



Shilinyuan New Courtyard-Garden Housing in Suzhou: Residents' Experiences of the Redevelopment

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ABSTRACT

Set within the theoretical framework of cultural sustainability, this in-depth case study examines the Shilinyuan (meaning “Lion Grove Courtyard-Garden Housing”) built in the old city of Suzhou, China, in 2000. It is a modern interpretation of southern Chinese vernacular houses, with private and semi-public outdoor spaces, and a communal Central Garden. The estate is in proximity to the famous Lion Grove Garden, and in walking distance to the renowned Humble Administrator’s Garden; both of which are UNESCO World Cultural Heritage sites. The Shilinyuan project won the *Lu Ban Award*, a national award to high-quality construction projects by Chinese Ministry of Housing. Through an onsite survey, in-depth interviews with residents, key planner and architect, and the author’s observations, the study finds that this project is only culturally sustainable to some extent, the private courtyard-gardens are often too small for family activities. The communal Central Garden has somewhat functioned as a social and cultural activity space, and living close to city gardens is a major benefit for residents’ cultural activities. The findings may have implications for courtyard housing redevelopment in China and cohousing development elsewhere. The study finally suggests two new courtyard-garden housing systems that may have wider application.

Keywords: courtyard housing, cultural sustainability, architectural regeneration, urban redevelopment, environment-behavior study, China

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1. INTRODUCTION

Cultural vitality has been held as the fourth pillar of the general sustainable development agenda together with the other three: environmental responsibility, economic viability, and social equity ^[1].

The cultural aspect of sustainability is a critical component of the theoretical framework of the research because architecture has been considered as a cultural artefact, and so the article evaluates both archi-cultural ^[2] and socio-cultural attributes of a new courtyard-garden housing project constructed in Suzhou, China, to examine whether it is culturally sustainable.

In this study, cultural sustainability is termed as the adaptation and transmission of the beneficial parts in a nation's material (tangible) and immaterial/spiritual (intangible) culture that are conducive to the development of their present and future generations ^[1].

Housing is a significant aspect of architectural culture, not only because it affects people's everyday living, but also because vernacular houses are a major part of a nation's material cultural heritage that must be preserved. It contains the cultural signs and symbols that are vital national heritage to pass on to offspring. Hence, new housing development should honor a local and regional identity by following traditional design philosophies and features.

However, compared with the amount of literature on new housing studies in famous Chinese cities such as Beijing and Shanghai, there are only a few studies on Suzhou housing development in recent decades ^[1, 3-5, 28], this article hopes to lessen this disparity.

1.1. Suzhou City Planning

Suzhou is located south of the Yangzi River in the southeast of China, about 83 km to the northwest of Shanghai, roughly 30 minutes by high-speed train. Suzhou has a splendid history and culture of over

2500 years. During the Spring and Autumn periods in 514 BCE, the city was built as the Wu State (吴国) capital by Wu Zixu (伍子胥, c.559–484 BCE), who “examined the soil and tasted the water, and mimicked the heaven and followed the earth” ^[6] (my translation). Suzhou's old city site has not changed since its inception because of the wise choice of the place ^[7]. Situated on the shores of Lake Tai in the lower reaches of Yangzi River, Suzhou has a latitude of 31°19' N and longitude of 120°37'E, it possesses a mild and humid subtropical climate with plum rains ^[8] in June and July ^[9-11].

Suzhou's affluence began after the construction of the Jinghang Grand Canal in the Sui dynasty (581–618), and the city was named Pingjiang (“Peace River”) in the Song dynasty (960–1279). The Pingjiang map [dated 1229; Figure 1] is the earliest and most complete ancient city plan in China, providing an important source for study the transformation of Chinese cities from ward to neighborhood system.

The Pingjiang map shows that Suzhou's old city is rectangular in plan, about 6 km north-south and 4.5 km east-west, with a ceremonial and regular but free and flexible layout. Suzhou planners employed the principles in the *Rituals of Zhou*, the Nine Squares System, and *Feng Shui* (“Wind and Water”) cosmology, making the city well integrated with the surrounding natural environment ^[1, 10, 12].

Pingjiang was laid out south by east 7°54' to benefit from the southeast wind for cooling in summer and avoiding direct winds in winter. The eight city gates are corresponding to the eight trigrams (*bagua*), pointing to the eight principal directions as well as obeying the waterways ^[1, 10, 11].

圖江平

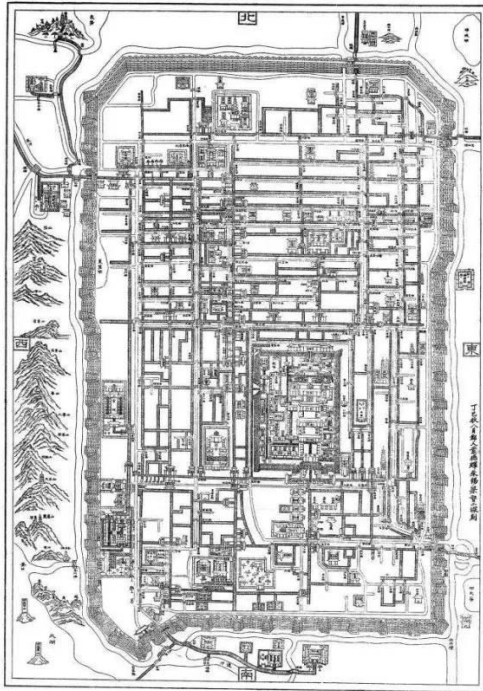


Figure 1. The Pingjiang map (dated 1229) from a stone stele showing a double-chessboard, road-river system. Source: Courtesy of Suzhou Inscription Museum (Suzhou Confucian Temple)

Suzhou was planned with water in mind, since ancient Chinese people regarded water as blood of the earth and believed that the wealth of a city depended on the circulation of water. The 14.2 sqkm old city has 35 km of manmade rivers, often 3–5 m deep and 10 m wide, directed from Lake Tai, because Suzhou is close to the Yellow Sea in the east and the Yangzi River in the north; tunneling canals and constructing city walls were thought to be best tactics for flood prevention.

