University of Cincinnati

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I, Lirong Yao, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture.

It is entitled:
Architecture Combined with Garden for a Safe and Healthy Life: A Community Typology for Urban Senior Living

Student’s name: Lirong Yao

This work and its defense approved by:

Committee chair: Udo Greinacher, M.Arch.

Committee member: Vincent Sansalone, M.Arch.
Architecture combined with garden for a safe and healthy life:

A Community Typology for Urban Senior Living in China

A thesis submitted to

the Graduate School of the University of Cincinnati

in partial fulfillment of the requirements for the degree of

Master of Architecture

in the School of Architecture and Interior Design of the College

of Design, Architecture, Arts and Planning by

Lirong Yao

B.A. Hefei University of Technology, June 2012

Committee Chair: Udo Greinacher
ABSTRACT

The senior population in contemporary China continues to drastically increase at a steady pace, especially recently. Experts estimate that China will become one of the super-aged countries in the world in 2050.

In the meantime, China suffers from a serious smog problem in prevailing major cities as well where economic activity has risen as a result of this phenomenon. Gauging from the statistics of other major countries, China needs at least thirty years to thoroughly solve this predicament.

This thesis aims to create a safe and healthy living environment for vulnerable seniors during the period of environmental management by weaving architectural design and garden elements together. Various types of Gardens can offer the seniors with beautiful vistas, memory care, fresh air, engagement, and happiness.

Moreover, to better address the issues surrounding the anxiety of aging, a continuing-care multi-generational community can be promoted among the urban citizens. It can encourage both a closer sense of community among the residents, and mutual assistance between family members. This new type is a good choice for young couples who are willing to take care of their parents, but still wish they could keep their own privacy to a certain degree. The seniors who choose this community want to maintain greater independence and age in place. They are re-conceptualizing “Retirement” responsive to the lures of convenience, cultural life,
shopping, good public transportation, and an exciting lifestyle. It is a revolutionary ideal for senior living in China.

Figure 00.1
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I was born in China, 1989. The single-child policy constricted my mum to only give birth to one baby. Now my grandma lives with my parents, since my grandpa died in the mid 1990s. I married to my husband in 2013, who is also a single child. Hence, the two of us have to take care of at least four elder people and maybe two children in the future, since the new two-child policy has been put into effect since 2016.

Traditionally, children are supposed to take care of their parents when they get old. This is called “孝Xiao” (filial piety), a moral definition unique to China. In the past, senior people always had more than one child on which to rely. Nevertheless, the 4-2-1 family is the most common mode in contemporary China, especially in urban areas. A single child has no siblings to share the responsibility for supporting their parents. Moreover, traditional Chinese thoughts are clashed by western cultures and thinking with the deepening of economic reforms. For both the young and elder generation, they value privacy and independence more than ever.

In addition, air pollution has become a major issue in China, and poses a threat to Chinese public health, which can cause asthma, bronchitis, and acute and chronic respiratory symptoms such as shortness of breath and painful breathing, and may also lead to premature death.¹

Even though this thesis project can never solve all the issues associated with the aging problem and the environmental pollution, it can at least provide one extra choice and a better retirement life for urban senior citizens. The community can function as a refuge for the residents of all generations during the terrible smog season. With the microenvironment built inside the community, seniors can live the rest of their life healthy.
"A larger population means greater manpower," which was Mao’s disastrous attempt to rapidly convert China into a modern industrialized state when the new China had just been established. Thus, there were two big baby booms occurring in the 1950s and 1960s -1970s. Then, in the 1980s, the government started to put the fertility policy (single child per family) into force to control the booming population. From the broad view, the fertility policy actually had raised the proportion of working population, and brought about the economic prosperity, which is called demographic dividend. Nevertheless, the ratio of the working population in China arrived at the peak of 74.5% in 2010. The demographic dividend has turned into population debt.

![Three Birth Peaks since the Founding of People's Republic of China](image)

Figure 02.1

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The senior population in contemporary urban China continues to increase at a steady pace. According to the National Bureau of Statistics of the People's Republic of China, 10.1% of the Chinese population was over 65 years old in 2014. Experts estimate that more than a quarter of the population will be over 65 by 2050. The whole society will therefore face an unprecedented burden of senior care.³

![Demographic Structure of China](image)

Since the beginning of 2013, China has experienced a severe smog problem generated by coal combustion for industrial development, especially during the winter season. The levels of air pollution in many Chinese cities often reach dangerous levels, with thick clouds of smog chasing people indoors, disrupting air travel, and affecting the health of millions of people.⁴ Hefei, my hometown, and the site of this thesis project, suffers the smog issues as well. Residents are breathing a hazardous mix of chemicals every day.


