

# Shanghai Lilong Tower Urbanism

## *Towards an Urbanism of Parametric Preservation*

Christian J. Lange<sup>1</sup>

<sup>1</sup>Department of Architecture, The University of Hong Kong

<sup>1</sup>cjlang@hku.hk

*This paper describes a design approach for a new urban building typology for Shanghai utilizing a set of parametric design techniques to arrive at an alternative solution to current models of urbanization. The goal in this approach was to find a solution that is adaptable and sensitive to the urban environment and has the capacity to preserve historic urban street patterns. The approach included an understanding of the historic urban fabric of Shanghai, a respective plot analysis and the development of a computational method to produce a new urban type. The parametric set-up was build upon an analytical workflow with integrated feedback procedures that informed the design exploration and resulted in multiple design solutions.*

**Keywords:** *Parametric Urbanism, Computational feed back strategies, Design Research*

Figure 1  
Old city fabric gets replaced with generic housing towers, Shanghai

### INTRODUCTION

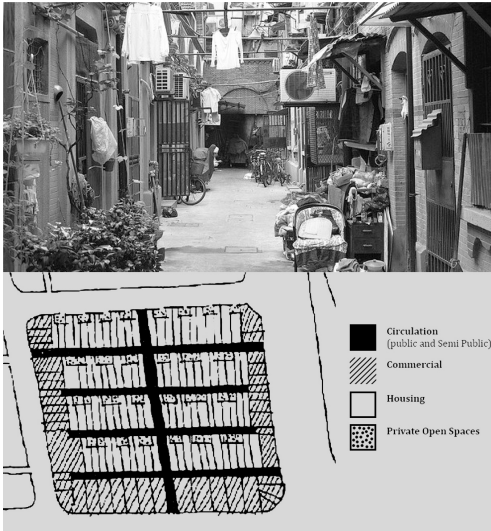
Shanghai is the largest city in China with a population of over 20 million inhabitants in its greater metropolitan area. In the last two decades the metropolis has undergone a rapid economic and urban expansion. The city contains now thousands of buildings labeled as tall, with many more to come within the next few years. This development has irreversible effects on the quality of urban space and the way people live. In large parts of the city the traditional urban fabric of low rise, low-density row houses has been already replaced by generic high-rise typologies that are transforming significantly the urban life and neighborhood relationships (Fig.1). If this trend continues, the original character of the city will be largely at danger.



The research project entitled "Shanghai Lilong Tower Urbanism - Towards an Urbanism of Parametric Preservation." is a theoretical attempt that offers a counter proposal to the current models of urban developments in Shanghai. By utilizing computational methods the project aims to arrive at an alternative solution, addressing the original qualities of the traditional urban fabric.

## ISSUE AND BACKGROUND

Until the early 1950's more than 60% of the total housing area in Shanghai consisted of Lilongs, Qian Guan (1996). This ground-related building block is characterized by an outer perimeter along the main streets that is dominated by workshops and shops and an inner circulatory rational system that gives access to the two to three story high residential units (Fig.2). This set up provides a high degree of security and privacy, while at the same time delivering social cohesiveness through a strong neighborhood community.



Since China's economy has burgeoned in the early 90s' huge parts of the city were redeveloped by utilizing to a large extent the two usual suspects of modern Asian city developments; the generic point block tower set in an open green landscape, and the podium tower dominating and internalizing an urban block. Both became the predominant building model of efficiency and economy for high-density housing in the city.

While the personal living conditions plus the floor area ratio for the individual increased through

the development of new housing towers, the traditional urban neighborhood qualities with active street life diminished. As a result social interaction amongst residents decreased and the concept of the collective shrunk, which in general are very strong in the traditional pattern of Lilong settlements in Shanghai, Qian Guan (1996).

## URBANISM | PARAMETRIC URBANISM

With rapid urbanization happening around the world and specifically in China, there has never been a more crucial time to challenge, reassess and propose alternatives to conventional urbanism and its associated conventions, types and standards, Verebes (2013). In the last two decades much research and design development has been undertaken utilizing computational methods to arrive at novel solutions for masterplans and urban organizational patterns, which all have one in common: To provide an alternative to the ideas of modernism.

