

## STUDY ON THE STREET INTERFACE OF THE FORMER NINE-COUNTRY CONCESSIONS' BOUNDARY IN TIANJIN, CHINA

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### ABSTRACT

*The former concessions' area of modern Tianjin was planned and constructed by nine different countries. Consequently, a typical collage fabric was formed and there were many administrative boundary streets between different countries' concessions or different construction stages of one country's concession, which became to be a unique kind of street network in Tianjin when comparing to other colonial cities. Considering that existing studies have indicated differences in morphological characteristics at the street network, block, and plot scale on opposite sides of the streets above mentioned, this paper aims to further discuss morphological boundaries of street interface. First, based on the spatial distribution of different courtyard walls, the most common interface type, it's summarized that morphological characteristics on both sides of some streets present convergence from the street network scale to building scale, while others present divergence. Meanwhile, the morphological differences can continue to the entrance scale. Moreover, this paper further discusses the three-dimensional interface characteristics on Jinzhou Road, the most typical and stable boundary street, also one of the boundary streets at the building scale, the contrast of streetscape influenced by interface layers and thickness on opposite sides is obvious through analysis, which thus affects pedestrians' perceived enclosure.*

*Keywords: urban morphology, boundary, interface, streetscape.*

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### INTRODUCTION

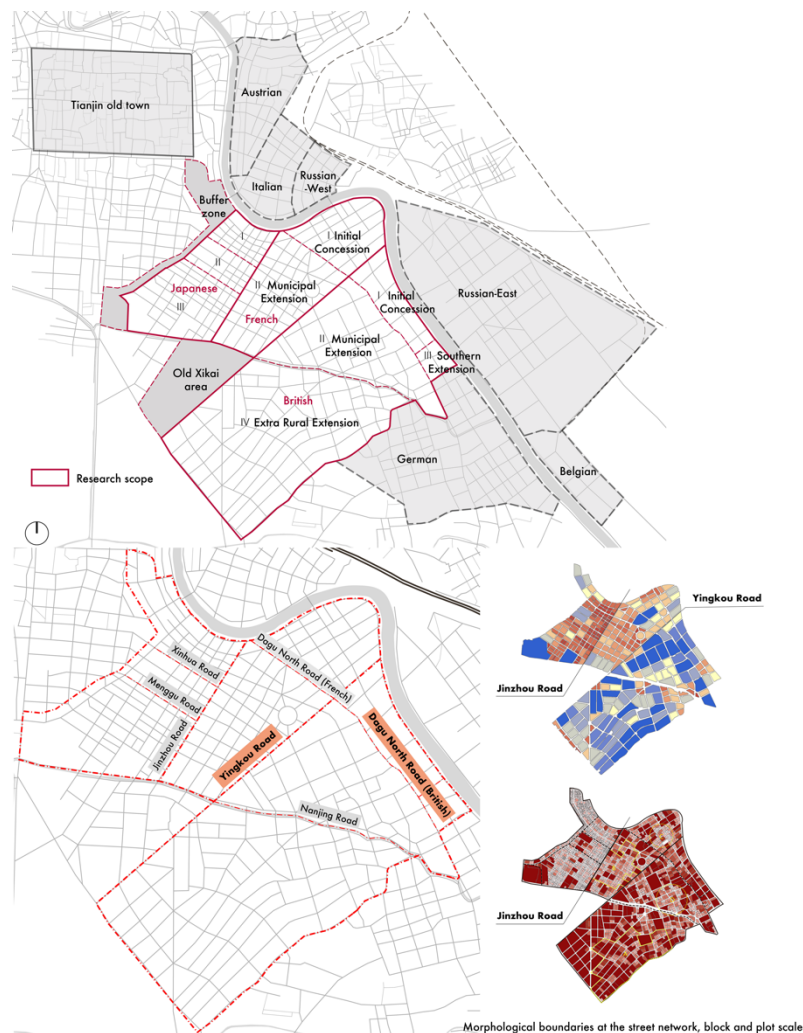
The former concessions' area of modern Tianjin from 1860 to 1945, was planned and constructed by nine different countries. Consequently, a typical collage fabric was formed during more than eighty years. Meanwhile, there were many boundary streets between different countries' concessions or different construction stages of one country's concession, which became to be a unique kind of street network in Tianjin, when comparing to other colonial cities.