Suzhou has a double-chessboard grid pattern, with waterways (*yin*) and roads (*yang*) complementing each other linked by 168 bridges. Main canals run east-west and most streets are parallel to them.

The city blocks normally have a rectangular shape, with 2-3-storey traditional houses along east-west lanes facing south-north. This basic plan forms a unique Suzhou style of “little bridges, rivers, and houses.” This blueprint has

been maintained in Suzhou’s old city until the present day ^[10, 11].

Suzhou was acclaimed as “Heaven on Earth” and “City of Gardens” because of its favorable natural conditions for growing lavish green woods, fish, and rice. With 1500 years of gardening history, Suzhou had over 170 gardens at the end of Qing dynasty (1644–1911), more than 60 of them are fully preserved, and 19 open to the public today ^[13]. Suzhou is such a place that “one can enjoy landscapes without going outside the city, and live in busy streets with the sights of forests and tastes of spring water” ^[14] (my translation). Thus, in imperial China, retired officials, literati, and rich merchants settled in Suzhou, resulting in its prolific number of renowned celebrities and outstanding talents. Suzhou Pingtan is one of the top four national operas; story-telling, ballads singing, and Kun Opera are considered as the “Three Flowers of Suzhou Culture” ^[9-11, 13, 15-17].

The old city of Suzhou was divided into 60 wards in the Tang (618–907) and 65 wards in the Song (960–1279) dynasties. With swift economic development in mid-Northern Song (960–1127), a new neighborhood system emerged, which gradually replaced the old ward system. The scroll painting *Gusu Fanhua Tu* (“Suzhou Flourishing”) by Xu Yang in 1759 [Figure 2] illustrates the prosperity of the city in the late 18th century and its courtyard house system.

Traditional Suzhou houses are characteristic of the southern type of vernacular Chinese architecture. Compared with the northern type such as Beijing *siheyuan* (courtyard house), traditional Suzhou houses generally have smaller, atrium-like courtyards, called *tianjing* (lightwells or skywells), to admit less sunlight due to their hot summers and to collect rainwater. This small outdoor space has been a vital feature in the design and construction of this region’s historic homes [Figure 3] ^[1, 10, 11, 18, 19].

Suzhou's old city walls suffered a similar tragic event to that of Beijing where over half of them have been demolished since the founding of the People's Republic of China in 1949, with the enduring 1442 m hidden in houses and factories. In 2001–2005, the Suzhou municipal government saved the remaining city walls and made them a unique “riverside green corridor” [11].

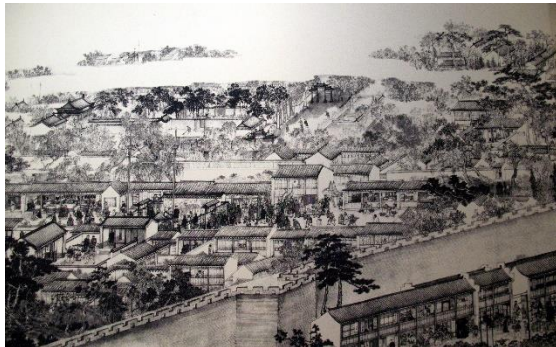


Figure 2. Partial scroll painting *Gusu Fanhua Tu* (“Suzhou Flourishing”) by Xu Yang in 1759 showcasing its courtyard house system. Source: Courtesy of Liaoning Museum, China



Figure 3. Traditional Suzhou courtyard house compound hosting a single-extended family. Source: Computer model by the author 2014

The Suzhou Master Plan 1996–2010 asserts that the city has “one body with two wings.” The body refers to the old city and the two wings are the two new satellite towns: The New District (developed in 1990) to the west, and the Industrial Park District (developed in 1994) to the east [5].

To preserve the old city, the Suzhou Municipal Government and Urban

Planning Bureau have introduced housing redevelopment principles as follows:

1. Maintain Suzhou's traditional planning and design such as white walls and black-tiled pitched roofs; building height should be mainly 2-3-storeys, some parts can be 3 ½ storeys to give a sense of level change; meanwhile, improve the quality of life;
2. Make maximum use of loft spaces and underground spaces to decrease building density, increase plot ratio, and increase green spaces;
3. Construct public buildings to accommodate Residents' Committees, senior's activity rooms, and kindergartens;
4. Maximize the use of existing conditions of a site such as the original street/lane network; conserve and renovate old houses in good condition; preserve old trees and wells on site; demolish and rebuild dilapidated houses;
5. Divide roads into three types: *xiang* (lane) 7 m, *nong* (alley) 3.5 m, and sub-alley not <2 m;
6. Make the ratio of building height to distance not <1:1;
7. Reach a financial balance between investment and profit, no more free housing; for those residents who do not purchase new housing but demand house ownership, they will be relocated to the New District;
8. Offer to the households social, environmental, and economic benefits as compensation for the use of their property for real estate development;
9. Concentrate bicycle parking, provide semi-basement garage;
10. Plant evergreens and fragrant flowers with bushes and arbors to create changes in level; tetrastigma should be planted inside estate walls to make gable walls green [20–24].

