# IS COMPACT URBANITY MORE CONNECTED?

**Xilu Liu**
Graduate Student
1741 Hickory Grove Way NW, Acworth, GA, 30102, U.S.
xliu18@students.kennesaw.edu
1-678-327-4275
Architecture Department
Kennesaw State University
1100 South Marietta Pkwy, Marietta, GA, 30060, U.S.

**Ameen Farooq**
Architecture Department
Kennesaw State University
1100 South Marietta Pkwy, Marietta, GA, 30060, U.S.

**Keywords:** Beijing, urban morphology, connectivity, compactness.

## Abstract

The concept of urban compactness is widely accepted as an approach in modern architectural and urban design fields, this belief may vary relative to the density and connectivity of various neighborhoods working within cities of developing countries.
Beijing has several compact residential neighborhoods in many of its urban districts. This paper argues that urban compactness as predictor of connectivity may carry an altogether different meaning when compared to the U.S objectives for achieving sustainable compactness by increasing density that is tactically connected.
The accelerated pace of migration following the economic progress from the countryside to cities in China helped grew the middle class while shifting demographics has added serious demands of housing and infrastructure within and outside of Beijing districts and its urban core.
Various neighborhoods within and round Beijing districts are swelling with unwarranted compactness, causing serious environmental and ecological challenging making basic living conditions unchecked. In addition, crowding, traffic congestion, pollution and limited housing surrounding this compactness is a threat to the public health.
Several residential blocks of various sizes in close proximity to each other appear to add physical compactness seemingly well threaded in urban fabric various urban districts. Morphological analysis of selected neighborhoods revealed that many urban neighborhoods similar to case study examples are marred with unregulated urban interventions with little cohesive system of connectivity within these neighborhoods.
This study analyzed morphological patterns of street connectivity using *Space Syntax* method tounderstand if physical compactness also means more connected. The morphological variables notably, integration, connectivity and choice were used as key variables to describe

the quality of connectedness of a diverse range of mixed-use commercial and residential typologies that were served by dense street networks.

Analysis of spatial morphology of selected compact neighborhoods provided perceptive clues to redevelop a spatial program to bring about a meaningful design intervention to achieve better connections to the unregulated compact urban neighborhoods for achieving more pedestrian-friendly urban neighborhoods that could co-exist with the existing vehicular street networks.

The findings indicated that much of mixed-use developments in close proximity to each other were part of a fragmented maze of dead-end streets serving these residential blocks. The incoherent street networks serving these neighborhoods created a lack of control between pedestrian and vehicular circulations causing congestions and unsustainable conditions for social and public realm to coexist.

## Introduction

The collaborative dynamics between economy, politics, culture, society, and the natural environment are key to development of any city. The 21st Century fast-paced development cycle has seen progress but at the same time deals with a number of conflicts with densely populated cities such as Beijing. The rapid industrialization encouraged many people to move from the countryside or undeveloped areas to Beijing in order to seek more paying job opportunities.

The 1978-Chinese economic reform Act opened up investment prospects for foreign entrepreneurs to establish trade in China (Wang, 2004). Since 1980s, the growth of industrial companies accelerated from 377,300 in 1980 to 7,957,800 in 1990s (Wang, 2004) with a continued economic in 21st Century. Much higher salaries compared to farming led millions to relocate to Beijing.

Beijing's rich cultural heritage with highly speculated real-estate market expanded its urban boundaries into the existing urban districts of varying scales and densities adding more physical compactness with new mixed-used buildings as part of the existing surroundings adding serious stress on the prevailing urban infrastructure that is already crumbling to meet the needs of the current population.

The perpetual addition of ill-planned and uncontrolled building stock to accommodate the continuous influx of rural migrants added injudicious compactness in these urban neighborhoods has produced an unhealthy physical density with serious environmental and ecological repercussions that includes water shortages, crowding, traffic congestion, lack of parking spaces; scarcity of open public spaces, limited housing and safety concerns. The disjunctive and congested street networks further contributes to carbon print using coal and natural gas for heating and petroleum for transportation causing a large amount of waste per capita, originating from everyday life besides soil, air and water pollution that are detrimental to health and overall quality of urban life in Beijing (Yang, Wu, Zou, Luo, Guo, & Lin, 2007).

This paper attempts to unravel the underlying spatial structure and the level of connectivity of street networks systems that served the selected compact urban neighborhoods to distinguish if these networks can effectively foster a public realm that is socially sustainable.

## Global and Local Study Areas | Xiaoxitian Pailou | Beijing

Beijing is comprised of various urban districts. Each district has its unique urban morphology that contains several compact residential neighborhoods combined with new mixed-use developments. We selected a large urban area that was further subdivided into two sub-urban areas. Each sub areas were treated as local urban morphology relative to its location within its larger urban surroundings.