One North Masterplan in Singapore by Zaha Hadid Architects is only one of many projects utilizing these new methods. While the masterplan uses parametric techniques to arrive at a solution that offers variation in plot size, density and plot height, it's mostly concerned with the urban form. One North achieves unity in difference - exploiting gentle, undulating, dune-like urban mega-forms to generate a sense of spatial coherence, (Hadid/Schumacher).

Most approaches in contemporary parametric urbanism neglect the existing city and use patterns to generate new kinds of street network and plot geometries. While the patterns are fascinating, there seems to be a lack of understanding whether they produce an urbanism that results in a livable city. It's not so much the pattern that dominates how a city works; it's rather open public spaces that provide a good living environment. Already over a century ago Camillo Sitte stated that the key element of successful city planning is the plaza or public square. If they are created and utilized in an accurate way they have the capacity to create a backdrop to everyday life within the city, animating their surrounding build-

Figure 2  
Lilong Settlement,  
Shanghai

ings as well as providing a space to perceive the build environment, Sitte (1889).

The other public space that generates city life is the street, which in most cities is along the edges of blocks. In most cases historic city fabric provides a lot of them in various grains. Though for modern planning they seem to be an obstacle, since there are difficulties to cope with the traffic of today, they represent an invaluable asset. Frequent streets and short blocks are valuable for a city, because of the fabric of intricate cross-use that they permit among the users of a city neighborhood, Jacobs (1961). So, why not keep them?

That leaves us with the last element of importance for a successful city, the building type. It's time for the search for 'renewable' building types that are able to negotiate the rapidly changing circumstances of cities in an era of global capitalism, Lee & Jacoby (2007).

### HYPOTHESIS AND GOAL

Taking the qualities of the Lilong settlement as a point of departure, the premise of the project was to establish an alternative building type with the capacity to maintain the original character and network of the city, while offering at the same time new types of urban public spaces(Fig.3). Based on a computational adaptable system the project suggests solutions that have the ability to preserve the identity and urban quality typical to Shanghai, without neglecting the call for densification. In fact the project is aiming to find a compromise between the need for compaction, the desire to preserve the most possible quantity of historical city fragments, and the idea of an architectural organism that combines vertical built volumes together with ground-level public open spaces.

As testing ground the project utilized a larger urban context around Xiaonanmen Subway Station (Fig.4). The site with an overall area of around 80 hectares is situated between the old city center and the Huangpu River. In the past two decades it has been heavily affected by the Tabula rasa mentality of

today and will have in a few years time if this development continues no historic residue left. While in 2001 the site was still primarily structured by low-rise urban fabric with a dense and intricate street network, in 2014 around three quarter of the area was transformed into a new environment that had erased most of the existing street pattern and combined the previous plots into larger zones that are now occupied with generic high-rise buildings.



### PARAMETRIC FORM GENERATION

The project utilized the generic Rhino software package with the Grasshopper plug-in to analyze the existing urban patterns, to simulate the overall urban configuration and to generate prototypical individ-

Figure 3  
Areal view of  
prototypical tower

Figure 4  
Testing site near  
Xiaonanmen.  
Urban situation  
2001 and 2014  
(Source: Google  
Earth).

ual towers that could adapt to any given individual plot. The overall digital set-up was divided into a set of different grasshopper definitions in order to make the workflow easier and less memory intensive. Eventually the definitions were divided into three main areas. There was one definition for the analysis of the plots, one for the massing of the typology, and one that interpreted the massing into a structural solution and unit arrangement.

