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Drawing the invisible: Visualizing Patterns of Occupation in Two Streets in Shanghai

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Abstract. From the many dynamics and urban planning features encountered in Shanghai, perhaps the two most iconic and recognizable are, on the one hand, the western urbanistic principles of the international settlements, and on the other, the Dan Wei-derived modern gated communities. Their foundations and historical contexts could not be further apart, yet the interaction between them has generated one of the world's most iconic and unique cities. These two approaches have been researched and compared from numerous perspectives, but the patterns of occupations taking place in their public spaces remain overlooked. This research proposes a methodology for mapping information in order to record and compare these patterns of occupations, aiming to understand their differences and similarities better, while also identifying findings that could be incorporated into modern architectural and urban design.

Keywords: Information Visualization, Digital Visualization, Place Theory, Patterns of Occupation, Social Spaces.

1 Introduction

The unprecedented urbanisation process in China has reshaped the country at a scale and speed that is impressive, representing a unique opportunity for researching and designing the built environment. In aiming to achieve its goal of 70% of urban population by 2035, China has created some of the newest and most extensive urban areas in history. Nevertheless, despite this significant progress, the urbanisation process has also presented numerous challenges, which can be tackled as opportunities. For instance, it has generated a substantial gap between urban life and rural development. The government has also addressed this by implementing different rural revitalisation policies in order to create a more balanced development of the country, enabling unique approaches to rural design [1]. These two dualities (urban and rural) are very easy to identify and compare, resulting in specialized and focalized efforts to address their specific problems. However, it is becoming more and more evident that some of these dramatic gaps can be found not only between villages and cities but also within

cities themselves, where co-existing urban fabrics might require radically different, yet integrated approaches to guide their interaction and development. The city of Suzhou is a great example of this, where we can find very modern developments (like Suzhou Industrial Park) located just a few kilometres away from Suzhou's old town, one of the oldest in the world. What makes these two completely different urban fabric parts of the same city? It is easy to assume that, due to the centralised planning of cities, the edges and differentiation between these different urban fabrics are consistently very clear and controlled, but this is not always the case. There are many instances in which different urban fabrics intertwine and interact with each other in ways that are not always evident or entirely planned. One of the unique characteristics of Chinese architecture and planning is using confinement and inward focus to organise and enhance spaces. Traditional courtyard houses, Dan wei units, new workers' villages and modern gated communities: all seem to share, in their own way, an inward vocation to dwelling [2][3]. This configuration presents both advantages and disadvantages. From the perspective of traffic and connectivity, it is inefficient to have large portions of the city inaccessible for public circulation and traffic. Because of this, the government started to discourage the construction of gated communities, yet this was met with opposition from residents [4]. While this is an ongoing debate involving multiple facets, we wanted to further understand this duality by comparing an open street with a closed one, trying to record and represent the public habitability which they generate. In order to do so, we undertook a case study in two streets Shanghai's former Frech Concession, testing a methodology for visualising their planning, character and patterns of occupation by residents.

2 Background: Representing intangible information

Modern architectural visualization can be used not only for generating images which represent the material features of the built environment, but it can also provide new theoretical and spatial distinctions so we can represent intangible information. Architecture makes use of a wide range of visualization tools for improving or modifying the design process. These visualizations are generally focused on representing perceivable, yet invisible, natural phenomena. The sequence is quite clear; the phenomena is first perceived, then measured and finally translated into a visual representation that can lead to a better understanding of the phenomena. However, architecture also defines and establishes spatial relationships with cultural, social and historical factors which may not have clear material implications, yet they permeate and determine our environments in ways which can be even more categorical than pure physical boundaries. When studying patterns of occupation in streets in Shanghai we are not confronted with a natural phenomenon, but an anthropological one. This demands a rather different sequence: through observation and analysis, certain aspects of the dwelling are theoretically understood and then, based on that understanding, a visual representation is created, which ultimately allows perception of what was initially theoretically intuited. Hence, architectural visualizations can be used not only for supporting new approaches and possibilities to the design process, but also for revisiting old

problems from a new perspective [5]. Digital representation and visualization can generate new ways of perceiving and understanding old yet relevant, essential concepts, allowing us to represent invisible information interacting with the built environment [6] [9].

