedings1091082.

43. Ibid.

I hope the visual narrative picture album of this study can attract more attention of designers, parents, teachers, educators and society people to children's living environment impacted by urbanization and we can create free and happy childhood for children based on our efforts.
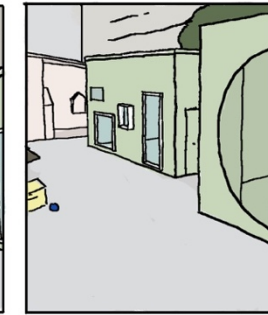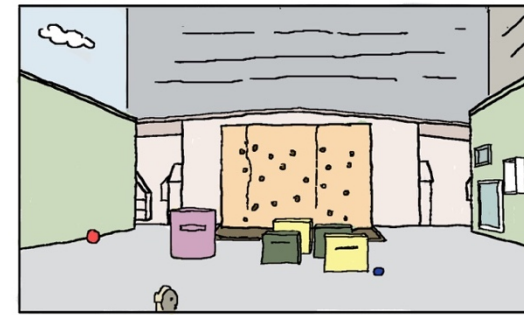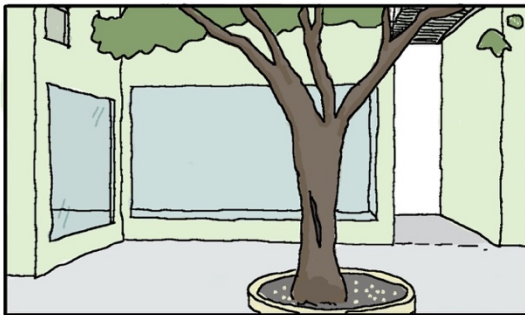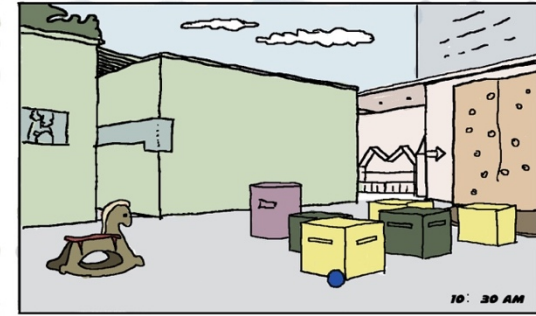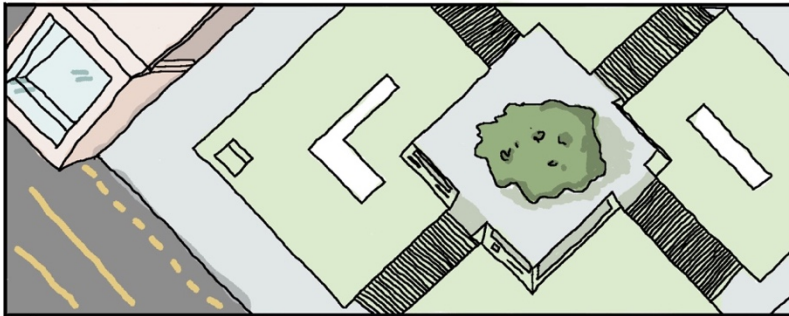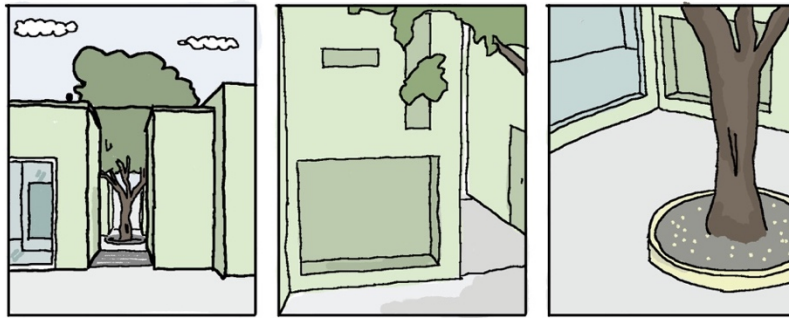
Figure 45. Left, Sida,C. 2019, A coloring draft page of visual narrative
Figure 46. Right, Sida,C. 2019, A coloring draft page of visual narrative