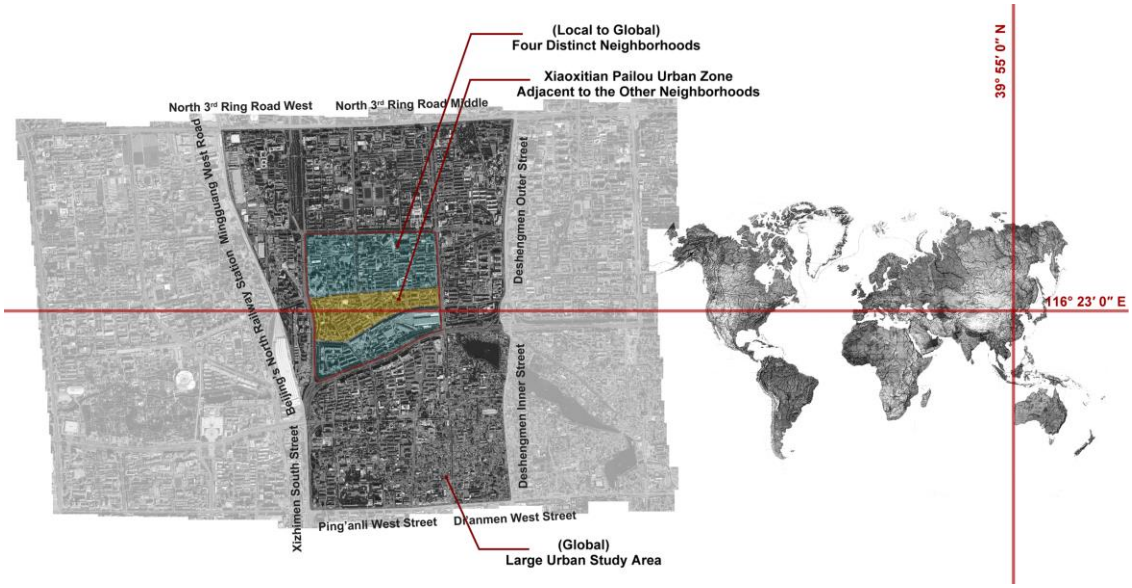
### *Global Morphology: Larger [Global] Urban Study Area | Beijing*

The North Third Ring Road West and North Third Ring Road Middle demarcated the north boundary of the larger [global] urban study area whereas Ping'anli West Street and Di'anmen West Street shaped the south boundary with its internal street networks. Similarly, Xizhimen South Street, Beijing's North Railway Station and Mingguang West Road defined the west boundaries and Deshengmen Inner Street and Deshengmen Outer Street determined the eastern boundaries of the larger study area (Figure 1).

### *Morphology of Four distinct neighborhoods set within the larger [global] study area*

The morphology relating to four neighborhoods [urban zones] set within the larger urban study is treated as "Local" urban morphology relative to its [Global] urban system. The four neighborhoods are bounded by Xueyuan South Road on the north and the western boundary by the Xizhimen North Street; the east by the Xinjiekou Outer Street and the south by the Deshengmen West Street (Figure 2).

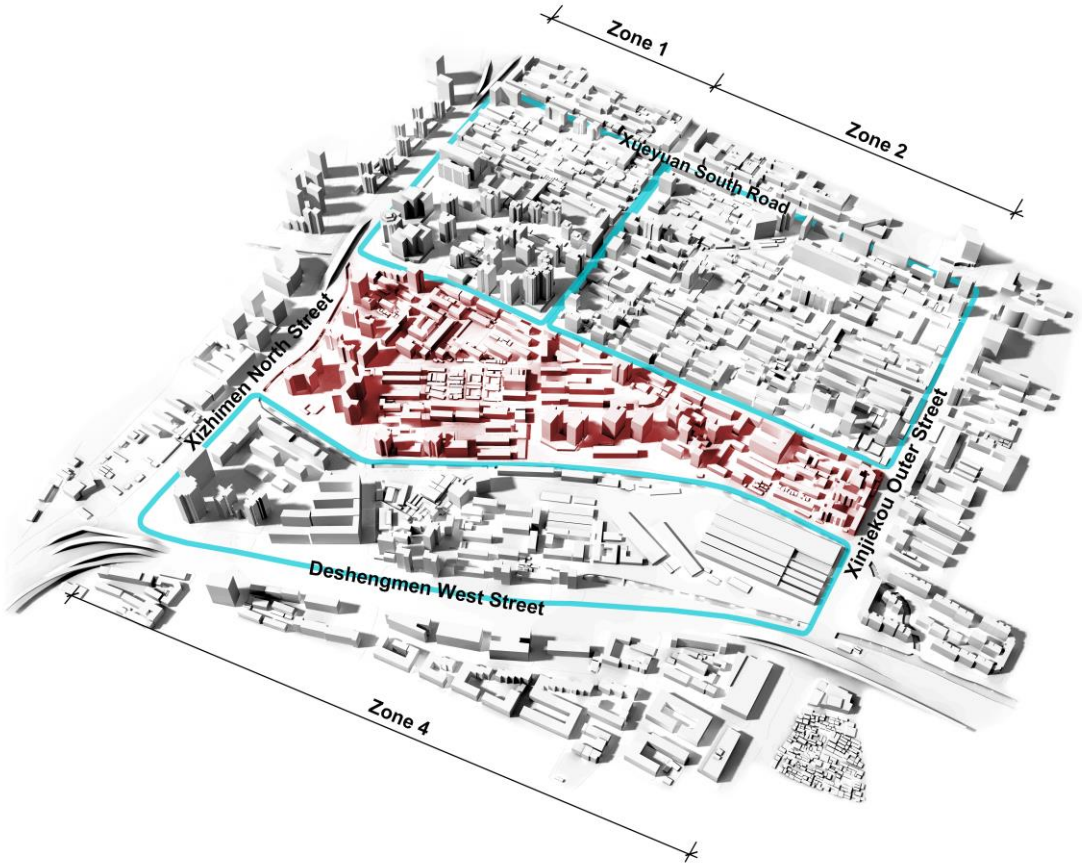
**Figure 1. Global Morphology of the study area in Xiaoxitian Pailou urban district in Beijing**



*Neighborhood Morphology within Xiaoxitian Pailou Urban Zone*

Xiaoxitian Pailou urban setting is known for its old temple located in the northwest side of the site. In Buddhism, each Buddha has his corresponding temple and Xiaoxitian is one of these Buddhist temples, where Pailou is a memorial archway belonging to the temple. This selected neighborhood entails residential and mixed-use functions relative to its surrounding neighborhoods set within the Xiaoxitian Pailou urban morphology.