3 Case study: introduction

For our research, we decided to undertake a case study by comparing two iconic streets in Shanghai's former French Concession; Jinxian Road and Simming Village. These streets offer an excellent opportunity for comparison due to their similarities and differences. Jinxian Road is a fully open public street, while Simming village is a gated street of public access. They are very close to each other -less than 300m apart- and their length is very similar- between 200m and 250m-. They both belong to the same area of Shanghai with comparable flow and activity levels, which is essential for undertaking a meaningful comparison of their patterns of occupation. Their two main differences are their orientation and their role in the city, since one is open and the other one is gated (Fig.1).
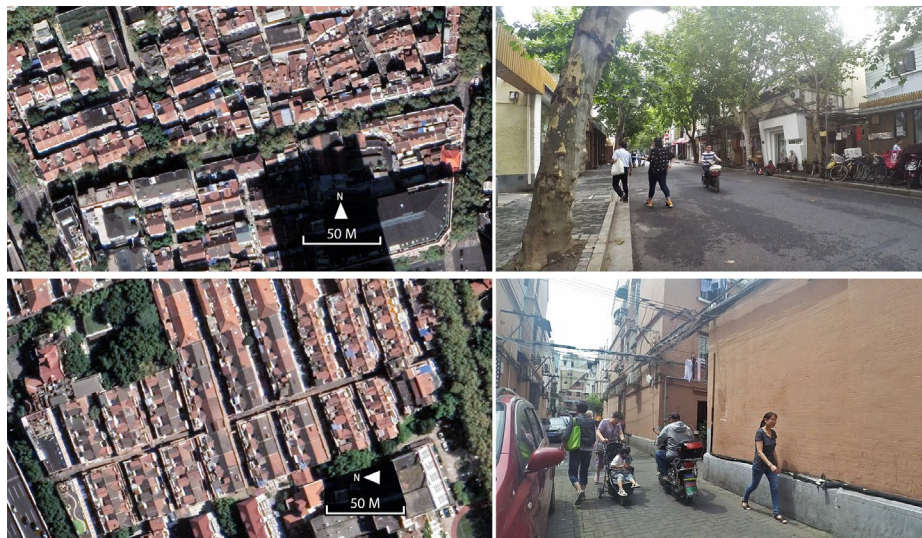
Fig. 1. Top view and street view of the two studied streets: Jinxian Road (top) and Simming village (bottom).

3.1 Case study: methodology

The proposed methodology is for visualising quantitative information in a qualitative way, and is divided in three main parts: Data collection, map generation and analysis.
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Data collection. Focused primarily on collecting external references like the historical profile, architectural styles and available data regarding past and current building

regulations and occupation profile of the studied streets. The second step is the place survey, which is executed in the streets themselves. Initially, we surveyed the architectonic elements (space-defining elements) responsible for boundary demarcation and identification, so we could divide the street into workable segments. The second step was to record the visual scenery of each segment, which later could be subdivided into "character categories". The third step will be the Facade's survey for each side of the street. The final step was the recording of occupation in both streets.

Maps generation. Once the information has been collected, we will generate the "place-maps", which are maps that can convey not only physical and geographical information, but also intangible information related to place coordinates. We will do so by applying two methodologies of visualisation overlapping historical, physical and photographic information with the patterns of occupations.

Analysis. Once the maps are generated, we will analyse them by searching for different patterns of occupation, character correlation and presence/use of architectonic elements, resulting in a complete overview of both streets. We argue that the "place-maps" have the potential to reveal relationships and conclusions that otherwise would not be possible or evident to visualise, allowing for a deep comparative analysis.

3.2   Case study: execution

The first steps of the research were focused on producing all the necessary material for supporting the site survey, starting with an initial site visit, rendering of the first plans of the two streets, modelling of 3d digital models, followed by a basic morphological study and comparison. The second step was to produce a historical overview of the studied streets, adding this information to the initial maps, which served as the base and support for the fieldwork. For the fieldwork and data collection, we visited the streets multiple times, surveying and mapping the following information: elemens, character and activity

Elements. The first step of the survey was to map and draw all the space-defining elements (architectonics elements) that play a role in creating spatial boundaries, with a special focus on identifying intermediate and weak boundaries. These are boundaries that exist in a site and play a role in organising the space and occupation of a place, but due to their size and nature, they are rarely indicated in plans at an urban scale. Occasionally, these types of boundaries are established informally by the residents themselves. Hence, they do not appear in the official documentation. Examples of these boundaries are sidewalks, curbs, small fences, changes of pavement, etc. The second step was to map the activity-defining elements. These elements are not very important or categorical when defining or demarcating spaces, but they are crucial for allowing certain activities to take place. Examples of these elements are benches, tables, or luminaries. Some of these elements can even be moved from one place to another by the residents (like foldable chairs). Again, this kind of information is rarely

present in ArcGIS databases or official documentation, yet they play a significant role in determining the activities, occupation and overall experience of a place.