Chapter 6 Exhibition

Figure 47. Left, Sida,C. 2019, Cover page of final visual narrative
Figure 48. Right, Sida,C. 2019, Page one of final visual narrative
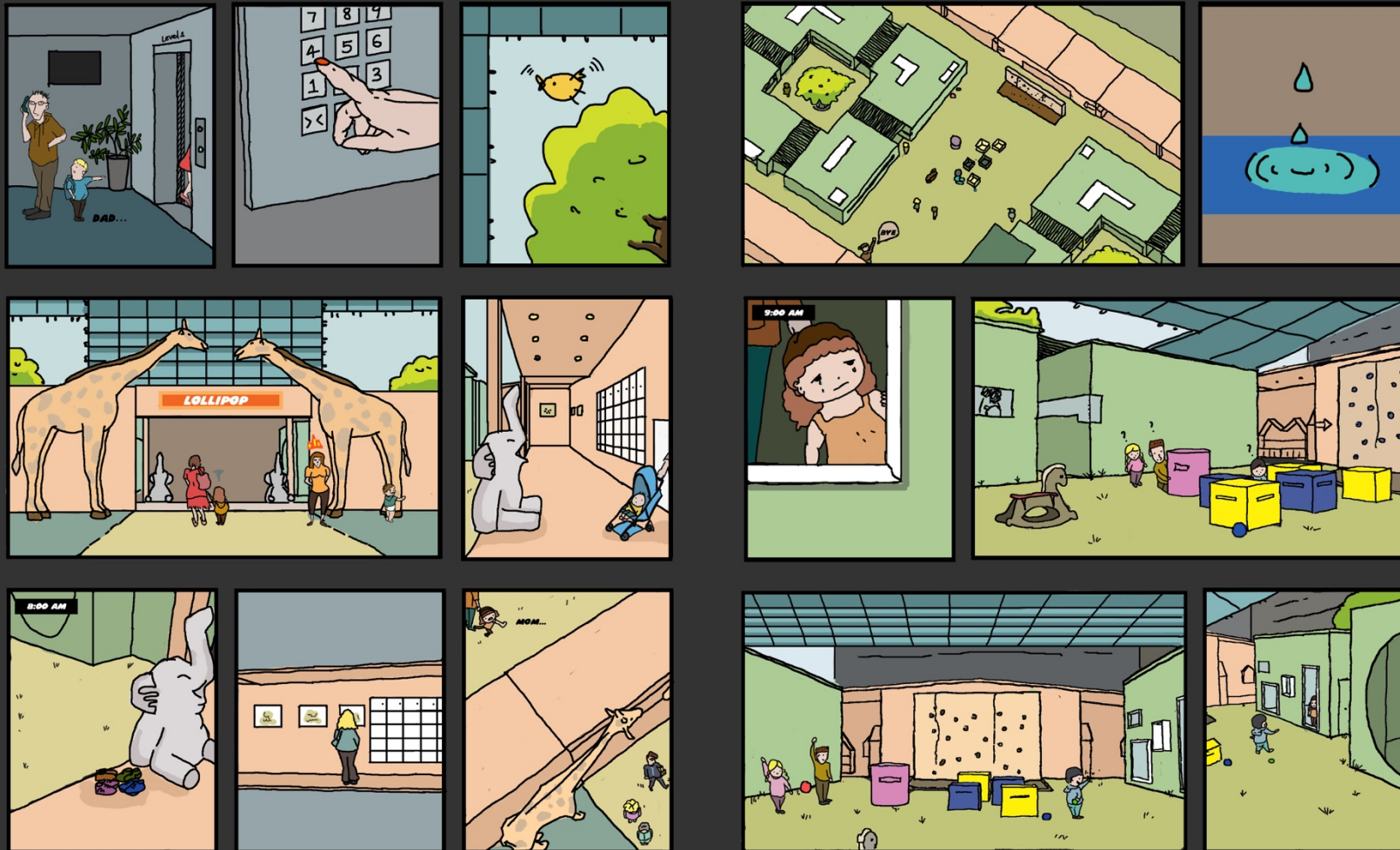
Figure 49. Left, Sida,C. 2019, Page two of final visual narrative
Figure 50. Right, Sida,C. 2019, Page three of final visual narrative

Figure 51. Left, Sida,C. 2019, Page four of final visual narrative
Figure 52. Right, Sida,C. 2019, Page five of final visual narrative

Figure 53. Left, Sida,C. 2019, Page six of final visual narrative
Figure 54. Right, Sida,C. 2019, Page seven of final visual narrative

Figure 55. Sida,C. 2019, Page eight of final visual narrative

Figure 56. Sida,C. 2019, The Exhibition of final visual narrative, Size: A3

List of Figures

References

2019. *Allchinanet.Com*.
http://www.allchinanet.com/chinese_garden/chinese_garden_design_borrow.shtml."Authentic Learning Environments In Higher Education By Herrington, Tony & Herrington, Jan". 2008. *British Journal Of Educational Technology* 39 (4): 765-765. doi:10.1111/j.1467-8535.2008.00870_23.x.

Campbell, Heidi. 2013. *Landscape And Child Development*. Ebook. 1st ed. Evergreen.

"Chris Ware". 2018. *En.Wikipedia.Org*. Accessed May 4. https://en.wikipedia.org/wiki/Chris_Ware.