Among these areas, the planning and development of former Britain, French and Japanese concessions were more in-depth, and the completed urban areas were also relatively large, attracting more attention from urban morphological analysis. In existing studies, we can observe that the above-mentioned administrative boundary streets present "boundary phenomenon" in terms of urban morphology, that is, different morphological characteristics on opposite sides of the road. In addition, these characteristics present varying degrees of divergence and convergence at different levels in the hierarchy of morphological elements, including streets, blocks and plots (Kropf, 2017, p.26).

Although two-dimensional analyses have accumulated rich materials, they can hardly reflect perception and experience from the pedestrian point of view while walking on these particular roads. Based on this, this paper deals with following problems: If we continue to increase the level of resolution in the hierarchy of elements, what are the differences in morphological characteristics

of buildings? When the perspective is converted from two-dimensional description above the city to three-dimensional description inside the city, how will the boundary phenomenon change? For pedestrians on the boundary streets, do they literally feel contrasting streetscape from the interface on opposite sides?

## BACKGROUND



**Figure 1. Research scope and morphological boundary streets in existing studies.**

Boundaries, borders and borderlands have been at the center of research in anthropology, political geography, ecology and sociology, to name just a few. By contrast, they have been neglected in urban studies for a long time. In 2013, a special issue of *Cities* was devoted to calling on scholars to pay attention to boundary issues across multiple spatial scales in the study of cities in which lies the hope to contribute to a more comprehensive understanding of cities as complex and evolving, their parts – like the boundaries around them – only partially formed and always incomplete. Of particular significance for a better understanding of urban condition appears the analysis of the interplay between the macro and micro scale forces that, as they intersect, give rise to and shape urban boundaries (Iossifova, 2013).

Among nine countries' concessions in Tianjin, the scope of this study is former Britain, French and Japanese concessions. These three concessions not only were best-developed during that period, but also form the current city center region which has been the major area for large-scale urban redevelopment and urban renewal. Needless to say, road-related research is a necessary prerequisite for street design and landscape control in these construction activities.

In the hierarchy of morphological elements, at the level of street network, the boundary phenomenon of several roads is particularly obvious due to grid networks of different planning schemes. Yingkou Road, between former British and French concessions, has typical boundary characteristics including specific network direction, intersection type and block shape. Dagu North Road, between initial concession and Municipal Extension of the former British concession, contains

a series of T-shaped intersections (Qiao, 2016). Looking down the hierarchy, in addition to Yingkou Road, Jinzhou Road, between former French and Japanese concessions, also presents morphological differences at the block scale (Xue, 2014). Down to the plot scale, Yingkou Road no longer appears as a boundary and only Jinzhou Road divides different morphological regions (Deng, 2016) (Figure 1).

Based on this review, we can preliminarily summarize that as the level of resolution increases, the difference between networks in different construction stages of one country's concession converges at the block and plot scale. As for boundary streets between different countries' concessions, some present similar convergence as the level of resolution increases while others present divergence in contrast.

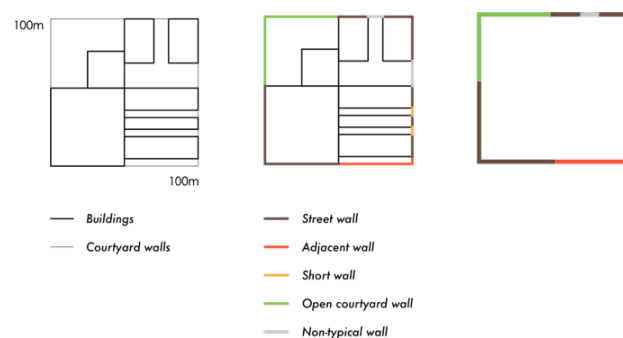
Recent years witness the raising of quantitative morphological tools in urban morphology, especially those focused on the pedestrian point of view, which could be particularly appropriate in the study of urban phenomenon related to human perception. In this paper, they provide support for clarifying the boundary phenomenon of street interface inside the city.