Character. The character of a street is not easy to define: We can all understand and experience it, yet it is very challenging to break down the concept into measurable and mappable elements. It involves the historical periods in which its buildings were constructed, materials, details and design features. Building functions play a crucial role in defining the character of a street, determining either its variety or uniformity. Generally speaking, a purely residential street will appear more uniform and homogeneous than a mixed-use street, affecting its overall vibrancy and atmosphere. In order to incorporate this variable in our comparison, we first mapped the functions of the buildings in the studied streets. We also included typological research, collecting some of the housing types found in Jinxian Road and Simming Village. Additionally, we did a facade study, recording every facade of each building facing the street and combining them into one continuous image of the streets' elevations. Progressively, we started to explore ways this information could be combined into single maps or images (Fig. 2).

Fig. 2. Sample image showing part of the survey conducted in Siming Village, showcasing a roof plan of the street, existing typologies and gates and facades details.

Activity. In order to fully understand and compare these two streets, we must incorporate the patterns of occupation which take place in them. Both streets have substan-

tial pedestrian traffic. Jinxian Road is fully embedded in the urban fabric, yet it spans only one block, resulting in low traffic of vehicles and a visible high occupation of its public space by both residents and visitors. Simming village also spans only one block, connecting a main artery (Yan'an Road) with Julu Road, one of the most iconic streets of the French Concession. Because of this. We wanted to see the implication of these different conditions in defining their occupation. In order to do so, we registered the places where people gathered and stayed in both streets by using video recordings, mapping down their location and length of stay. We recorded ten minutes videos for every hour, from 9:00AM until 6:00PM, on the same day in both streets, making sure that the weather conditions (partially cloudy) were the same consistently throughout the day. This sample time for data recording has been proven dependable in numerous urban surveys, and allows for reliable information for data extrapolation [7]. This data would enable us to study both the location and concentration of activity in the studied streets. In order to do so, we introduced a tool for visualising the recorded information so it would allow us to analyse it quantitatively. For this, we introduce the Activity Counter Maps.

3.3   Case study: using the Activity Counter Maps

The Activity Counter Maps (ACM) is a digital tool that allows representation and visualization of different kinds of data in a geographical context. What the ACM does is to assign an area of influence to an object or location in the space. The radius and height of the area of influence can be assigned accordingly to the specific needs of varied researches (Fig. 3). When x areas of influence meet, the highest point where they are intersected is multiplied by x, generating a new common area of influence [8]. The process continues until every area of influence is combined with the others into a resultant common area, allowing visualization of both the shape of the combined personal spaces and the intensity of activity, since the combined spaces grown vertically. Hence, the intensity of activity can be expressed three-dimensionally, just like topographic contour lines. Especially for this research, here is where it lays the potential of this tool; it can be used not only for generating graphics, but also to generate form, and therefore, space [9].
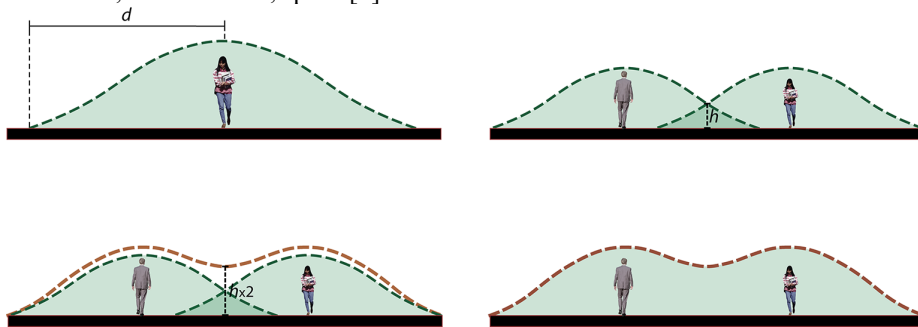