Last but not least, people who live in the new high-rise residential buildings in urban China now, all miss the previous neighborhood life when the Chinese economy had not recovered. People were poor and life was simple, but happy. Neighbors knew each other and community life was rich and vibrant. Everyone took care of each other. The whole community ran like a big warm family. The previous situation is totally different from what is seen today. Modern apartments have less communal space and neighbors are indifferent, typically not even knowing each other’s names. The society becomes impersonal and coldhearted. The city is cold and unfriendly, like a concrete jungle.

Figure 02.3
Through today, nursing homes all across China can offer 4.16 million total beds. Although there are more and more private nursing homes being built, the number is far from enough. In 2013, Wang Hui, the director of the Department of Social Welfare and Charity Promotion, said so far China needs about 10 million more nursing home beds. In Beijing and Shanghai, all nursing homes are at full capacity. Moreover, nurses are in short supply and the anticipation for the second half of life from Chinese aging population cannot be fulfilled by the current situation. Thus, there is a great demand of something new to be discovered for China’s senior housing market.

The aging population is one of the greatest social problems in contemporary China. In addition, due to the high speed of urbanization in China, social and natural environments become less suitable and much harsher for senior citizens. China’s fast-developing economy, the unsound social security system, and the environmental pollution are three main factors that impact the quality of senior living. In particular, the smog and food safety issues occurring in China’s large cities make urban seniors yearn for really anticipate a better way of aging.

The one-child policy has violently changed the traditional family structure in China. Numerous young men left their hometowns and families to study, work, and even settle down, so that fulfilling their traditional family duties is becoming more

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and more difficult. In an investigation conducted by China Youth Daily in 2010, 41.8 percent of 12,534 young people polled said they do not live in the same city as their parents. Even worse, most of the young people find it so hard to afford the high expense of housing in bigger cities, let alone fetch their parents. Therefore, tons of elder people have to live all by themselves without the direct care from their children, who are normally known as "empty-nest elderly." This phenomenon has become more and more common in China now.

When their parents are still healthy enough to look after themselves, they can live apart. Nonetheless, when the health conditions of the seniors are getting worse and worse or one of them dies, the young have to find a solution, because their senior parents only have one child. How can the young generation be so hardhearted to let their parents age alone and helpless? Most young people still hesitate because they are afraid that they will be controlled and educated by their old parents all the time if they live together.
The urban citizens, who were born during the second birth peak (1960s and 1970s) in China, are the primary target client group this thesis focuses on, which now account for the majority of aging population in urban China. Most of them just entered the Post-parental Phase of Life (Also Known as the Empty-Nest Phase), which means they are still young and healthy among the seniors. They start to imagine and plan their later retirement life. On the one hand, they have relatively strong economic capacity and open consumption attitudes, so that they desire to improve the quality of their future retirement life both materially and spiritually; on the other hand, they still keep part of the traditional thoughts that they want to age with their children nearby.

The secondary client group is the seniors who need instant medical care or assistance. They might be too old to live alone or too sick to live independently. They may have an ill spouse to nurse or become widows or widowers. All in all, they need assistance.

The existing institutions in China, neither public nor private can meet the expectations of both senior groups. They do not want to live in nursing homes feeling old, isolated, useless, and miserable. Therefore, a unique senior living model should be put forward to fill in the blank of the senior housing market in China. It

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6Shengshu Li, Community Design for China's Urban Elderly, University of Cincinnati, 2013.
10Care homes The new way to get old (EGM architecten)
should be a brand new mix of work, play, health, and social relationships. It will be a mix of the young and the old. Moreover, it will be a multi-generational win-win community where different generations support each other and realize a new definition of filial piety suitable for the modern China.

Since housing is the largest investment for most of the families in China, it is commonly unacceptable for most Chinese seniors to pay the rent for a single room or bed in a care institution. If they have the chance to decide, they will absolutely prefer to age in place, rather than move to an isolated environment. However, most residential buildings in China are now high-rise complexes, which are inconvenient, boring, and alienating. It’s certainly not a safe and comfortable place for seniors to live. The target clients of this thesis are middle-income seniors, who normally own at least one apartment. They are able to purchase this new senior-friendly community apartment that I put forward to replace their previous old apartment, hoping to live a better retirement life.
Chinese Garden

In ancient China, home and garden formed an organic integrity, following the principle of connecting harmony with nature. The garden a man built was always an integral part of his house, playing a role as an outdoor living room to relax and retreat.8

Chinese gardens are always sticking to the principles of “learning from nature” and prioritizing the natural beauty. The gardens were extracted from nature but surmounted to their original status. One rockery was enough to create the image of a mountain, one tiny pond a boundless river or lake.