## METHODOLOGY

If we observe urban form at the building scale, the courtyard wall is an obvious and important component in traditional Chinese block. It is not only an integral part of the urban fabric but also occupies most of the interface along the street (accounting for 70% in the famous Wukang Road in Shanghai as an example) (Sha et al., 2009, p. 54). For this reason, this study first classifies the courtyard wall according to its morphological characteristics and its relationship with the building. Their spatial distribution partially reflects the morphological boundaries of the building scale. The study also examines the micromorphology of street interfaces, considering the entrance form of the courtyard wall, where close encounters with buildings always happen.

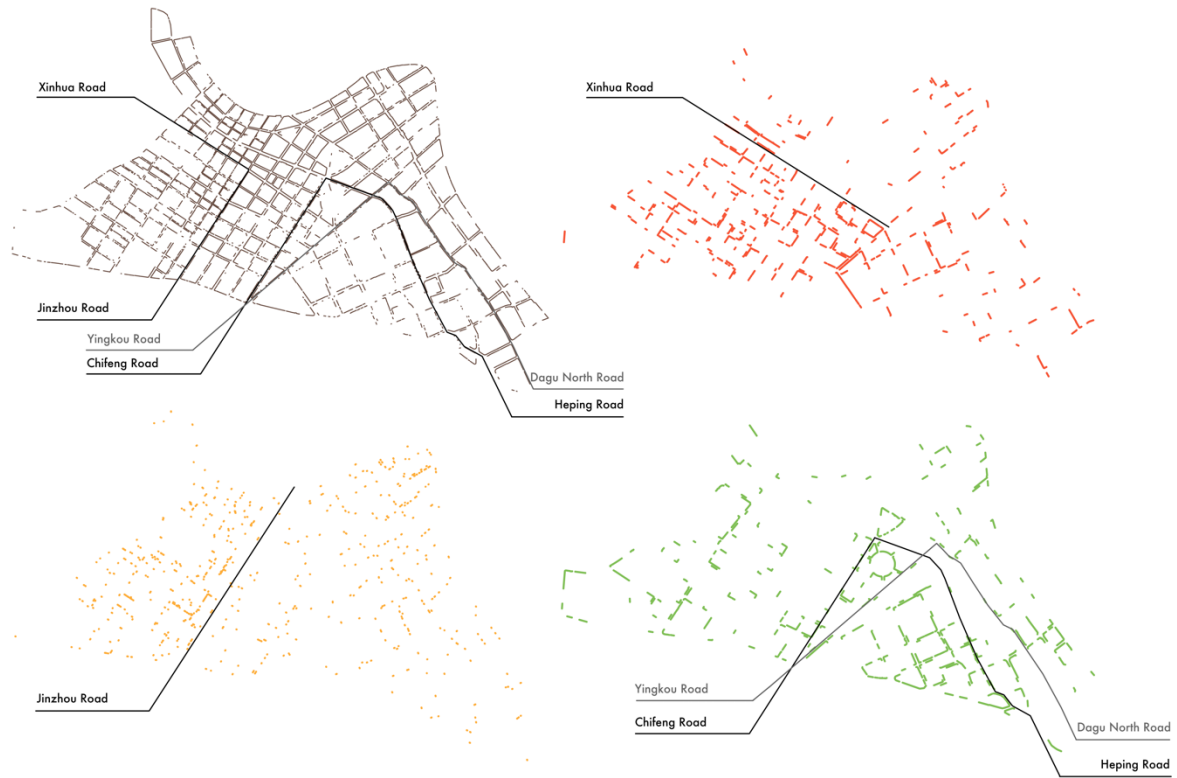
The further study focuses on the three-dimensional morphological characteristics of the interface. In the early stage of urban morphological analysis, the endeavor of the French school of urban morphology gives rise to the systematization of quantitative measurements of urban forms. The analytical approaches of the street were then developed to be more applicable via the manuals by Allain (2004, p. 144). Following the early theory, the spatial information was reinterpreted into a series of indicators through the pedestrian point of view (Araldi and Fusco, 2017). This paper refers to the above methods and divides the morphological indicators of the street interface into three dimensions: plan, elevation, and section.