Fig. 3. Diagram showing the logic behind the Activity Counter Maps

3.4 Case study: generating the maps

In order to generate the ACM for both streets, we first created digital files containing the location and number of people staying in the streets. We generated one digital file for each studied hour, plus one file combining all the occupation of the day, resulting in 10 files for each street and 20 files in total. Additionally, it is possible to change the area of influence in the activity counter maps, allowing us to generate many results depending on the area which we want to visualise. After testing different areas of influence, we finally assigned a social area of 9 meters for each user, which is also an established proxemic for public distance in public places (Fig. 4). Once the maps were generated, we could quickly identify the areas with occupation concentration and recognise changes throughout the day. This would allow us to see if there is a correlation between the patterns of occupation and the other collected data for both streets.

Additionally, we generated several other maps with the rest of the collected information. For instance, we not only recorded the location and quantity of activity, but we also categorised it, indicating if it was a social or individual activity, passive or active activity, and so on. We also mapped the location and quantity of restaurants, cafes and stores on both streets, aiming to see the impact of these commercial functions on the occupation. We identified and categorised the level of openness in both streets, identifying the public, semi-public and private open areas, seeing how extruded walls and balconies could be occupied with temporary kitchens and gathering areas. Another important map was the service and infrastructure one, in which we mapped the location and quantity of the many elements that may populate and allow streets to function, like generators, bicycle parking areas, garbage collection areas and self-made mailboxes, which added a unique identity to the streets. One of the most exciting and unexpected maps was the one about planting and vegetation. Besides the public trees, which are part of the streets, many residents engage in claims of public space for placing their own plants and vegetables, once again blurring boundaries between public and private and concentrating a big deal of activity and occupation.
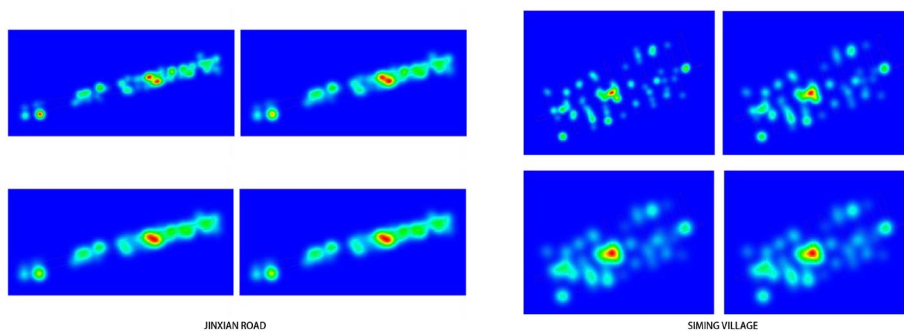

JINXIAN ROAD   SIMING VILLAGE

Fig. 4. Image showing selected sample of the concentration of occupation for different times of the day in the studied streets, testing different areas of influence. Jinxian Road (left) and Siming Village (right).