From the very beginning, Chinese gardens were not places simply for a relaxing walk or where people planted trees or prettified their environment. Those who lived in cities and were kept away from nature found a way to reflect upon their nostalgia and longing for the natural world by constructing gardens. Gardens

offered them a psychological compensation and an opportunity to pursue an ideal spiritual and cultural life. Creating gardens was among the things that Chinese ancestors did best during their leisure time.\(^9\)

**Housing Typology**

**Quadrangle** is a historical type of housing that was commonly found throughout China, especially in Beijing. The name literally means a courtyard surrounded by buildings on all four sides. A quadrangle offers a comfortable, quiet space with plants, rocks, and flowers. The courtyard is also a garden, and acts like an open-air living room, where family members can chat with each other and enjoy the casual family time.

Quadrangle was initially designed for one big family with four generations living together. Since the founding of new China, most of the remaining quadrangles have been transformed to accommodate several families in one unit, more public housing than private property. Families living in the same unit always keep a good mutual-aid relationship.
**Tulou** (Earth building) is a unique type of traditional communal housing mostly found in Fujian Province, China. Most of them are in circular or rectangular configurations, with very thick, load-bearing earth walls. The top level of these earth buildings is constructed for defensive purposes. Smaller interior structures, such as halls, storehouses, wells, and common living areas, are enclosed by the peripheral structure where the residential units are occupied by a group of families. Each
building functions likes a semi-enclosed community. Families live close together in these buildings and a group of earth buildings forms a large village.

**Hui-style housing,** one of the major traditional Chinese housing styles, is mainly situated at the foot of Yellow Mountain in Anhui Province, and characterized by white walls, grey tiles, courtyards and skylights. The elegant colors of it are in harmony with the surrounding natural environment and enhance its beauty. This housing style developed along with the success of Hui merchants. For good fortune in business, rainwater is drained off to the courtyard through the skylight, which means treasures will not escape from the home. Since most of the houses are built very close to each other, the side walls are built quite tall to prevent fire from sprawling to and from neighbors. Although the exterior appearance of Hui-style

![Figure 05.6 Hui style house](image)
buildings appears similar, their interior can vary a lot based on the wishes of the owners. The interior is normally decorated with artworks made of brick, wood, and stone.¹⁰

**RESEARCH: SENIOR LIVING PRECEDENTS**

The **Humanitas Apartments for Life** were set up in the Netherlands by charismatic multimillionaire Dr. Hans Becker in 1995. The 12-story, 195-unit Humanitas Bergweg project in Rotterdam by EGM Architecten is a classic example of the Humanitas housing model. The indoor ‘village square’ at its center acts as the complex’s recreational hub. Becker passionately rejects the West’s “cure and care” approach to housing older people as a destructive and debilitating institutional obsession that focuses undue attention on “handicaps and medical and hygienic problems. Their motto is: “Too much care is worse than too little care.”

![Image of Humanitas Apartments](image.png)

Figure 06.1

It is a care home with regular disco nights, film screenings, cash machines, a beauty parlour, salons, a museum, a sculpture garden, a restaurant, and an on-site bar. This isn’t some surreal septuagenarian Willy Wonka-esque dream; it is in fact
an innovative and highly popular brand of care-free home in the Netherlands that, to date, houses up to 6,000 people. ¹¹

**The Clare** is a continuing care retirement center in downtown Chicago, where seniors can live an active, urban lifestyle, and then remain in place throughout their needs for increasing levels of care. It offers both housing for seniors and classroom space for Loyola University. It conforms to the trend of building college-affiliated retirement centers, so that the retirees can live in an intergenerational community, have easy access to volunteer services, and earn lifelong learning chances. Among the context of downtown Chicago, seniors can not only have maximum independent living and privacy, but also enjoy nearby dining, shopping, and cultural attractions.