## FINDINGS



**Figure 2. Classification of courtyard walls in former British, French and Japanese concessions.**

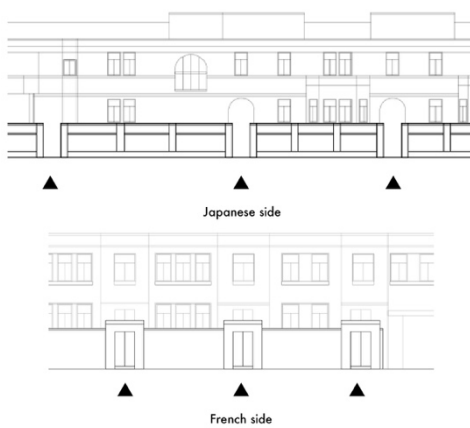
Through observation of the form of the courtyard wall in three concessions, three general and typical courtyard wall types can be summarized, namely adjacent wall (the distance between wall and building is less than 5m), short wall (the length of the wall itself is less than 5m), and open courtyard wall (the length of wall exceeds 20m and there is always a certain distance between wall and building). Combined with buildings



**Figure 3. Boundary streets at the level of building**

behind, each type of courtyard wall has a completely different sense of perceived enclosure and perceived spaciousness. Together with the street wall formed by street-facing buildings and other non-typical walls, they constitute all the enclosed interfaces in the block (Figure 2).

Here we can see the boundary phenomenon of building scale from the spatial distribution maps of different types of courtyard walls (Figure 3). In the distribution map of the street wall (see the upper left corner of Figure 3), the former French concession is more directly enclosed by buildings in general. At the same time, four relatively obvious boundary streets can be identified: Jinzhou Road, which still has boundary characteristics as the level of resolution increases. Xinhua Road, as the spatial boundary between the first and second construction stages of the former Japanese



**Figure 4. Comparison of the form of entrances on courtyard walls.**

concession, it presents boundary phenomenon for the first time at the building scale. Chifeng Road and Heping Road, though they are not boundaries in any administrative sense, considering Yingkou Road and Dagu North Road that is one or two blocks away from them, we can regard them as a result of a “borderland” when the two sides of Yingkou Road and Dagu North Road continue to converge. In addition, the boundary characteristics of these four roads can be verified in the spatial distribution maps of three types of courtyard walls respectively. That is, Jinzhou Road is a boundary of adjacent walls, Xinhua Road is a boundary of short walls, Chifeng Road and Heping Road are boundaries of open courtyard walls simultaneously.

Given that the relatively rough classification of the courtyard wall has boundary characteristics in the spatial distribution, we move forward to the more micro-scale, discussing the concrete form of courtyard walls, as well as the entrance form. Based on the field survey and case collection, it can be found that the entrance form of courtyard walls in the former Japanese concession is different from those of former British and French concessions. This contrast is reflected on both sides of Jinzhou Road. Specifically, on the French side, there are pillars between the wall as intervals, producing a rhythm of façade, the entrance is an interval between two pillars. And on the Japanese side, the entrance is a door opening on the courtyard wall, its form is emphasized and more prominent on the façade. This kind of entrance form is also prevalent inside the former Japanese concession (Figure 4).



Figure 5. Comparison of three-dimensional morphological characteristics on both sides of Jinzhou Road.