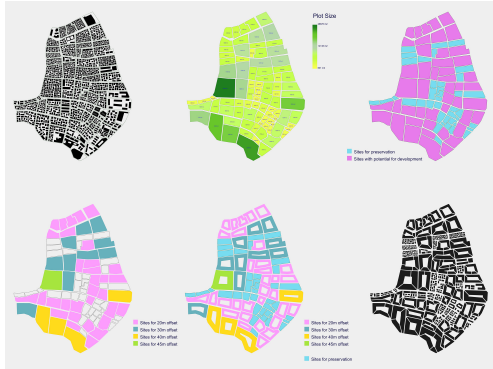


Figure 5  
Analysis & Process  
diagrams



Figure 6  
Plot analysis with  
Grasshopper,  
Understanding of  
potential  
configuration for  
courtyard  
measurements

### Analysis:

Most existing plots within the testing ground can be categorized as shapes with four dominant corners that form the intersections of the circulatory system. Each shape within the system is unique in its edge condition and geometry. All plots were first drawn manually in the Rhino environment as accurate as possible and with the least amount of control points as possible for better control purposes. Plugged in into Grasshopper all plots were then analyzed in terms of shape (length to width relationship), access possibilities and overall area, to determine whether a site had the potential to be redeveloped or to be preserved (Fig.5). This judgment was mainly based on the prospective building mass possible for each site and not on the actual cultural value of the buildings on the site. The shapes were also tested for the possible courtyard scenarios using different offset settings of the boundary condition (Fig.6).

### Research into existing plazas:

While Sitte suggests that urban plazas and courtyards are key elements within a city context, they don't work per se. The success of them is dependent on eaves height, width, length and programs. Since program is a factor that is difficult to monitor, the project focused on the geometry and size of the resulting open spaces. To determine the maximum area a research was conducted into existing plazas that are generally considered as spaces with a high degree of spatial quality, but are also on the larger end of the spectrum in terms of area.

- Pariser Platz in Berlin (108m x 120m, 12960m<sup>2</sup>)
- Placa Real in Barcelona (80m x 48m, 3840m<sup>2</sup>)
- Placa Major in Madrid (120m x 85m, 10200m<sup>2</sup>)
- Piazza Navona in Rome (40m x 246m, 9600m<sup>2</sup>)
- Hoxton Square in London (54m x 84m, 4536m<sup>2</sup>)
- Place des Vosges in Paris (130m x 130m, 16900m<sup>2</sup>)

Most of these places develop a vibrant life throughout the day, yet this might be also largely due to their touristic character. However, the average sizes of these spaces were around 9600 m<sup>2</sup>, which eventually was used as a maximum size for the courtyard sizes of the project. Since larger sites in the testing ground had a larger offset the biggest courtyard was eventually 6900m<sup>2</sup>. Most of the generated spaces were between 700m<sup>2</sup> and 4500m<sup>2</sup>.

### **Rule based approach:**

The problem with parametric design in general is that a designer of a definition or script can easily get carried away and set up a system with too many parameters. The danger of this is that it becomes hard to evaluate the possible outcomes. To avoid this the project was following a set of strict rules, making it easier to understand the outcomes. For the footprint generation of the towers and courtyard's the project utilized the following rules:

- No plaza should be larger than 9600m<sup>2</sup> and smaller than 700 m<sup>2</sup>
- Plots that could not cater for open spaces above 700m<sup>2</sup> would be automatically preserved
- Offsets of plots should be a minimum of 20 m and a maximum of 45m to allow for economical use of the resulting footprints.
- Plots can either have two, three or four access lanes, resulting into two three or four towers per plot.
- To allow for more variation and more privacy courtyard offsets can be rotated by a maximum of 25 degrees.

For the towers the following rules were applied:

- Each tower had a two-story extrusion of the generated footprint to adapt to the eaves of the adjacent lilong structures.
- The massing of the tower was generated through a surface generation that negotiated between the profile of the actual footprint and a generic rectangular profile that allowed

for a double loaded corridor with unit depths of around 7m.

- The intermediate geometry that negotiated between the extrusion of the footprint and the generic tower was set at a minimum height of four stories and maximum of seven stories, in order to minimize too much deep space.
- Cores of towers could be either located on the inner perimeter of the footprint towards the courtyard or on the outer perimeter towards the existing street, depending on whether one would like to activate the courtyard or keep it more private.

While there are exceptions of plots with more than just four dominant corners, in principle, the system offers plot access strategies that have one, two, three or four access lanes. Depending on the offset parameter and number of access lanes for each plot, the overall set up produces a secondary urban network, resulting in more connectivity of the neighborhood. Multiple configurations would be possible that would result in different kinds of urban flow (Fig.7).