**Figure 2. Neighborhood Morphology within Xiaoxitian Pailou Urban Zone marked in red**




The selected neighborhood set within the Xiaoxitian Pailou urban morphology is bounded by the Wenhuiyuan Road on the north and is delineated by the Binhe Road (Yinmacao Road) and Lianhui Road on the south. Xizhimen North Street defines the boundary on the west; and the east by the Xinjiekou Outer Street (Figure 2).

Xiaoxitian Pailou (the memorial archway) was built in 1989, which became an identifiable symbol for the residents of this urban district. Xiaoxitian Pailou urban zone consists of several residential neighborhoods co-existing with mixed-use and high-rise buildings. The selected study area highlighted in red is in close proximity to Beijing's North Railway Station and to

several imperial gardens on its southeast edge, with a memorial site to its northwest, and is close to five well-known universities (Beijing University of Posts and Telecommunications, Beijing Normal University, China University of Political Science and Law, Central University of Finance and Economics, and Beijing Jiaotong University). The significance of study area is further noted given its spatial juxtaposition to a man-made canal constructed for the 2008 Beijing Olympic Games.

The existing conditions of this area is challenged by traffic congestion, crowding and un-regulated mixed-use functions that are counter-productive to achieve a sustainable urban living that is conducive to generate healthy social and public realm which could co-exist with pedestrian-friendly activities strategically animated with street densities served by the current vehicular networks (Figure 4).

It is important to link the street density to the argument of urban compactness assuming that more compact settings served by a denser street network would be animated by more lively pedestrian-oriented activities.

## Street Density | Xiaoxitian Pailou Urban Zone

This study measured street density ratios by using average line length multiplied by the node count (number of streets), and then divided by the entire area [Xiaoxitian study area]. Street density refers to block sizes. A larger street density ratio indicates that the urban area is composed of smaller block sizes, whereas a smaller street density ratio implies that an area is comprised of larger block sizes.

The street density ratios of Xiaoxitian area when compared with the street density ratios of other cities during 19th century found that it is mostly composed of smaller blocks (Table 1). Further investigations revealed that most of these blocks created a "*network density*" (Pont, & Haupt, 2009, p. 86) that is compacted with smaller block sizes with irregular shapes and miscued land use functions (Figure 3).

**Figure 3 Street Density Comparative Studies**


**Source:** Peponis, J., Shpuza, E., & Rashid M. Comparative Spatial Analysis of Historical Cities (Unpublished raw data, Georgia Institute of Technology, 2000)

**Figure 4 Xiaoxitian Pailou Urban Zone Current Conditions**


The *network density* is defined as the amount of network [streets] per area unit, and is expressed as meters [*feet*] of network (length) per square meters [*feet*] of surface area (Pont, & Haupt, 2009, p. 86) that includes a network of *connected space (s)* for bicycling, driving, walking, or a combination of all.

The concept of network *density* is about understanding the relative connectedness comparative to the arrangement of lots and buildings in a street system relative to its connectedness with various land-use functions in an urban setting or plan. It also manages to validate the perception and the functional nature of a "public street" within a network (Pont, & Haupt, 2009) connecting various private open spaces (islands), lots and buildings in Xiaoxitian Pailou. Accordingly, the urban fabric formed by public streets and private islands may be understood as *urban public network space* linking all spatial entities together was found regularly disjointed in Xiaoxitian Pailou and in its surrounding neighborhoods.

Research findings claim that street density followed by small or medium blocks between 60 to 80 meter of one side to approximately 3600m$^2$ to 20,000m$^2$ are the optimum options for functional operation of a city and are able to provide more opportunities for lot frontages and

generate more regulated circulation flow patterns (Siksna, 1997). In addition, smaller block sizes in an urban fabric facilitate flexible spatial proportions and exposure ratio of network system to plan an entire urban area. A successful *network space* promotes movements and flows fostering connectedness, privacy and public-ness requiring most islands to be tactically distributed between public and private zones (Pont, & Haupt, 2009).

The findings further indicated that Xiaoxitian Pailou with its relatively smaller blocks is filled with incongruent mixed-use functions connected to a fragmented street system that served new developments along with the existing without much consideration to constructing a flexible *network of space* (Figure 3 and Table 1).

It is also important to point out that occasionally, *network of space (s)* within an urban fabric can also form spatial transitions and as the transitional boundaries are crossed new changes to the conditions of network density may emerge (Pont, & Haupt, 2009). Findings pointed to the spatial transitions between the study area of Xiaoxitian and its urban neighborhoods were relatively inflexible due to dead-end street network filled with incongruent land use functions.

This study further investigated the operative nature of the *network of space (s)* using Space Syntax Method (Hillier and Hanson, 1984; Al_Sayed, Turner, Hillier, Iida, & Penn, 2014) measuring the Integration, connectivity and choice of urban morphology of Xiaoxitian study area. All three are syntactic variables to analyze and understand the underlying spatial structure and the operative behavior of an urban setting.