The first three floors house Loyola classrooms. Forty-one levels contain 250 independent living units. There are three floors of skilled nursing and 3 floors with

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52 units of assisted living. Amenities include a fitness center, an indoor aquatic center, a beauty salon, barbershop and day spa, a social lounge, private and main dining, and a plethora of other activities. Moreover, the building design maximizes views of Chicago’s Water Tower District and Lake Michigan.\(^\text{12}\)

**Home farm** is a conceptual proposal in Singapore brought about by SPARK for the next generation of urban retirement housing. It is designed to address the issue of Singapore’s rapidly aging population, by combining residential living for seniors with vertical urban farming. ‘Home farm’ allows the country’s older inhabitants to live in a garden environment that provides high-density, flexible housing, designed to cater to the needs of seniors.

The project also offers post-retirement employment, with residents able to work part-time hours under the direction of a professional implementation team. Public accessible farming facilities are situated at the lower levels of the scheme, while housing is stacked above in a curvilinear terraced formation. The gardening activity would help generate a sense of community, while promoting the health

\(^{12}\)Assisted Living & Senior Living Chicago-The Clare. Home Comments.
condition of the senior residents. The environmental sustainability and efficiency of ‘home farm’ would be enhanced by proposed features such as the collection of rainwater, for use in water-cycling systems, and the use of plant waste for energy production.\textsuperscript{13}

The research-based design addresses two pressing challenges faced by Singapore: how the city state might support a rapidly ageing society, and how it might enhance its food security (90% of which is currently imported).\textsuperscript{14}

\textsuperscript{13}SPARK combines residential living with urban farming in Sin design magazine SPARK combines residential living with urban farming in Singapore Comments)

Hefei is the provincial capital city of Anhui Province, which is located in eastern China. It is an inland city, without too much height difference yet.

Hefei features a humid, subtropical climate with four distinct seasons. Spring and fall are relatively shorter than summer and winter. Winters are damp and cold, while summers are humid and hot. The predominant wind direction is southeast in summer and northwest in winter.

Over-urbanization is now a common problem in China. Thus, cities are like giant concrete jungles lacking any natural environment. Furthermore, Hefei is now faced with the air pollution problem, the same as other main cities of China. In the entire year of 2014, 175 days were polluted in Hefei, ranking the 24th among all the polluted cities in China.
The site is situated between the first and second loop of city, very close to the central commercial center, with convenient public transportation provided. The surrounding neighborhood is mainly residential; peaceful and friendly. A medium size retail center is opposite the street, including a supermarket, restaurants, banks
and offices. West side of the rectangle site faces Huizhou Boulevard, a vital primary road running from north to south across Hefei, while the other three sides of it are encircled by residential buildings.
PROGRAM

Sunshine Condition Study

[Diagram of building levels and spaces]

[Diagram of different living units and community centers]

[Diagram of garden within living units]

[Diagram of residential parts of independent living units]
According to the sunlight-hour requirements of residential buildings in China and senior living design laws, four 7-floor buildings are arrayed in one line facing the south and equally spaced. In order to have more units built to gain the full benefits and still have abundant sunlight for all residential units, the northernmost building and the third building from the north are built up to nine floors, while space between the middle two buildings is enlarged. According to the
volumetric study of sunlight conditions, this hypothetical model has a quite ideal sunlight quality, except for the ground floor during the winter.

Aside from winter, courtyards between two buildings possess an ideal sunlight quality. Therefore, shared facilities are all arranged and located at the first floor of the structure, which do not have as strict sunshine requirements. Artificial LED lighting is added to promote health plant growth, when natural sunlight conditions are poor. Private gardens of independent living units stretch out to receive more sunlight, while the residential part recedes back to form spontaneous southern balconies.

PROGRAMMING

Figure 08.1 Master plan of the community
This multi-generational community is an urban continuing care retirement community (CCRC) situated in the downtown area of Hefei, housing seniors in independent living and assisted living. Senior residents can live an active, urban lifestyle, and then remain in place throughout their needs for increasing levels of care.

The following lists the main buildings that compose the community:

Senior Apartment (Independent living Units; Assisted Living Units; Courtyard; Community Center);

Young Apartment;

Shopping Mall;

Kindergarten.

This thesis aims to respond to the aging problem in China. Thus, senior apartments are carefully designed. It consists of two 7-storey and two 9-storey senior residential buildings. Four individual buildings are weaved together by the communal facilities located at the ground floor and enclosed by an integral glass box. Seniors can enjoy arts, culture, and lifelong learning opportunities and keep a lively and diverse social and intellectual life. Comprehensive supporting facilities are built in the community to make the senior life easier, such as health care station, volunteer service station, home service center, classroom, dining hall, café, library,
gyms, dance studio, auditorium, agricultural lab, and walking ramps. Second and third floors are assisted living, while the upper ones are independent living.