Figure 7  
Density Scenarios  
of Urban Formation



In essence the overall set up generates a two to three story podium that adapts to the eaves height of the traditional context, while implementing access lanes to a variably sized inner courtyard that provides a more private urban environment. This inner courtyard is surrounded by a commercial perimeter, activating the more intimate public space (Fig.8). The landscape of the podium that terraces from the roof of the second level several floors up before merging into the tower, provides an open space accessible to the public working as half park and half promenade. Animated with trees and urban green it functions as an extension of the urban life. The typology is in principle a synergy of a podium and a tower that generates in between the two conditions publicly accessible urban terraces vertically and inner urban courtyards horizontally. The towers that are flexible in form evolve out of the ground figure that adapts to the site and the specific input settings (access, height, courtyard-size, etc.) The typological configuration can be changed to a more extroverted setting, that directs the cascading terraces towards the street and a more introverted setting that directs the same towards the inner courtyard (Fig.9).



Since each plot has its unique polygonal shape with its respective control points, the definition to create the overall massing was developed with a set of numerical sliders that allowed for real-time feedback during the design process. The system underlying the project that is based on a simple lofting techniques that negotiates between the footprint and the profile of the tower is hereby able to adapt to any given plot topology of the city, while offering flexible tower morphologies that can orient independently. All urban and architectural features that are important for the overall outcome can be altered through interactive sliders.