**Table 1. Xiaoxitian Pailou street density ratios compared to the evolving nature of street density in other cities in the World during the 19th Century**

| **Area of Study** | | **Street Density** | |
|---|---|---|---|
| Year | City | | Street Density = $\frac{\text{Average Line Length x Node Count}}{\text{Entire Area}}$ |
| **2015** | **Xiaoxitian Pailou Urban Areas (Beijing, China)** | **(Global) Larger Urban Study Area** | **0.0787** |
| | | **(Local to Global) Four Distinct Neighborhoods** | **0.0964** |
| | | **Xiaoxitian Pailou Urban Zone** | **0.1748** |
| 1842 | Calcutta, India | | 0.0122 |
| 1833 | Berlin, Germany | | 0.0132 |
| 1835 | London, England | | 0.0219 |
| 1834 | Paris, France | | 0.0156 |
| 1834 | Saint Petersburg, Russia | | 0.0120 |
| 1840 | Istanbul, Turkey | | 0.0160 |
| 1833 | Vienna, Austria | | 0.0176 |
| 1840 | New York, U.S.A. | | 0.0224 |
| 1840 | Philadelphia, U.S.A. | | 0.0253 |
| 1830 | Rome, Italy | | 0.0194 |

**Source:** Peponis, J., Shpuza, E., & Rashid M. Comparative Spatial Analysis of Historical Cities. Unpublished raw data, Georgia Institute of Technology, 2000.

## Space Syntax Method

Space Syntax studies argue that there is an embedded social logic that intrinsically operates within the network of spaces. If a building or an urban area were a system that carried movement from every space to every other space, those spaces that are most directly connected to every other space would "attract higher densities of movement" (Peponis, & Wineman, 2002, p. 271; Al_Sayed, Turner, Hillier, Iida, & Penn, 2014). This interdepended network of spaces would establish patterns of human behavior generating and affecting social functionsin an urban system specific to its layout. There are several factors that can influence the patterns of behavior and movement including one's position within an urban system, the distance between two spaces and the directional turns as determined in a layout. Another important consideration is the significance of *Depth* between two spaces. Each space (a street in an urban setting or room in a building) can be considered as a *node* connected by links (connections), the *Depth of a node* is the sum of the lines (connections) that are necessary in order to reach to all other nodes in turn (Peponis, & Wineman, 2002).

Space syntax method determines the underlying nature of the spatial structure that determines the movement and the relative value of spatial relationships of one space to all other spaces within a building or from one street (node) to all other streets (nodes) of an urban setting. These spaces can be voids (open spaces such as lots or empty spaces or blocks) bounded by streets in a given urban setting or rooms in a building defined by walls, furniture or partitions (Al_Sayed, Turner, Hillier, Iida, & Penn, 2014). The aggregations of *spaces* voids and buildings defined by street boundaries in case of an urban setting form a network of spaces that determine and affect the pedestrian movement and vehicular circulation flows (Hillier, 2014) that intersect with aggregations of buildings composing and defining the underlying structure of different urban topographies within cities while continually evolving with new land use functions added to the existing.

This study has considered three key measuresused in space syntax simulations. Among the three measures, Integration is important to understand the syntactic nature and spatial morphology and behavior of the Xiaoxitian Pailou urban area.

1. Integration is a global measure in terms of understanding the morphology of a layout (urban or building). It is a function of the mean *Depth* (number of nodes/spaces that must be traversed) if one were to move from every street (node/spaces) to every other space (node/connection) in an urban setting (Peponis, & Wineman, 2002).

   The inverse relationship between *Integration* and *Depth* showed that the higher the integration value of the node (street) the lesser is its degree of *Depth* value. Integration, therefore, is considered a relative degree of syntactic accessibility of an urban setting, where spaces (node/streets) are ranked from the most integrated to the most segregated indicating the degree of accessibility from one space (street) to all other spaces (streets) in an urban setting (Al_Sayed et al., 2014).

Spatial studies have maintained that *movement* creates potential co-presence, co-awareness and encounters that can foster interactions among individuals at different frequency intervals depending upon spatial structure of a layout in a given urban setting to be able to influence

encounter by daily interval. Integration value, therefore, is a strong predictor of movement and space use patterns cultivating social encounters and space use behaviors when people explore an area in an urban setting, majority would be most likely to be attracted to more integrated spaces (Peponis, & Wineman, 2002).

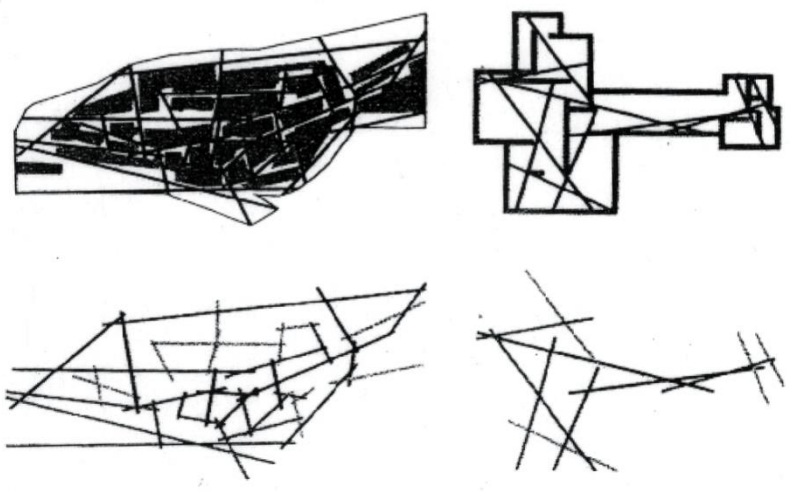
2. Connectivity is a local measure of spatial morphology. It measures the number of immediate neighbors (spaces) that are directly connected to a space that embodies the sum (s) of junctions between each axial line and other axial lines (Al_Sayed et al., 2014; Peponis and Wineman, 2002).