The architectural layout of these two different living types is almost designed the same intentionally to provide a familiar feeling for seniors, when they are too old or too weak to live independently and have to move downstairs to assisted living units. Of course, they still possess different conditions. Assisted one is equipped with medical instruments, while each independent unit is a private garden on its top. Private gardens of independent living units keep the seniors busy and offer a healthy environment. Seniors can utilize their private garden according to their interest, such as growing crops, raising a pet, etc. The floors of private gardens extrude out to receive more direct sunlight. All the specific plan designs can be checked at the appendix part.

![Diagram of independent living unit](image.png)

*Figure 08.2 Diagram of independent living unit*
ACCESSIBILITY

All the designs in the senior living building are to create a convenient, healthy and safe living environment. All the main stairs in the structure are senior-friendly. The kick of stairs is designed as 120mm high, while the normal one is usually 150mm. Four elevators are installed to make every floor accessible to the handicapped people. Additionally, ramps are constructed to encourage the senior to walk through the building, and embrace the green in the courtyard.

Figure 08.3 Egress diagram of senior living
Gardens of different scales and themes are designed accordingly to meet the demands of residents, especially the seniors. For instance, the palm garden in the courtyard is a good place for social activities. Intimate zen gardens are designed to create a peaceful and quiet atmosphere for individual wards in the health care center. Green walls enclose the staircases in order to make the climbing feelings more enjoyable.
better and provide more fresh air. Vertical steel structures or trellises guide the vine and bougainvillea to grow up, while columns of plants are hanging from the ceiling structure. These two main elements form the vertical garden in the courtyard.

In line with major social and behavioral shifts in the senior living market, sustainability will be a “must” in future marketability of environments, since it has long-term economic value, helps reduce energy and resource consumption and improves the quality of life (natural light, ventilation, indoor air quality). Rainwater is collected by the pitched glass giant roofs to water the plants. Plants can not only provide a good view, but also help filter the toxic air for the seniors.

Operable glass curtain walls are used to wrap the four residential buildings inside and create a controllable indoor environment. When the air quality is poor or the weather is freezing in winter, the curtain walls can be closed to form a protective box. When air is in good quality or the weather is warm enough, all the curtain walls can be open to allow for natural cross ventilation.
CONCLUSION

While the old parents are still healthy enough, they can help the young to do some housework and look after the grandchildren to help the young couples release some living pressure. In return, young couples can assist their old parents more in the daily life when they are aging to lose some physical and mental abilities. In this way, filial piety can be carried out to a certain degree. This new senior living mode will meet both physical and psychological needs of Chinese urban seniors.

This will be an inward oriented community with multiple functions. There will be independent units and assisted living units provided for the seniors. Seniors can choose the type of unit based upon their own physical conditions. The younger and healthier seniors can volunteer to help those live in assisted living units as a supplement for professional nurses.

Although the site is far away from all the main public green space that produces fresh air and good natural environment for the city, the community itself has enough green space that can serve to modify the micro-environment for vulnerable seniors and young children.

Because China is a big developing country, this thesis project is not suitable to all situations and cannot thoroughly solve the aging anxiety and its following problems. It can however provide a healthy choice for seniors who live in medium-sized cities. For those who live in metropolitan cities or in rural areas, they still need more options to live their later life.
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Preface


Problem

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Background

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Client

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Care homes The new way to get old (EGM architecten)
Culture


Research: Senior Living Precedents

Care homes The new way to get old (EGM architecten)


SPARK combines residential living with urban farming in Singapore Comments)


APPENDICES

01_PRECEDENTS

PRECEDENT ANALYSIS

The Humanitas Apartments
Location: Rotterdam, Netherlands
Typology: Multi-generation community; Care-free Home
Accessible to neighborhood: No
Floors: 12
Units: 195

THE CLARE
Location: Chicago, USA
Typology: Continuing care retirement community
Accessible to neighborhood: Yes
Floors: 53
Units: Independent Living(248); Assisted living; Skilled nursing; memory care

HOME FARM
Location: Singapore
Typology: Living and farming; Multi-generation
Accessible to neighborhood: Yes
Storey: 12
Units: Studio(216); 2-Bedroom APT(27); Dual-Key APT(24); 3-Generation APT(33)
### 02_BUILDING PROGRAM

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1st Floor

2nd Floor

3rd Floor

4th~5th Floor

6th~7th Floor

8th~9th Floor