Briefly summarize, the boundaries of spatial distribution are different at different levels in the hierarchy of morphological elements. Citing theories of the ecological boundary, these boundaries in the sense of urban morphology are “scale-dependent” (Strayer et al., 2003). Moreover, as the resolution level increases from the street network, block, plot to the building, even entrance, the morphological characteristics on both sides of one group of streets present a trend of convergence, though there are obvious boundary characteristics at the street network scale, they don’t present continued contrast on the block (Dagu North Road) or plot (Yingkou Road) scale. Further, at the level of building, this convergence shifts the boundary one or two blocks away, forming a borderland, which is similar to the “permeable” characteristics of boundaries in ecological terminology (Ibid.). Conversely, the other group of streets presents a trend of divergence. Although the street network is connected, the contrasting morphological characteristics appear at higher resolution levels, like the block (Jinzhou Road) and building scale (Xinhua Road). And this boundary phenomenon persists at least until the building scale (Jinzhou Road).

The follow-up part of this paper will focus on Jinzhou Road, the most stable boundary street at the building scale, comparing the three-dimensional interface form on the former French concession side and the former Japanese concession side separately, aiming to analyze the pedestrian's boundary

perception. The objects of analysis include only blocks with remaining historical buildings because, in addition to their plans, the data and information of the sections and elevations of the street can also be obtained through street view maps and surveying.

First, in the plan view, the interface is divided into three layers. The first interface layer is the boundary between the sidewalk and roadway, the second layer is the courtyard wall (optional) and the third one is the building interface. Meanwhile, the interface thickness between every two layers can be calculated separately. The analysis result indicated that there are more three-layer interfaces on the side of the former Japanese concession, that is, more courtyards. At the same time, the third layer on the Japanese side is always continuous with uneven changes, while the only few three-layer interfaces in the former French concession are broken and not parallel to the street. In addition, the thickness between the second and third interface layers, that is, the depth of the courtyard on the Japanese side is much larger than that on the French side (Figure 5).

Second, in the cross-section view, there are four typical forms. The section diagram and their prevalence along the street are shown in the figure. There are more courtyard walls in the former Japanese concession and more street-facing buildings in the former French concession. This conclusion is consistent with the results of analysis in the plan view as mentioned before. Except for that, on the Japanese side, it's a common phenomenon that many second interface layers are small-volume one-story buildings themselves. We can speculate reasonably that it's a kind of spatial strategy dealing with the narrow street while taking advantage of deep courtyards.

Finally, it's found that the morphological characteristics of the elevation dimension are not contrasting obviously by comparison. It confirms that is pedestrians' perceived streetscape is more related to the form of courtyard in plan and section view.

Therefore, this paper further answers the question of pedestrians' perception of the streetscape on a morphological boundary. Differences in the plan and section dimensions of the interface on both sides of the street, especially interface layers and thickness which closely related to courtyard walls will affect their experiences like perceived street width and enclosure. In addition, the differences in the form of entrances mentioned above can affect the perception of human scale to a certain extent.

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## CONCLUSIONS

In conclusion, this paper firstly takes the representative street interface, namely the courtyard wall as an example to analyze the morphological characteristics of former British, French and Japanese concessions at the building scale, then identifies boundary streets in spatial distribution maps. Then by comprehensively comparing these streets with boundary streets at the street network, block, and plot scale in the hierarchy of morphological elements, we can find out the changes of boundary streets at different levels as the resolution increases. It's clarified that the boundaries of spatial distribution are different at different levels in the hierarchy of morphological elements, indicating morphological boundaries inside city are "scale-dependent". Meanwhile, from the macro scale to micro scale, one group of boundary streets present convergence of morphological characteristics, the contrast between two sides goes from obvious to disappeared, even forming a borderland due to the "permeable" characteristics of boundaries. Conversely, the other group of boundary streets present divergence, the contrast between two sides only appears at a certain scale and continues to those smaller scales. The formation mechanism behind this boundary phenomenon needs further study.

The study further focuses on the three-dimensional interface characteristics of a typical road presenting divergence, Jinzhou Road, between the former Japanese concession and French concession. It's found that the morphological differences between two sides of the street are obvious in plan and section view, especially those of interface layers and the thickness, which affect pedestrians' perceived street width, and thus perceived enclosure. Moreover, the difference in the micromorphology of entrance form can affect pedestrian experience on human scale as well.

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