3. Choice is a measure of indicating the *movement flows* through spaces. Spaces (streets) with high global choice of (movement) are located on the shortest paths from all origins to all destinations. Choice is a powerful indicator at forecasting pedestrian and vehicular movement potentials" (Al_Sayed et al., 2014).

4. Axial Map: It is significant to mention the concept of Axial Map or "linear representation" of an urban setting that contains the fewest and the longest lines that can cover all ways of movement in a layout to reach all other the spaces (streets). Axial lines define and describe the relativized asymmetry of network of spaces and their degree of Integration in Xiaoxitian Pailou. The relative degree of Integration values allows describing how integrated or segregated a space is in relation to all other spaces (Figure 5).

This study has used the most current version of *Depthmap* software to be able to compute syntactic variables (Integration, Connectivity and Choice) considered to reveal the potential social interactions and urban activities (Al_Sayed et al., 2014; Hillier 2014).

**Figure 5 Axial Map**[1]



**Source:** *Spatial Structure of Environment and Behavior* by Peponis and Wineman (2002, p. 273). Peponis, J., & Wineman, J. Spatial Structure of Environment and Behavior. In Robert B. Bechtel & Arza Churchman (Ed.), *Handbook of Psychology* (p. 271-291). New York: John Wiley & Sons, Inc., 2002.

[1]"Axial map" or "linear representation" of an urban setting. **Source:** *Spatial Structure of Environment and Behavior* by Peponis and Wineman (2002, p. 273). Peponis, J., & Wineman, J. Spatial Structure of Environment and Behavior. In Robert B. Bechtel & Arza Churchman (Ed.), *Handbook of Psychology* (p. 271-291). New York: John Wiley & Sons, Inc., 2002.

## Spatial Analyses based on Overall Urban Context (Global Values)

Global values are calculated by considering the larger urban area as one spatial urban entity.

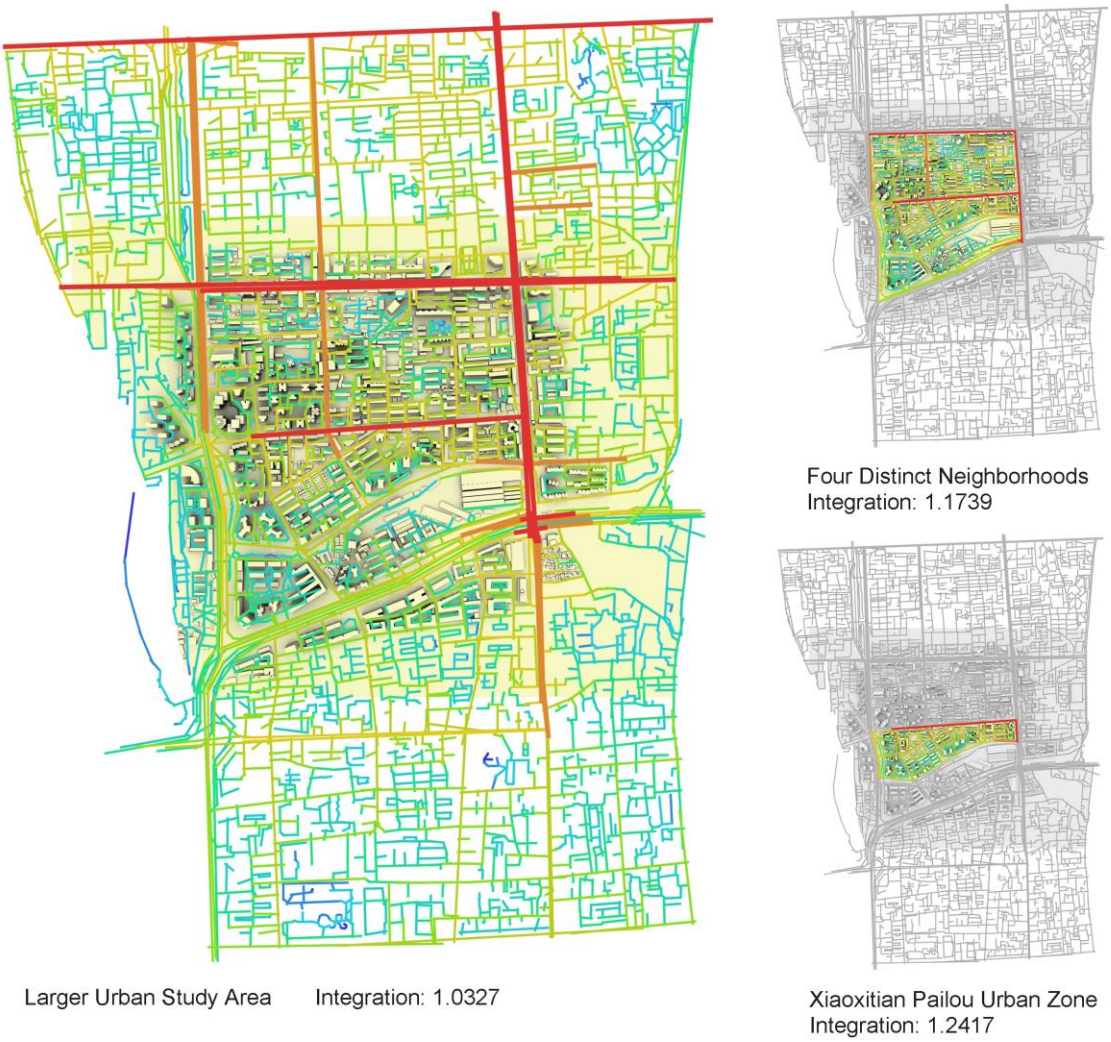
The Depthmap simulations showed that the *Integration* value for the entire urban area is 1.0327 (Figure 6), which points to a quite fragmented spatial structure in which the selected four urban neighborhoods (zones) exist with an integration value of 1.1739 (Figure 6); One of four neighborhoods --Xiaoxitian Pailou had integration value of 1.2417 (Figure 6). The fragmented pattern remains throughout with slight improvement in integration values as the spatial structure of a local urban setting become slightly improved as Xiaoxitian Pailou connects to its local surroundings. The darker blue axial lines (network of spaces) indicate the most segregated areas whereas the red axial lines indicate more integrated network of spaces (spaces/streets/nodes/areas).