The Suzhou Old City Construction Office (1991/1992) has likewise complemented new housing design and construction procedures as follows:

1. Carefully design each housing unit and strive to perfect residential functions; create large living rooms and small bedrooms; kitchens and bathrooms should be bright; interior spaces should be staggered and intricate; design some higher-standard units to satisfy different users' demands;
2. Save land and energy and utilize advanced and appropriate building technologies and fine building materials, components, and equipment;
3. Pay close attention to the organization of a supervisory team on construction sites; carefully select contractors; set up a complete construction schedule and management system to ensure the quality of construction.

Since the late 1980s, Suzhou has renovated 54 inner-city neighborhoods with phased approach by integrating modernization with conservation of the city's architectural heritage, preserving the exterior appearances, and improving infrastructure and interior functions. A special advisory committee was formed, including renowned planners and architects I.M. Pei (1917–2019), Wu Liangyong, Zhou Ganchi, and others. Care was paid to the needs of the elderly, of mothers with young children, and of other disadvantaged groups. Daycare centers, kindergartens, primary schools, and leisure/exercise facilities were added [3].

1.2. Case study: Shilinyuan new courtyard-garden housing

This case study examines the Shilinyuan (狮林苑 “Lion Grove Courtyard-Garden Housing”) built in 2000, located in proximity to the famous Lion Grove

Garden, and in walking distance to the celebrated Humble Administrator's Garden; both of which are UNESCO World Cultural Heritage sites [Figure 4].



Figure 4. Map of Suzhou showing the location of the Shilinyuan new courtyard-garden housing estate (A5), in proximity to the Lion Grove Garden. Source: <http://maps.mychinastart.com>

Shilinyuan has an area of 3.32 hectares and is located beside the Tongfangyuan Courtyard-Garden Housing; the two estates are separated only by the Yuanlin Lu (“Garden Road”). The Shilinyuan site was originally the Suzhou Elastic Weaving Factory with slightly over 100 old houses, and the factory was forced to shut down by the government because it drained a large amount of polluted water containing toxic waste [Figure 5] [25, 26].

Shilinyuan (2000) was built four years after Tongfangyuan (1996), so its design was somewhat improved. For better sales, the private developer Sujing Real Estate Development Corporation allowed wider alleys and a bigger communal Central Garden as a social space. The estate has 30 percent landscaping and 232 units in two forms: 3-storey Chinese-style row houses, each with a small private courtyard; and 3-4-storey parallel apartment buildings enclosed by low walls pierced by moon gates on two sides, creating a series of semi-public courtyards resembling traditional lightwells [Figure 6]. White exterior walls and black-tiled roofs are the norm, although traditional regional architectural vocabulary seems simplified.

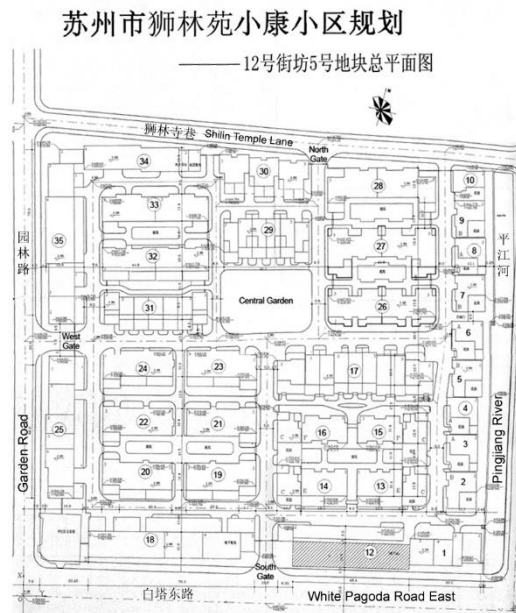


Figure 5. Shilinyuan new courtyard-garden housing estate site plan. Source: Suzhou Urban and Rural Construction Archives, 2007



Figure 6. Shilinyuan new courtyard-garden housing site map. Source: Photo by the author 2007

Like Tongfangyuan, Shilinyuan is surrounded by retail units along the estate's enclosing walls facing the street, selling arts, crafts, and souvenirs. Suzhou planning regulations strictly prohibited the building of restaurants there to minimize noise and pollution (Qu Weizu, project planner, interview, 2008). Shilinyuan was an experimental project set up by Chinese Ministry of Housing for affluent (*xiaokang*) households in the area, and the spatial design had to fulfill middle-class living

requirements with innovation. The living space needed to be bigger, the functions more rational, and the overall project more original. After completion, the project went through rigorous examination by Suzhou Environmental Protection Bureau and won the *Lu Ban Award* (a national recognition of high-quality construction projects) by Chinese Ministry of Housing.

2. RESEARCH METHOD

The research used both quantitative and qualitative methods to examine the architectural, environmental, spatial, constructional, social, cultural, and behavioral aspects of the Shilinyuan new courtyard-garden housing project. Data included onsite surveys, interviews, observations, time diaries, drawings, photos, and so on.

The fieldwork was conducted in October 2007. The property manager allowed the author/researcher to set up a table and chair by the gate for handing out survey questionnaires to passing-by residents and observing their activities. At Shilinyuan, 42 surveys were collected from the residents. The 27 respondents who provided contact information enabled the researcher to later carry out semi-structured interviews with 16 residents, one with the project planner Qu Weizu, and another with the project architect Peng Hongnian^[27] by phone and via email in 2008.