Guo, Qian, and Yuan Ping Liu. 2014. "Study On Beijing's Hutong And Siheyuan: Renovation And Development". *Advanced Materials Research* 1065-1069: 312-316. doi:10.4028/www.scientific.net/amr.1065-1069.312.

Jiang, Liyuan. 2013. "Discussion On Application Of Landscaping Techniques Of Chinese Gardens To Modern Interior Design" 现代装饰理论 (5). http://www.qikan.com.cn/.

JUAN B, JOSÉ JUAN BARBA. 2015. "A Little Bit Of Beijing · Dashilar, By Li Han And Hu Yan | The Strength Of Architecture | From 1998". *Metalocus.Es*. https://www.metalocus.es/en/news/a-little-bit-beijing-dashilar-li-han-and-hu-yan.

Kaijima, Momoyo, Junzo Kuroda, and Yoshiharu Tsukamoto. 2012. *Made In Tokyo*. Tokyo: Kajima Inst. Publ.

Li, Han, and Yan Hu. 2013. *A Little Bit Of Beijing*. Tongji University Press.

Ma, Lan. 2014. "AN ANALYSIS OF BEIJING'S HUTONGS AND SIHEYUANS: AN URBAN TREE APPROACH". *The Pennsylvania State University*.

"Made In Tokyo: 15Th Year Update - Lys Villalba". 2019. *Lysvillalba.Net*. Accessed May 5. https://www.lysvillalba.net/Made-in-Tokyo-15th-Year-Update.

Naiman, Linda. 2019. "Design Thinking As A Strategy For Innovation". *Creativity At Work*. https://www.creativityatwork.com/design-thinking-strategy-for-innovation/.

Nonis, Karen P. 2005. "Kindergarten Teachers' Views About The Importance Of Preschoolers' Participation In Sports In Singapore". *Early Child Development And Care* 175 (7-8): 719-742. doi:10.1080/0300443042000244000.

"Object Empathy". 2019. *Flyleaf Graphic Design*. Accessed May 5. http://flyleaf.studio/blog/object-empathy.

Olds, Tim. 2001. "Modelling Human Locomotion". *Sports Medicine* 31 (7): 497-509. doi:10.2165/00007256-200131070-00005.

"Ouchi / HIBINOSEKKEI + Youji No Shiro + Kids Design Labo". 2018. *Archdaily*. Accessed September 27. https://www.archdaily.com/805591/ks-kindergarten-hibinosekkei-plus-youji-no-shiro-plus-kids-design-labo.

Park, Mijung, and Catherine Chesla. 2007. "Revisiting Confucianism As A Conceptual Framework For Asian Family Study". *Journal Of Family Nursing* 13 (3): 293-311. doi:10.1177/1074840707304400.

Quici, Fabio. 2017. "Architecture And Visual Narrative". *Proceedings* 1 (9): 1082. doi:10.3390/proceedings1091082.

Rikhy, Sumeet. 2018. "5 Stages In The Design Thinking Process". *ALLAVANCE*. http://www.allavance.com/blog/5-stages-in-the-design-thinking-process/.

ŞAHİN, B. Ece, and Neslihan DOSTOĞLU. 2016. "INDEPENDENT ATELIER MODEL: SUPPORTING PRESCHOOL EDUCATION AND FUNCTIONAL REQUIREMENTS". *INTERNATIONAL REFEREED JOURNAL OF DESIGN AND ARCHITECTURE*, no. 9: 35-35. doi:10.17365/tmd.2016922561.

Shonkoff, Jack P. 2014. "Changing The Narrative For Early Childhood Investment". *JAMA Pediatrics* 168 (2): 105. doi:10.1001/jamapediatrics.2013.4212.

"Siheyuan". 2019. *En.Wikipedia.Org*. https://en.wikipedia.org/wiki/Siheyuan.

"Siheyuan Culture,The Culture Of Siheyuan". 2019. *Chinatourguide.Com*.
    http://www.chinatourguide.com/beijing/siheyuan_culture.html.

"Split Courtyard House, Beijing, China/ Trace Architecture Office - 谷德设计网". 2015. *Gooood.Cn*.
    https://www.gooood.cn/split-courtyard-house-beijing-china-by-tao.htm.

Wang, Qijun. 2019. *The Vernacular Dwellings Of China*. Ebook. 1st ed. China.
    http://www.cypressbooks.com/samples/9781784590154.pdf.

Ware, Chris. 2012. *Building Stories*. New York: Pantheon Books.

"北京四合院中的私家花园_北京旅游网". 2019. *3G.Visitbeijing.Com.Cn*. http://3g.visitbeijing.com.cn/a1/a-
    XCBLA8E4227FB0B448F2FD.

"四世同堂（老舍著长篇小说）_百度百科". 2019. *Baike.Baidu.Com*.
    https://baike.baidu.com/item/%E5%9B%9B%E4%B8%96%E5%90%8C%E5%A0%82/5388452.