Familiar Strangers: Visualising Potential Metro Encounters in Beijing

Why can cities in general be more productive and richer than villages? Some scholars believe that the main reason lies in economic agglomeration and spillover effects (e.g., Anas et al., 1998). But what exactly can trigger those effects? Glaeser (2012) regarded face-to-face interaction, along with other factors such as human capital, communication, built form, development density and professional network, as the premise and booster of the effects. Cities with tall buildings and high population/employer density may be a pain for those who prefer and enjoy a countryside lifestyle; however, such cities can better facilitate a variety of face-to-face interactions, with "familiar strangers" as one of them. Familiar strangers are those urban residents or visitors who encounter one another at various locales in the city. Prior to the emergence of big data such as smartcard and cellular network data, it is mostly through discrete evidence, anecdotal personal experience and/or movie/novel episodes that we know the existence of the familiar-stranger phenomenon and perceive its magnitude. Nobody knows exactly where familiar strangers encounter the most, how many familiar strangers on average there are at a specific locale and which factors would affect the distribution and the number of familiar strangers at a locale.

Using a week's smartcard and cellular network data and the average number of points of interest (POIs) in a year of Beijing, the capital of China with a population over 20 million, we have created three visuals for us to fathom the distribution and the number of familiar strangers at different metro-served areas (MSAs)--metro stations and their respective surroundings--and two factors we speculated that influence the former: the active cellphone users, which represent the pool of people who can potentially encounter, and the POIs, which are opportunities/destinations that people would go for/to. Our smartcard and cellular network data are both for August 10-14, 2015. Based on these data, we derived on average 2,664,796 distinct smartcard holders (assuming each user has one distinct smartcard) and approximately 17 million distinct cellphone users (assuming each user has one distinct phone number) per weekday. In the same year (2005), there were on average 101,440 POIs within all the 314 MSAs, which is defined as areas within an 800 meters' radius of a metro station. Of those distinct smartcard holders, we treated those swiped their smartcard into the same metro station within the same hour on the same day as familiar strangers (encounters). We could have used smaller temporal resolutions such as ten minutes and a minute when defining encounters; however, we still could not guarantee that after swiping their smartcard, smartcard holders would all go to the same spot at the platform and/or enter the same car of a train. Thus, we used hour rather than smaller units when defining encounters, which also saved us a lot of time when processing the data. Our work below thus is illustrative rather than exact. But it shows to some extent the overall pattern of encounters at MSAs in Beijing.

Figure 1 visualises cellphone users, encounters per weekday and POIs by MSA in

Beijing. Not surprisingly, Guomao and Chaoyangmen, where is largely the local Central Business District (CBD) saw the most encounters. The second to fifth most significant MSAs for encounters were, somehow to our surprise, Jianguomen, Xierqi and Tiantongyuanbei. The density of POIs is only positively correlated to the numbers of encounters at the CBD whereas Jianguomen, Xierqi and Tiantongyuanbei did not enjoy a high density of POIs as compared to other MSAs but were still among the top five sites for encounters. Cellphone users can be used to well predict encounters at MSAs in or around the CBD whereas they cannot do so at Xierqi, Tiantongyuanbei and Dongzimen. Interestingly, too many encounters may be annoying to metro users. Tiantongyuanbei, for instance, on the hand is a popular site for encounters, on the other hand is arguably a nightmare for many metro users during rush hours (Branigan, 2014).

As a whole, our work indicates that big data such as smartcard and cellular network data have great potential in visualising and explaining such complex urban phenomena as encounter.

Software: Surfer 13; MySQL 8.03.

References

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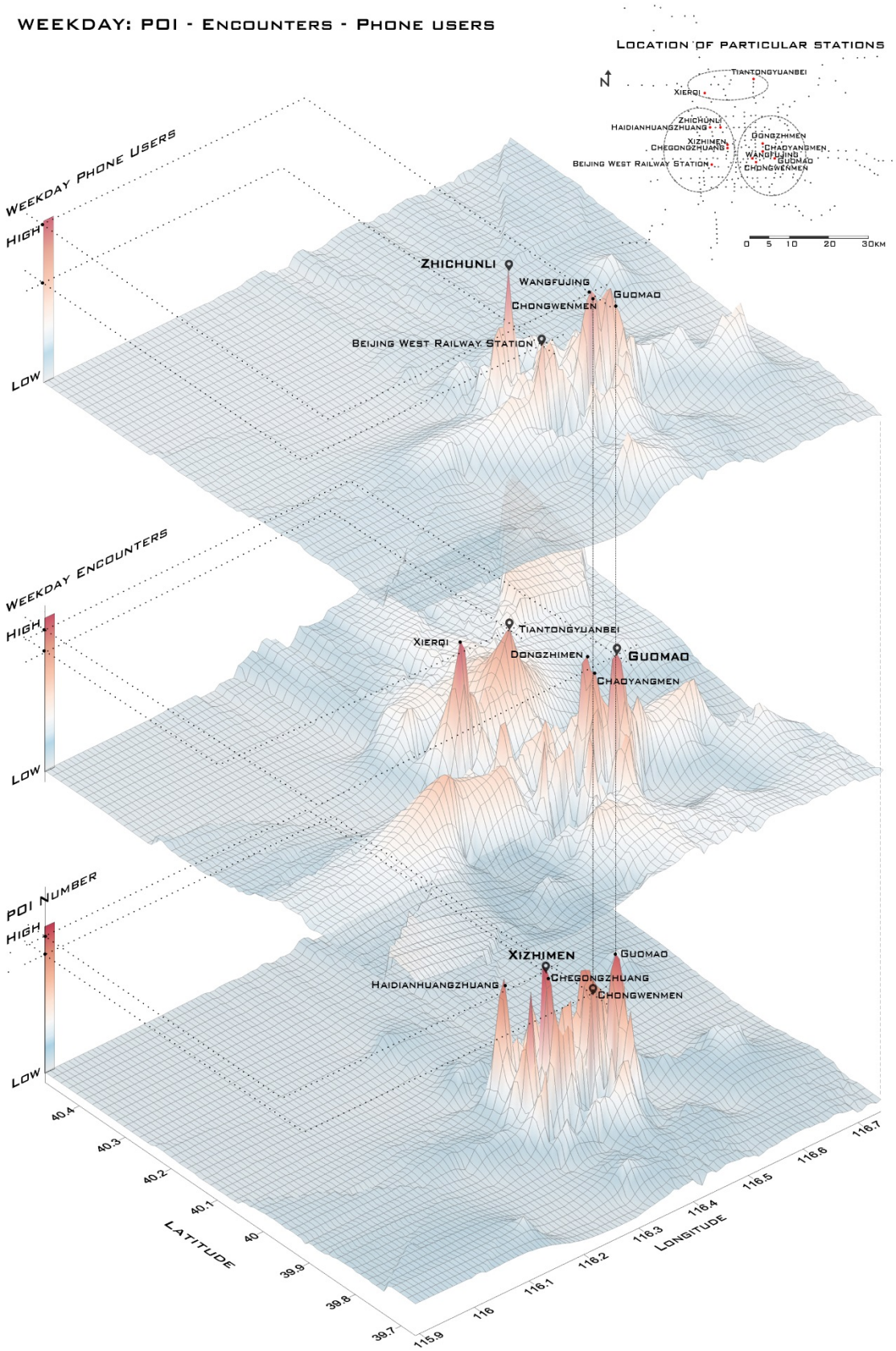

Figure 1: POIs, Cellphone Users and Encounters by MSA in Beijing

POI: point of interest.