To put the interviewees at ease and encourage them to talk freely on sensitive issues, no tape-recording was used. Notes taken during telephone interviews were transcribed on the same day and translated into English by the researcher. On average, each telephone interview lasted about 30 minutes, with the longest spanning 65 minutes, and the shortest 10 minutes. The accompanying three tables show the demographic composition, education levels, and occupations of the sample population [Tables 1-3].

Table 1. Composition of residents in the study area (n=42)

Residents Information		Suzhou Shilinyuan New Courtyard-Garden Housing Residents
Age (average)		52
Gender	Male	45%
	Female	48%
	Not known	7%
Marital status	Single	2%
	Married	88%
	Divorced/Widowed	0%
Years of residency (average)		5
Household size (average)		3.44

Source: Author's survey results

Table 2. Education level of residents in the study area (n=42)

Education Level	Suzhou Shilinyuan New Courtyard-Garden Housing Residents
1. Primary School	2%
2. Junior Middle School	5%
3. Senior Middle School	10%
4. College Certificate	5%
5. College Diploma	10%
6. Associate Degree	21%
7. Bachelor's Degree	36%
8. Master's Degree	5%
9. Doctoral Degree	0%

Source: Author's survey results

Table 3. Occupations of residents in the study area (n=42)

Occupation	Suzhou Shilinyuan New Courtyard-Garden Housing Residents
1. Legislators, senior officials and managers	29%
2. Professionals	29%
3. Technicians and associate professionals	5%
4. Clerks	17%
5. Service workers and shop and market sales workers	0%
6. Skilled agricultural and fishery workers	0%
7. Craft and related trades workers	0%
8. Plant and machine operators and assemblers	0%
9. Elementary occupations (e.g., street vendors, domestic helpers, cleaners and launderers, building caretakers, window and related cleaners, messengers, porters, doorkeepers, garbage collectors, etc.)	0%
10. Armed forces	2%
11. Other	5%

Source: Author's survey results

Onsite survey data were analyzed using SPSS. Frequencies were used as the basic measurement. Each interviewee was given a unique ID with his/her survey comments combined with interview data for content analysis using MS Word. With the interview data analysis, the author was particularly looking for issues related to architectural form, spatial layout, social relations, and cultural activities/festivities associated with the project. The data on these issues were entered in the Findings section.

3. FINDINGS

This section discusses findings of the study in relation to several key areas of concern: form and environmental quality, space and construction quality, social cohesion, and cultural activities.

3.1. Form and environmental quality

The Shilinyuan new courtyard-garden housing has been designed in accordance with the Suzhou city planning regulations. Because the site is within a 6–9 m height restricted zone, its style and features must adhere to the regional characteristics and the nearby Suzhou gardens (Peng Hongnian, project architect, interview, 2008). Shilinyuan has three gates: South, West, and North [Figures 7-8]; the multiple accesses make it convenient for the residents to come in and out.



Figure 7. Shilinyuan South Gate. Source: Photo by the author 2007

When asked, “*How does the form (such as exterior appearance, gate location, sunlight, ventilation, roof design, etc.) of the new courtyard-garden housing help or hinder your daily/cultural activities?*”



Figure 8. Shilinyuan West Gate. Source: Photo by the author 2007

Two of 16 interview respondents commented on the exterior appearance of the housing. One said this architectural form complies with the aesthetic value of those attached to traditional Chinese culture [Figure 9]. Another said: “I like the exterior appearance of the buildings that looks antiqued and quaint. Many tourists from abroad or other parts of China mistook Shilinyuan as Shizilin [Lion Grove Garden] as they all appreciated its appearance” [Figure 10]. The other 14 residents did not comment on the exterior appearance, but other issues related to the form (gate location, sunlight, ventilation, roof design, etc.).



Figure 9. Shilinyuan row/town/terraced houses, each with a small, private courtyard. Source: Photo by the author 2007



Figure 10. Shilinyuan exterior. Source: Photo by the author 2007

A resident felt that the space between buildings is like a *tianjing* (“lightwell”), but it is better than a traditional *tianjing* because the landscape is cared for by the property management, making life easier for the residents [Figures 11-12].



Figure 11. Shilinyuan apartment buildings with a semi-public courtyard. Source: Photo by the author 2007



Figure 12. Shilinyuan semi-public courtyard, Suzhou. Source: Photo by the author 2007

Five of 16 interview respondents spoke positively that sunlight and natural ventilation are good from the ground/1st to the 3rd floors. Three residents stated that having windows on all four sides brought benefit from sunlight in all directions and internal airflow, with one resident also indicating that having a skylight on the top/3rd floor gains the most direct sunlight. As one resident revealed that since her house has eight windows downstairs and four upstairs, including French windows, it receives excellent sunlight and north-south ventilation. French windows seem suitable to warmer climates of southern China. However, a resident also complained that her ground/1st floor unit gets almost no sunlight for half a year. While some bathroom windows open to the outside and receive natural ventilation, others on the ground/1st and 2nd floors open to public corridors and have poor ventilation, despite fans. While some kitchens are well designed so that cooking exhaust can be emitted directly to the outside, other kitchens without windows have a ventilation problem. While the storage space on the ground/1st floor has good sunlight and ventilation, the underground storeroom is not airy, and things go moldy.