Recent spatial studies have indicated that integrated spaces can be reached easily from other spaces whereas segregated spaces are hard to reach since segregated network of space create spatial conditions where people have to travel through several spaces first in order to get to the destination (Wineman, & Peponis, 2010).

The integration values in this study indicate that Xiaoxitian Pailou though compact and with smaller block size is predominantly less integrated and more due to the fragmented spatial configuration of its layout and form of space as connected to its larger urban setting. Most street network is filled with small alleys and dead-end streets that have pointedly limiting influence on people's exploratory movement and their visual connection to find intelligible reference to develop a meaningful social co-presence and co-awareness of each other.

The network of spaces (streets and roads) in Xiaoxitian Pailou area represented in red axial lines are the most integrated paths or primary circulations that are more heavily utilized than other routes by residents or visitors for pedestrian and vehicular circulation. In other words, the integrated network of space of Xiaoxitian Pailou can guide residents or visitors to its local paths and areas more comprehensibly relative to the larger urban area in which it exists. Land use functions (restaurants, theaters, bookstores, grocery stores etc.) located on the integrated routes are more reachable and have higher likelihood be visited more than others land use functions located on the segregated or (fragmented) routes regardless of the urban compactness.

**Figure 6 Spatial Morphology Axial Map Analyses-Global Integration[2]**




[2]Left: Spatial morphology (degree of integration) around four zones within its larger urban context. Top right: Spatial morphology (global integration) of zone 1+2+4+Xiaoxitian Pailou urban zone within its larger urban context. Bottom right: Spatial morphology (global integration) of Xiaoxitian Pailou urban zone in relation to overall urban context.

**Figure 7 Spatial Morphology Axial Map Analyses-Global Connectivity[3]**


The connectivity value for the entire (global) urban area is 3.00 (Figure 7) while the four zones in the larger urban entity is around 4.76 (Figure 7); and for Xiaoxitian Pailou urban zone within the larger urban entity is 5.62 (Figure 7). The connectivity values indicate that the larger urban area has weaker network of spaces despite its urban compactness.

The spatial analysis indicated that North Third Ring Road West and North Third Ring Road Middle have the most connections (39) compared to other routes with much higher degree of integration to become the primary circulation route.

*Connectivity* is a local measure to describe the local network of connections of a setting to its immediate surroundings. Thus, from a local standpoint, these roads and streets (routes) may

[3]Left: Spatial morphology (degree of connectivity) around four zones within its larger urban context. Top right: Spatial morphology (global connectivity) of zone 1+2+4+Xiaoxitian Pailou urban zone within its larger urban context. Bottom right: Spatial morphology (global connectivity) of Xiaoxitian Pailou urban zone in relation to overall urban context.

not have many connections in relation to all other routes. The *Integration* is a global measure, consequently, from the global view, the roads and streets that have higher integration values will have more connections than most other routes within this entire urban area where urban compactness may not be contributing spatial agent for making any area more integrated as in the case of Xiaoxitian Pailou.

**Figure 8 Spatial Morphology Axial Map Analyses-Global Choice**[4]


The spatial analysis indicated that the movement flows being the degree of *Choice* to choose routes within the larger urban zone is 0.004960 (Figure 8); whereas four neighborhoods within

[4]Left: Spatial morphology (degree of *Choice*) around four zones within its larger urban context. Top right: Spatial morphology (global choice) of zone 1+2+4+Xiaoxitian Pailou urban zone within its larger urban context. Bottom right: Spatial morphology (global choice) of Xiaoxitian Pailou urban zone in relation to overall urban context.

the larger urban entity is 0.01822 (Figure 8) and for Xiaoxitian Pailou neighborhood is 0.01836 in relation to its larger urban structure (Figure 8).

Findings showed that Xinjiekou Outer Street being the most integrated offer relatively more choices of movement flows of people to move from one destination to the next destination relative to its fragmented configuration and urban compactness.