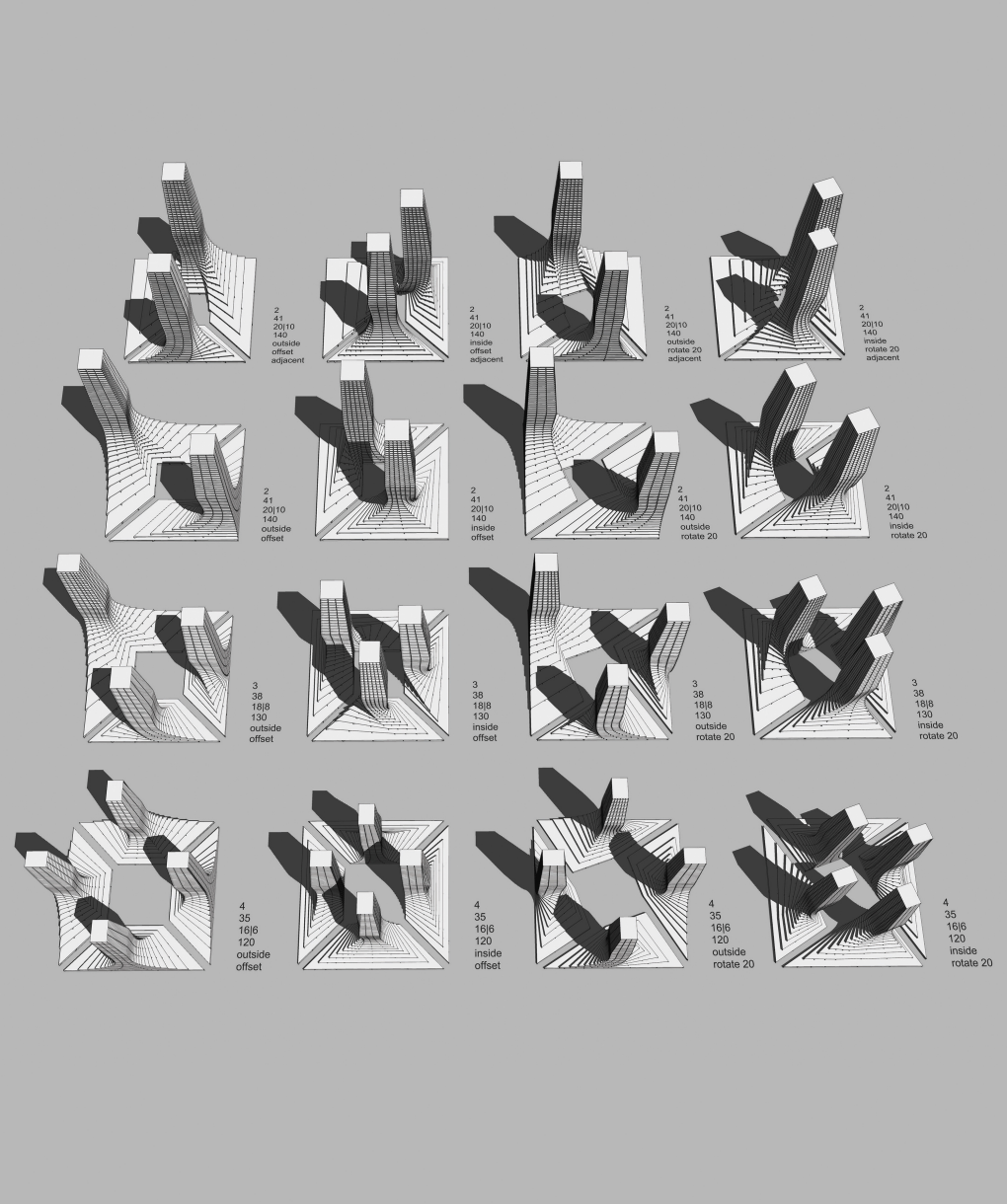
## CONCLUSIONS + OUTLOOK

The key question must be asked, how does this new typology compare to the current models of urbanism in Shanghai that are ultimately following the maximization of any given plot ratio. Since quality of space is at times hard to measure a quantitative analysis was undertaken. For evaluation purposes two specimen of the generic typology within the vicinity of the site were measured in terms of their plot ratio and compared with the proposed typology on one of the larger sites within the testing zone (Fig.10). While the generic podium tower had a plot ratio of 7.5 the tower in the green park had a plot ration of 5.9. In order to make the comparison meaningful the height of the proposed typology was set to the same, which was in this case 100m. Although none of the three versions of the new typology (four towers, three towers, two towers) reached the plot ratio of the podium tower, two of them had at least a higher plot ratio than the tower in the park.

Ultimately it needs to be discussed whether this type has a chance against the more efficient podium tower. Certainly it has the potential to preserve parts of the city and to bring new public spaces to the neighborhood.

Figure 8  
Inner Courtyard  
setting of  
prototypical tower

Figure 9  
 Matrix of adaptive  
 Tower  
 configurations



Type	Height	Tower Footprint	Plot Ratio
Lilong Row house	~ 6m	n/a	1.2 - 1.5
Generic podium tower	~ 100 m	16m/50m	7.5
Tower in a green park	~ 100 m	14m/30m	5.9
<b>Proposed Tower Typology</b>			
4 towers	~ 100 m	16/20	6.7
3 towers	~ 100 m	16/20	6.2
2 towers	~ 100 m	16/20	5.7
4 towers	~ 100 m	20/20	7.6
3 towers	~ 100 m	20/20	6.8
2 towers	~ 100 m	20/20	6.1
4 towers	~ 120 m	14/16	6.0
3 towers	~ 135 m	16/18	6.9
2 towers	~ 145 m	20/20	7.2

However, given the current situation in cities in China today, the project could open up a discussion about new types for the city and the implementation of computational tools in city planning. Though the project was in this case focusing on Shanghai and its respective urbanism, the project could be applied onto different urban settings within China. The country is currently facing tremendous urban pressures. Within the next two decades the government's vision is to transform around 270 million village dwellers into city dwellers. In the years to come China will annually construct more than fifteen hundred buildings of thirty stories or higher, which is in essence the equivalent of a new Chicago every year, Hulshof & Roggeveen (2011). The pressure on existing environments is large. Parametric modeling techniques could be part of a solution to simulate environments ahead of time and to evaluate the spatial qualities and quantities.

Preservation is a complex topic. The project leaves it up for discussion the negotiations between preservation of the architectural heritage of the city, and the need for urban densification, rather than suburban sprawl.

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Figure 10  
Plot Ratio Chart of  
generic and  
proposed  
typologies