The Suzhou Building Code regulates that on the Great Cold Day (January 20–21, the 24th solar division), sunlight penetration should be not <2 h, and on Winter Solstice (December 21–22), sunlight penetration should be at least 1 h. These requirements demand the ratio of building height to distance at a minimum of 1:1.3 in Suzhou ^[1], which means if the building is 9–12 m high, the distance should be 12–16 m. Shilinyuan was designed with 10–11 m distances between the 3–4-storey buildings, with landscaping enclosed by two side-walls to create a sense of quasi-courtyard. However, Shilinyuan site plan reveals uneven building distances between 8–13.5 m. Seven of 16 interview respondents commented positively that the 11–13.5 m building distances are wide, and that they

like the landscaping. However, two residents observed the 8–9.5 m building distances are too close.

As Shilinyuan residents are generally aware of land shortage in the old city, they accepted their small private courtyards. The communal Central Garden [Figure 13] is a platform for social interaction because the Suzhou Building Code requires that public green space should be 1 sqm per person, and for groups as large as a 500-resident housing estate, the green space needs to be 0.5 sqm per person, which determined the size of the Central Garden. As environmental designs for new housing are crucial, landscaping is an important aspect at inspection (Peng Hongnian, project architect, interview, 2008).



Figure 13. Shilinyuan communal Central Garden. Source: Photo by the author 2007



Figure 14. Shilinyuan private courtyard of a row/town/terraced house. Source: Photo by the author 2007

Two residents living in row houses revealed their 30-sqm private courtyards with the layout perfectly fitting for a couple or small family [Figure 14]. One resident commented with satisfaction: “My apartment is in a good location, with the communal Central Garden right outside my front door, and a private yard at the back.”

3.2. Space and construction quality

As most people spend at least one third of their time (8/24 h) at home, the spatial design becomes crucially important. When asked, “*How does the space (interior and exterior) of the new courtyard-garden housing help or hinder your daily/cultural activities?*”

Two of 16 interview respondents preferred more spatial divisions for practicality, especially more bedrooms [Figure 15] if an elderly or a sick person needs a living-in nanny. Since Shilinyuan was designed at a time when the fashion was to build large living rooms but small bedrooms, several residents indicated that some units have bedrooms big enough only for a bed and two bedside tables, with no room for a chair; one has to awkwardly sit on the bed after entering the room. Moreover, an apartment with several staggered levels connected by steps makes it inconvenient to go between the floors.



Figure 15. A bedroom on the 2nd floor of a row/town/terraced house, Shilinyuan. Source: Photo by the author 2007

In Suzhou, the ground-/1st-floor apartments are generally damp during plum rains in June and July, but these new houses are not raised above ground to block rainwater. While traditionally Suzhou has no basements because of a moist and humid climate, a resident observed that underground storage is still necessary for bicycles and household objects.

While Shilinyuan have larger and similar unit sizes, residents observed that a unit of 90–120 sqm is sufficient for a 2-3-person household and 120–150 sqm is very satisfactory, they also found 150–180 sqm to be very spacious and 220–350 sqm very large. Thus, a unit of 90–180 sqm is generally a satisfactory interior space for these residents.

The survey results showed that most Shilinyuan residents preferred to live on the 3rd floor (48%; $n = 42$), followed by the 2nd floor (40%), and 1st floor (29%). This finding is consistent with the Suzhou Jiaanbieyuan new courtyard-garden housing^[28], and Beijing Juer Hutong new courtyard housing^[29], but contrary to the renewed Beijing traditional courtyard houses^[30], likely because the lower levels receive poor sunlight due to the close building distances, also because in Suzhou the ground is damp during the rainy season.

Planning regulations for Shilinyuan mandate that basic services such as water, electricity, and gas, be provided (Qu Weizu, project planner, interview, 2008), residents seemed to be satisfied with their facility provisions.

One of 16 interview respondents objected to disturbing noise generated from her neighbor's air-conditioner. Two residents were critical of the heat emitted from their neighbor's air-conditioners because it discouraged them from opening windows. Another two residents reported that when their small sewer pipes are blocked with backed up drainage water, their kitchen and toilet will also be flooded.

Shilinyuan new courtyard-garden housing has applied new materials to save

energy and resources. For example, load-bearing perforated clay bricks (30% hole) that offer good thermal insulation were used instead of solid clay ones. With well-insulated doors and windows, the design can save 50 percent of energy consumption (Peng Hongnian, project architect, interview, 2008). A resident observed that the walls are firm and sturdy, with adequate sound and thermal insulation. However, one resident commented that some east- and west-facing exterior walls leak during heavy rains and thunderstorms, which is a construction quality issue.

The initial property management at Shilinyuan was part of the developer's company that always responded to damages and repairs. However, it did not keep a public property account. Some members in the Property Owners Committee started looking for faults in their management and introduced a new management company that would have to offer benefits to homeowners serving the Committee by exempting their maintenance fees. Consequently, some homeowners have never paid maintenance fees. Although the new management company is proficient with a more professional attitude towards service, its profit margin is so decreased by the Property Owners Committee that it is very difficult to ask them to repair anything for the homeowners if they must spend money on it. In 2008, the maintenance fee at Shilinyuan was lower (CNY ¥0.5/sqm) than that in the new Industrial Park District (e.g., CNY ¥2.59/sqm), with differences in the quality of service and sense of responsibility. These variances lie in the size, number, and maintenance of communal green areas and children's playgrounds, supply of healthcare facilities, clear division between car park and pedestrian spaces, organized social and cultural events, 24-h duty of property management, professionally trained security guards, tighter security control at the estate gate, and so on.