Further analysis of local spatial conditions of four zones (zone 1+2+4+Xiaoxitian Pailou urban zone) as one spatial urban entity (Figure 9) showed Integration (1.2446) and Xiaoxitian Pailou urban zone only revealed (1.3985) (Figure 10). The relative higher values at the local levels are due to Wenhuiyuan Road and Wenhuiyuan Byway that are more integrated and are operating more effectively at the local levels. These two routes are the key local circulatory spines used by residents and visitors compared to other routes due to their primacy to various congruent land use functions such as shopping and entertainment located along these two routes. The findings indicate that diverse and corresponding land use functions are more integrated into the local area that can be simply reached. Similarly, the Connectivity value is 4.75 when are deemed as one urban entity (Figure 9); and Xiaoxitian Pailou neighborhood is 5.61 (Figure 10) connected to Wenhuiyuan Road that has the most connections (29) compared with other routes.

The Choice value of four zones indicating movement flows is 0.05194 (Figure 9); and for Xiaoxitian Pailou neighborhood only is 0.06465 (Figure 10) that is connected to Wenhuiyuan Road, which offers more choice of *movement flows* to access other spaces in the local urban network of spaces.

**Figure 9 Spatial Morphology Axial Map Analyses-Local Values (Four Distinct Neighborhoods as One Spatial Urban Entity)**

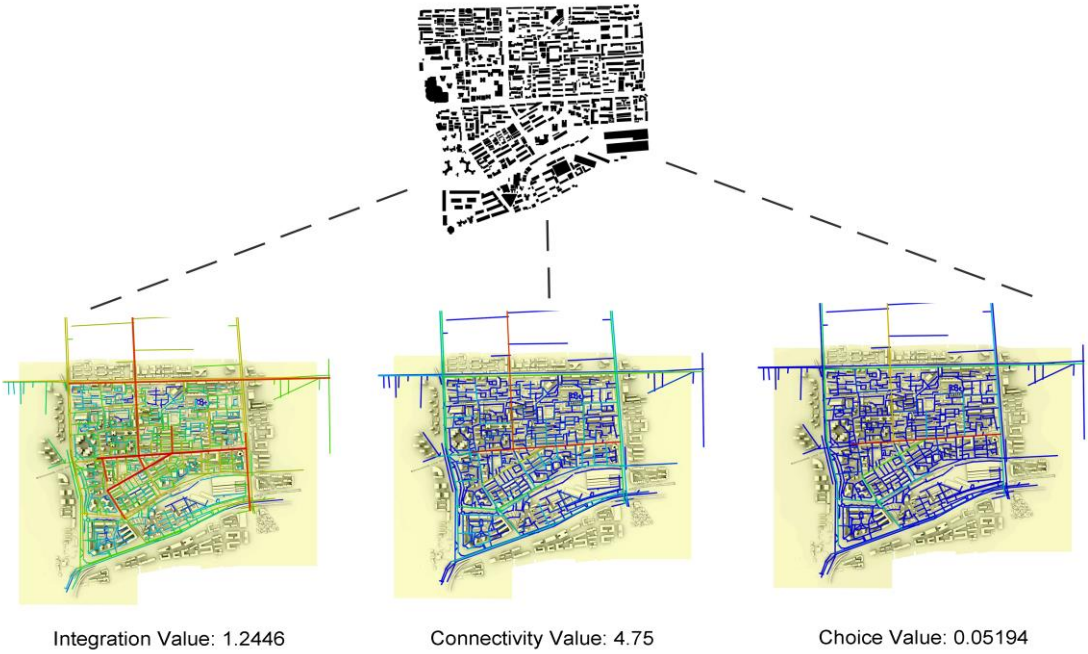


**Figure 10 Spatial Morphology Axial Map Analyses-Local Values (Xiaoxitian Pailou Urban Zone as Part of Zone 1+2+4)**


**Figure 11 Spatial Morphology Analyses**

| Spatial Morphology Analyses | | | | |
|---|---|---|---|---|
| | Integration | Connectivity | Choice | |
| Larger Urban Area | 1.0327 | 3.00 | 0.004960 |  |
| Zone 1+2+4+Xiaoxitian Pailou Urban Zone set in the Larger Urban Entity | 1.1739 | 4.76 | 0.01822 |  |
| Zone 1+2+4+Xiaoxitian Pailou Urban Zone as One Spatial Urban Entity | 1.2446 | 4.75 | 0.05194 |  |
| Xiaoxitian Pailou Urban Zone as Part of Larger Urban Entity | 1.2417 | 5.62 | 0.01836 |  |
| Xiaoxitian Pailou Urban Zone as Part of Zone 1+2+4 | 1.3985 | 5.61 | 0.06465 |  |

## Concluding Remarks

The findings of the *Depthmap* simulations confirmed that the selected study area (larger urban setting Integration: 1.0327) composed of smaller but irregular block sizes are seemingly compact but connected to a fragmented network of spaces both at the local and global scales including Xiaoxitian Pailou. Integration value (1.1739) of all four neighborhoods combined as part of the larger urban area vaguely improved. On the other hand, Integration value (1.2417) of Xiaoxitian Pailou urban zone slightly improved due to the higher degree of local connectivity compared to its global counterpart that is mostly comprised of disjointed network of spaces impacting all other spatial entities within it.