3.5 Case study: combining the maps

Once we finished all of our maps, we ended up with a total of 42 maps (21 maps per street) showcasing all the surveyed information. At that point, we understood that, while we could compare and study all the maps individually, there was much potential for visualising deeper correlations if we could combine all the data into one single map for each street. There were a couple of problems in executing this. First, the amount of data was too large, which resulted in very concentrated maps that were almost impossible to read and understand. The other problem was the type of data. The occupation patterns, building facades and typologies, location and size of informal planting and vegetation, stores and restaurants; They all needed different representational languages to be effectively integrated into the line maps of the streets, creating a problem of visual consistency. Finally, we managed to generate the map by switching from a 2D map to a 3D one, creating a tridimensional, layered poster containing different types of information in different translucent surfaces, allowing each type of data to be independent yet combined at the same time (Fig.5). This also allowed us to include vertical information (like the height and facade of the buildings), which emphasised even more the vertical quality of the ACM. The resultant maps were compelling in showing the correlation between the different variables, like vegetation and and activity, or history and facades, allowing for more accessible and unforeseen opportunities for analysis.
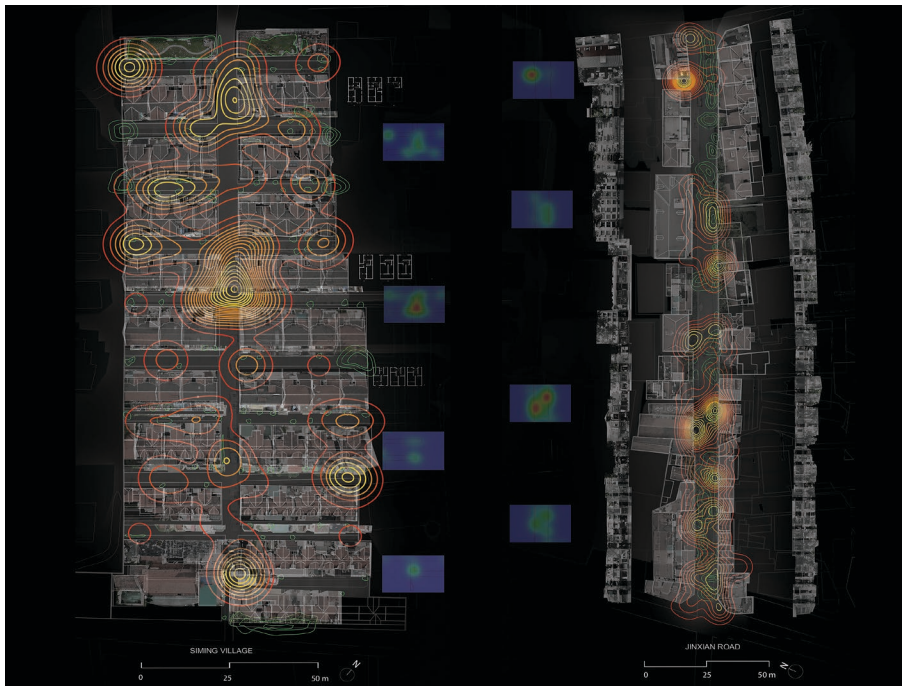

Fig. 5. 2D representation of one of the 3D illustrations which combines different layers of information of the two studied streets into one final map

4 Discussion and Conclusions.

After combining the data, we were able to see correlations and distinctions within each street and between them. Regarding the elements, both streets showed several informal interventions by the inhabitants, creating users-made boundaries that altered the patterns of occupation of the original planning. Surprisingly, Jinxian Road presented more of these interventions, which was unexpected considering that it is a fully public street. They range from self-made post boxes to installing benches and chairs. The most common one on both streets was the growing of plants and greenery. Spaces around planting revealed themselves as powerful places for congregation. Neighbours would take care of plants, which would attract other neighbours, creating moments of socializing. This was shared by both streets, and while this was initially intuited before the analysis, it was surprising to see how substantial and important these informal greeneries are for determining patterns of occupation. Regarding the character of both streets, they were quite distinctive. Simming village is mostly residential, dominated by three types of buildings with similar details and consistent heights. However, users have played a great role in modifying the buildings over the years, creating a distinctive community. Jinxian Road has evolved into a very concentrated and mixed street, which combines residential buildings with stores, restaurants and services. The type of stores is also very varied, ranging from traditional and old local restaurants to modern cafes and boutiques. All of the above, combined with low traffic of vehicles and the presence of trees and shades, has resulted in a street that is not only constantly occupied by locals, but also highly visited by other people, creating a mixed and unique street in which the occupation is ever-changing and flexible. The patterns of occupation in Simming village were also quite unexpected and surprising. The branch-like organization of the alleys produces public spaces which are more secluded and intimate, where residents are more likely to meet with each other. In opposition, the main central street acquires a semi-public identity in which residents and passing citizens can indirectly (or directly) interact. However, this type of indirect interaction also becomes important in defining patterns of occupation because people passing by would draw attention from people in the alleys, creating a constant exchange of gaze.

While both streets are different in their urban role, their level of activity and occupation had more similarities than initially presumed. We believe that there are many lessons to be learned from Simming village: its semi-public condition seems to create a good balance between openness and concealment. Perhaps this is a way forward for planning parts of Chinese cities, in which gated communities could become more fragmented and numerous, incorporating semi-public streets within them. Regarding the methodology, Its innovation is that it successfully represented and combined the collected information, allowing for meaningful comparisons and unexpected conclusions, showing new opportunities for analysing a variety of places and phenomena. We expect to expand and advance this methodology so it can be applied in other cities and urban scenarios, since we believe that it has the potential to provide meaningful information and new perspectives for better understanding and designing our built environment.

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