Due to land shortage, Shilinyuan is provided with bike parking but not a car park (Peng Hongnian, project architect, interview, 2008). A resident complained that too many cars are parked along the estate's alleys, creating disorder. Some residents also honk and speed through the estate, disturbing the peace of the residential environment.

3.3. Social cohesion

Traditional Chinese courtyard houses facilitate social interaction among the single-extended family members when they greet each other at the courtyard or the main hall. In answering the survey question, "*Which space helps your relationship with other families in the courtyard-garden housing?*" Half of the respondents chose "courtyard" (50%; $n = 42$), followed by "public corridor" (21%), but one third of them indicated "very little communication" (33%).

During subsequent interviews, when asked, "*How does the new courtyard-garden housing help or hinder you socialize/communicate with your neighbors?*"

Three of 16 interview respondents enjoyed good neighborly relations, regular visits and chats. For instance, when it rains, they remind each other to bring in their laundry. Another example is an elderly neighbor with a fracture of the lumbar vertebra. Since her children worked during the day, her neighbor looked after her and provided food that she liked every day until her recovery. For neighbors with closer contacts, they send *zongzi* (a pyramid-shaped dumpling made of glutinous rice wrapped in bamboo or reed leaves) during Dragon Boat Festival and give gifts to each other's children during Spring Festival (2/16 respondents). However, five residents felt that life was sincerer in traditional courtyard houses where the gate was always open with several generations living together, and where the elderly enjoyed visiting

neighbors and communicating directly. A resident recalled:

I lived with over 10 households in a *dazayuan* ["big and mixed-yard"] for a few years. Every time we saw each other when coming and going, we would say "hi." We enjoyed cool summer breezes in the courtyard and had good contact. The kind of housing we now live truly hinders our social interaction and communication with neighbors.

Similarly, Jin *et al.* (2004) noted that in traditional Suzhou neighborhoods, almost all the residents living on the same street knew each other because when their children visited each other's homes and the elderly chatted often, there was a strong sense of social interaction. Newly-built housing offers much fewer venues for this cohesion, perhaps because the developers' approach to establishing traditional ambience rely more on architectural applications for exterior features than human factors^[31].

Over 70 percent of the interview respondents revealed that the neighbors seldom communicate, and that every household lives its own life behind closed doors, mainly because people are very busy with their work. If there is an issue with neighbors, they will try to solve it through the property management. Although they walk around the housing and talk with neighbors when they meet, these relationships are superficial and distant. Thus, China's fast-paced economic development extracts a high social cost.

A communal Central Garden located in the middle of Shilinyuan is paved with patio stones, with grass and bushes on the edges, but no water feature (unusual for a Suzhou garden). A resident explained that because this housing was built to meet standards of its time (2000), certain important garden elements are missing. Four of 16 interview respondents revealed a handful of elderly residents chat in the Central Garden regularly, but others

seldom or never do so; these differences are more related to character, habits, and educational levels than architecture.

On a Saturday afternoon between 2:30–5:00 pm in early October 2007, the author/researcher observed seven adults sitting on a stone bench in the Central Garden, chatting and watching children play. Two were young mothers, and five were in their 60s and 70s [Figure 16]. One young mother told the researcher that she rarely saw the residents frequent the Central Garden; quite often, only her husband, daughter, and herself would be in the Garden because they did not have their own private courtyard. When her daughter played with other children in the Garden, she could make new friends. Although it was helpful to get acquainted with neighbors through children, mosquitoes were a threat. Another young mother explained that she was in regular contact with the neighbors because of the Central Garden, but the Garden was too small for the children to bicycle or to roller skate. Although many children often play ball games in the Garden, there is no sports ground here. Only schools in the Pingjiang Historic District have sports grounds, but Suzhou schools are closed to the public.



Figure 16. A group of elderly residents chatting in the Central Garden, Shilinyuan. Source: Photo by the author 2007

Two of 16 interview respondents complained that the district community to which Shilinyuan belongs has incomplete facilities; there is no library, reading room,

or room for residents to meet in. Some residents exercised in the district Community Center's gym, 5 km away. Two residents suggested that social and cultural activities should be organized by the Residents' Committee or the property management. However, in 2007, few activities were arranged that residents would enjoy and benefit from.

3.4. Cultural activities

In Suzhou in the past, scholars and artists would regularly meet in classical gardens of private homes where they could actively socialize, peacefully contemplate, philosophize, study, compose and read poetry, paint, play chess and games, drink tea or wine, pick herbs for medicine, make elixirs in quest of immortality, and the like. Many of these trendy pastimes were practiced well into the Song (960–1279), Ming (1368–1644), and Qing (1644–1911) dynasties^[32]. Courtyard-gardens thus served as spiritual and material refuges and fostered a cultured way of life.

In reaction to the survey question, "*What is the focal point of your home, if any?*" The findings indicated that the residents' focus at home is the television (45%; $n = 42$) and their children (45%), followed by the computer (31%), and lastly, the dining table (14%). It shows that Shilinyuan residents have adopted modern technologies in their lifestyles; meanwhile, they have also maintained their traditional life of caring for their children.

In the succeeding interviews, when asked, "*What is your major activity at home in an ordinary day? Which space do you use for this activity?*"

Six of 16 interview respondents mentioned that they exercise, hang out laundry, and plant grass and flowers (e.g., sweet-scented osmanthus, wintersweet, azalea, clivia, etc.) in their private courtyards, because the courtyards have a water tap for washing and watering plants. Several residents do *taiji* between the apartment buildings, or enjoy gardening, reading, drinking tea, and resting on roof

terraces in the summer. Loft spaces are also well used activity areas.