Other studies showed that integration values of larger urban settings in Qazvin (1.4368), (Azimzadeh, & Klarquist, 2001), and English traditional cities was 1.44 (Karimi: Choudhary, & Adane, 2012) that were significantly higher than the study area in Beijing (1.0327) confirming that the network of spaces in the study area is composed significantly of segregated routes despite being spatially compact.

The connectivity value of the larger urban zone of Beijing is 3.00 relatively is smaller than the connectivity values of urban cores in other cities in USA (5.835), Europe (4.609), United Kingdom is (3.713) (Raman, 2003), urban cores of central Indian cities (3.46), English traditional cities (3.45), Brazil (3.88), Asia Pacific (3.50) (Choudhary, & Adane, 2012). These comparisons indicate that local conditions of network of spaces were relatively were served more with fragmented connections compared to other cities. Four neighborhoods (4.76) as part of larger urban entity and one Xiaoxitian Pailou neighborhood study area (5.62) has significantly higher levels of connectivity at local scales but with low Choice values indicating restricted movement flows (Figure 11).

The spatial analysis of the selected urban area in Beijing demonstrates a pattern of fragmented urban structure predominantly served by a network of spaces that are more segregated than integrated with lower levels of connectivity and choice despite its compactness with smaller block sizes as a value to achieve sustainable spatial conditions as argued in other studies. The urban compactness filled with miscued land use functions connected to a predominantly segregated network of spaces would generate limited opportunities to sustain the social logic of space in Xiaoxitian Pailou that is impacted by the overall fragmented networks of its larger urban area.

The findings in this study illustrated that the integration and connectivity values of selected larger urban zone of Beijing, as well as some local neighborhoods, are not high as expected despite being compact with smaller size blocks that are seemingly compact and dense; however, it does not mean that these areas are well connected and integrated into the entire urban district. It will be hard to enable co-presence and co-awareness of people among each other who living in a neighborhood set in a fragmented urban fabric operated by a weak network of spaces.

The findings in the study suggest to redevelop unregulated-planned and disjointed urban zones, in order to achieve more integrated, well-connected and sustainable urban settings generating

co-presence and co-awareness to foster a strong sense of public-ness and to improve quality of life quality pertaining to a social logic to cultivate a sustainable network of spaces.

## References

**Al_Sayed**, Kinda, **Turner**, Alasdair, **Hillier**, Bill, **Iida**, Shinichi, & **Penn**, Alan. (4th Edition). *Space Syntax Methodology*. London: Bartlett School of Architecture, UCL, 2014.

**Azimzadeh**, Mir, & **Klarquist**, Bjorn. *Metamorphosis and Evolution of Cities.The Status of Planning and Urban Design*. 2001. Proceedings. 3rd International Space Syntax Symposium. Retrieved from http://www.ucl.ac.uk/bartlett/3sss/papers_pdf/51_azimzadeh.pdf

**Choudhary**, Priya, & **Adane**, Vinayak. *Spatial Configurations of the Urban Cores in Central India*. 2012. Proceedings: Eighth International Space Syntax Symposium. Retrieved from http://www.sss8.cl/media/upload/paginas/seccion/8028.pdf

**Hillier**, Bill. *Space Syntax as a Theory as well as a Method*. 2014. ISUF 21st International Seminar on Urban Form. Retrieved from http://isuf2014.fe.up.pt/Hillier.pdf

**Hillier**, Bill, & **Hanson**, Julienne. *The Social Logic of Space*. Cambridge: Cambridge University Press, 1984.

**Peponis**, John, **Shpuza**, Ermal, & **Rashid** Mahbub. *Comparative Spatial Analysis of Historical Cities.* Unpublished raw data, Georgia Institute of Technology, 2000.

**Peponis**, John, & **Wineman**, Jean. Spatial Structure of Environment and Behavior. In Robert B. Bechtel & Arza Churchman (Ed.), *Handbook of Psychology* (p. 271-291). New York: John Wiley & Sons, Inc., 2002.

**Pont**, Meta Berghauser, & **Haupt**, Per. *Space, Density and Urban Form*. Netherlands, 2009. Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwidhNHc_5PMAhXEKCYKHVMhDeMQFggrMAE&url=http%3A%2F%2Frepository.tudelft.nl%2Fassets%2Fuuid%3A0e8cdd4d-80d0-4c4c-97dc-dbb9e5eee7c2%2FSpace_Density_and_Urban_Form.pdf&usg=AFQjCNF9Fu_UFRbe1Q-4WwvdDBqKv0_f_Q

**Raman**, Shibu. *Communities and Spatial Culture in a Communally Diverse City: Ahmedabad, India.* 2003. Proceedings. 4th International Space Syntax Symposium. Retrieved from http://www.spacesyntax.net/symposia-archive/SSS4/fullpapers/74Ramanpaper.pdf

**Siksna**, Arnis. The Effects of Block Size and Form in North American and Australian City Centres. *Urban Morphology*, 1997, 1, p. 19-33.

**Wang**, Yanzhong. Financing Difficulties and Structural Characteristics of SMEs in China. *China & World Economy*, 2004, vol. 12, no. 2, p. 34-49.

**Wineman**, Jean D., & **Peponis**, John. Constructing Spatial Meaning: Spatial Affordances in Museum Design. *Environment and Behavior*, 2010, vol. 42, no. 1, p. 86-109.

**Yang**, Xiaobo, **Wu**, Qingshu, **Zou**, Wei, **Luo,** Changying, **Guo,** Tao, & **Lin**, Guozhen. (2nd Edition). *Urban Ecology*. Beijing: Science Press, 2007.