A resident observed that Suzhouers used communal courtyards more often in the 1970s because without TV, computer, internet, air-conditioner, or electric fans, people came out more often to rely on natural cooling. Hence, not only does design matter to people's activities, modern lifestyles have also changed their behavioral patterns.

The private courtyards of row houses in Shilinyuan are normally 20 sqm, with slightly larger ones at 30–40 sqm. Two of 16 interview respondents expressed that although some courtyards are landscaped with a pond, flowerbeds, grass, and concrete paving, their use of them for activities is low due to the small spaces; the yards are mainly open views that residents enjoy from their windows. For apartment buildings, the front yard is as small as 3 sqm and only useful for drying laundry. To build more units, the developer has made courtyards much smaller than they should be, but this limited feature does not function well for residents. Thus, a courtyard size impacts on residents' cultural activities.

Nevertheless, the survey results show that Shilinyuan residents' most common cultural activities in the courtyards are maintaining health/natural healing (mean=3.36; $n = 25$) and gardening (mean=3.14; $n = 22$) [Table 4], while their most celebrated cultural festivities in the courtyards are Spring Festival (mean=3.30; $n = 23$) and Mid-Autumn Festival (mean=3.05; $n = 22$) [Table 5].

In the subsequent interviews, when asked, "*What traditional Chinese cultural festivals do you celebrate at home and how do you celebrate them?*"

The results confirm that the most celebrated is Spring Festival (Chinese New Year: the first day of the first lunar month), as 14 of 16 interview respondents said they did so.

Table 4. To what extent do you or your family use the courtyard to do the following cultural activities, if any? ($n=42$)

Cultural activities in the courtyard	Mean (1-5)
1. Maintaining health/natural healing	3.36 ($n=25$)
2. Gardening	3.14 ($n=22$)
3. Drinking tea	2.72 ($n=18$)
4. Holding birthday party	3.20 ($n=10$)
5. Practicing calligraphy	2.63 ($n=8$)
6. Playing musical instruments	2.62 ($n=8$)
7. Playing games	2.33 ($n=12$)
8. Singing traditional operas	2.29 ($n=7$)
9. Composing poetry or article	2.00 ($n=7$)
10. Dancing	1.90 ($n=10$)
11. Doing painting	1.86 ($n=7$)
12. Holding wedding ceremony	1.71 ($n=7$)
13. Other, please specify:	5.00 ($n=1$)

Source: Author's survey results

During the Spring Festival, they would paste on door panels and walls with traditional ornaments such as the character 福 (*fu* for "good fortune" or "happiness") (5/16 respondents), spring couplets and posters (5/16), hanging red lanterns (5/16), putting a vase of flowers in their dining rooms, and so on. Their home decorations are normally conforming to Confucian and Daoist principles. They also have a family reunion dinner at home (4/16) or in a restaurant (5/16). There are many dishes, among which are the New Year's cake made of polished glutinous rice. On the Lunar New Year's Eve, some let off firecrackers (3/16) in the courtyards and

stay up until 12 o'clock midnight to eat dumplings and turn on all the lights to expel evil. Some families (3/16 respondents) would also worship their ancestors on the New Year's Eve.

Table 5. To what extent do you or your family use the courtyard to do the following cultural festivities, if any? (n=42)

Cultural festivities in the courtyard	Mean (1-5)
1. New Year's Day (Solar New Year)	2.69 (n=13)
2. Spring Festival (Lunar New Year, 1st day of the 1st lunar month)	3.30 (n=23)
3. Lantern Festival (Spring Spirit Festival, 15th day of the 1st lunar month)	2.79 (n=14)
4. Qing Ming Festival (Clear and Bright Day, or Tomb-Sweeping Day, April 5, leap year April 4)	2.11 (n=9)
5. Dragon Boat Festival (5th day of the 5th lunar month)	2.45 (n=11)
6. Mid-Summer Spirit Festival (or 'Ghost Festival,' 15th day of the 7th lunar month)	2.12 (n=8)
7. Mid-Autumn Festival (or Moon Festival, 15th day of the 8th lunar month)	3.05 (n=22)
8. Double Ninth Festival (9th day of the 9th lunar month)	2.11 (n=9)
9. Winter Solstice Festival (December 21-22)	2.50 (n=12)

Source: Author's survey results

Five of 16 interview respondents mentioned that they celebrate the Qing Ming Festival (April 5 or April 4 in leap years) by sweeping their ancestral tombs and kowtowing to pay respect.

Two of 16 interview participants celebrate the Start of Summer (May 5–7, one of the 24 solar divisions) when they would eat salted duck eggs.

Four of 16 interview respondents celebrate the Dragon Boat Festival (5th day of the 5th lunar month, originally

derived from the Summer Solstice, June 20–21) when they would have a family reunion dinner and eat *zongzi* together. Normally they also hang wormwood and calamus on the door panel and wrap and roll garlic in a red paper to prevent insects and expel evil.

Two of 16 interview respondents celebrate the Mid-Summer Spirit Festival (15th day of the 7th lunar month) when they would offer sacrifices to their ancestors by kowtowing and paying respect.

Twelve of 16 interview participants celebrate the Mid-Autumn Festival (15th day of the 8th lunar month, initially associated with the Autumn Equinox, September 21–24), making it the second most celebrated festival among the residents. On this occasion, they would have a family reunion dinner at home or in a restaurant, eating moon cakes, fruits, water chestnut, sugar taro, and enjoy the full moon at home or along the riverside. The celebration has such a rich variety that has left some residents with very profound memories about their childhood lives on the day.

One of 16 interview respondents celebrate the Start of Winter (November 7–8) when they would steam crabs, boil rice wine, admire chrysanthemums, and listen to Pingtan (a storytelling and ballad singing in Suzhou dialect).

Ten of 16 interview respondents celebrate the Winter Solstice Festival (December 21–22). The Suzhou custom is that the Winter Solstice is as big as the Spring Festival, and a Suzhou proverb even says: "The Winter Solstice is bigger than the Spring Festival, the rich eat all night and the poor are in the cold all night." This is the time when they would spend with their parents and siblings. On the night before and on the Winter Solstice Day, they would gather together, cut lamb cake (made of frozen lamb mixed with lamb soup, eating it may help to keep warm), and drink osmanthus winter wine (a traditional Suzhou rice wine made of

osmanthus). In the afternoon, some families would prepare a table of many food, including wine and vegetables, then they would worship their ancestors, and then they ate the feast at home. Still, siblings and their children would gather together in the early evening (normally in a brother's home), with many dishes and lit fragrant candles, in front of which the family would kowtow to the departed family members and burn tinfoil paper (formerly used as funeral offerings). Then the family would be seated around the dining table for dinner. But now they would mostly gather for a meal in a restaurant, and then worship their ancestors and sweep the tombs.

Although Christmas is not an indigenous Chinese cultural festival, two of 16 interview respondents celebrate it. They would display a Christmas tree and hang colorful mini-lights at home. On the Christmas Eve, a couple said they would have some Suzhou specialty winter wine. After dinner they would watch TV that shows how people spend the Christmas Eve outside in Suzhou Amusement Park and Ferris Wheel Park, as many parents would take their children to play in the cold wind.

As community/city parks/gardens are more public than residential courtyards, they have become the most common sites for cultural activities (43%; $n = 42$), followed by balcony/roof terrace (10%). This finding is confirmed by the interviews when residents complained about a lack of public or recreational facilities in the courtyards for cultural activities. When asked where they partake in cultural activities, if not in courtyards, residents noted that cultural activities, such as a private calligraphy club or morning exercises, often take place in a city garden. Shilinyuan is near the Lion Grove Garden [Figure 17] and the Humble Administrator's Garden [Figure 18]. However, the spaces of such city gardens are limited because Suzhou gardens were originally private family gardens that are

small. Now they have become public gardens which many people frequent, making them unsuitable for quiet walks.

In a 2017 trip to China, the author revisited Suzhou Shilinyuan. She asked the security guard if the original property management was still there as she wanted to thank Mrs. Chen who provided conveniences for her research at the estate. The security guard said there had changed several management teams since 2007. Many things are transient in China nowadays, which is only one aspect of modern lifestyle there. The author also observed more vehicles at the South Gate than 10 years ago, making pedestrian walking more dangerous, especially for children and the elderly.



Figure 17. The Lion Grove Garden adjacent to Shilinyuan. Source: Photo by the author 2017



Figure 18. The Little Flying Rainbow Bridge in the Humble Administrator's Garden near Shilinyuan. Source: Photo by the author 2017

4. CONCLUSION

Shilinyuan new courtyard-garden housing is a modern interpretation of traditional Suzhou houses, and this research examined its architectural, environmental, spatial, constructional, social, cultural, and behavioral aspects of it. The findings show that this project is only culturally sustainable to some extent, but has the following issues raised by the residents.

Due to land shortage in the inner city of Suzhou, the courtyard sizes do not always follow the minimum ratio of 1:1.3 for the building height to distance required by the Suzhou Building Code. As such, many courtyards do not function well. Some private courtyards are only big enough for drying laundry, not for cultural activities. Nevertheless, in the larger private and semi-private courtyards, the top two cultural activities are maintaining health/natural healing and gardening.

Regarding the interior design, in most cases the bedrooms are also too small to accommodate chairs for the residents to sit on, and the lack of additional number of bedrooms for living-in nannies have presented a problem for some households who require homecare services.

The communal Central Garden facilitates social interaction for seniors and physical activities for children, but the size of the Garden prevents kinetic activities such as bicycling and roller skating. Moreover, private cars driving along the alleys have presented a threat to pedestrian walking and cultural activities in the housing estate. An automobile-free residential environment is a must for a safer outdoor life.

Spring Festival, Mid-Autumn Festival, and Winter Solstice Festival are the most celebrated by these residents, and they did so largely indoors, with some occasionally celebrating in the nearby city gardens and along the canals. Thus, living close to a scenic spot is conducive to cultural activities. These findings may have implications for future courtyard housing designs in China and around the world.

5. RECOMMENDATIONS

Based on the research findings, the author has proposed two new courtyard-garden housing systems that encourage social interaction and cultural activities for ordinary citizens and middle-income families in Suzhou [Figures 19 and 20], which may also have broader application.



Figure 19. Proposed new courtyard-garden housing compound hosting four nuclear families. Each unit is 180 sqm on three levels above the ground. Source: Zhang (2013/2016)^[1]



Figure 20. Proposed new courtyard-garden housing compound hosting four nuclear families. Each unit is 240 sqm with 2½ levels above the ground and a semi-basement. Source: Zhang (2015/2017, 2016, 2017)^[4,33,34]

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CONFLICT OF INTEREST

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