Highways are barriers to urban social connections

Keywords: Urban Informatics, street network, social network, segregation, Twitter

Extended Abstract

Geographic distances influence social connections inside cities – even in our digital age [1, 2]. Both the perception of physical distance and the likelihood of forming social ties across locations are influenced by infrastructural elements, as previous studies showed: public transport increases social connectivity along routes [3]; barriers to physical mobility influence the creation of social connections [4]. To directly investigate the relationship between highways and social connections, we analyse how the spatial configurations of a city's social and infrastructural networks are correlated. We use a highly granular, geo-referenced social network of mutual follower relationships between Twitter users in the top 50 US metropolitan areas [5]. The social graph contains a total of 0.97M users and 2.71M social connections between them, and a high accuracy estimate of the home locations of all users is available. For each of these cities, we create a gravity-law inspired configurational null model of the social graph [6] that reflects the population density and distance distribution of users' home locations. We then overlay the spatial network of social connections with the network of highways from OpenStreetMap, and measure the average number of highways crossed by social network ties both in the real graph and in the null model. We find that both the probability of an edge crossing at least one highway and the numbers of highways crossed are significantly lower for real social connections than for the null model, after controlling by geographical distance (Figure 1). We validate these findings by several multivariate regression models. Our results confirm that urban highways, apart from causing spatial segregation patterns, also have a directly measurable negative correlation with the density of social connections. These results unveil the importance of road infrastructure to the study of urban social network fragmentation, which leads to increasing inequalities within urban areas alongside decreasing opportunities for certain social groups.

References

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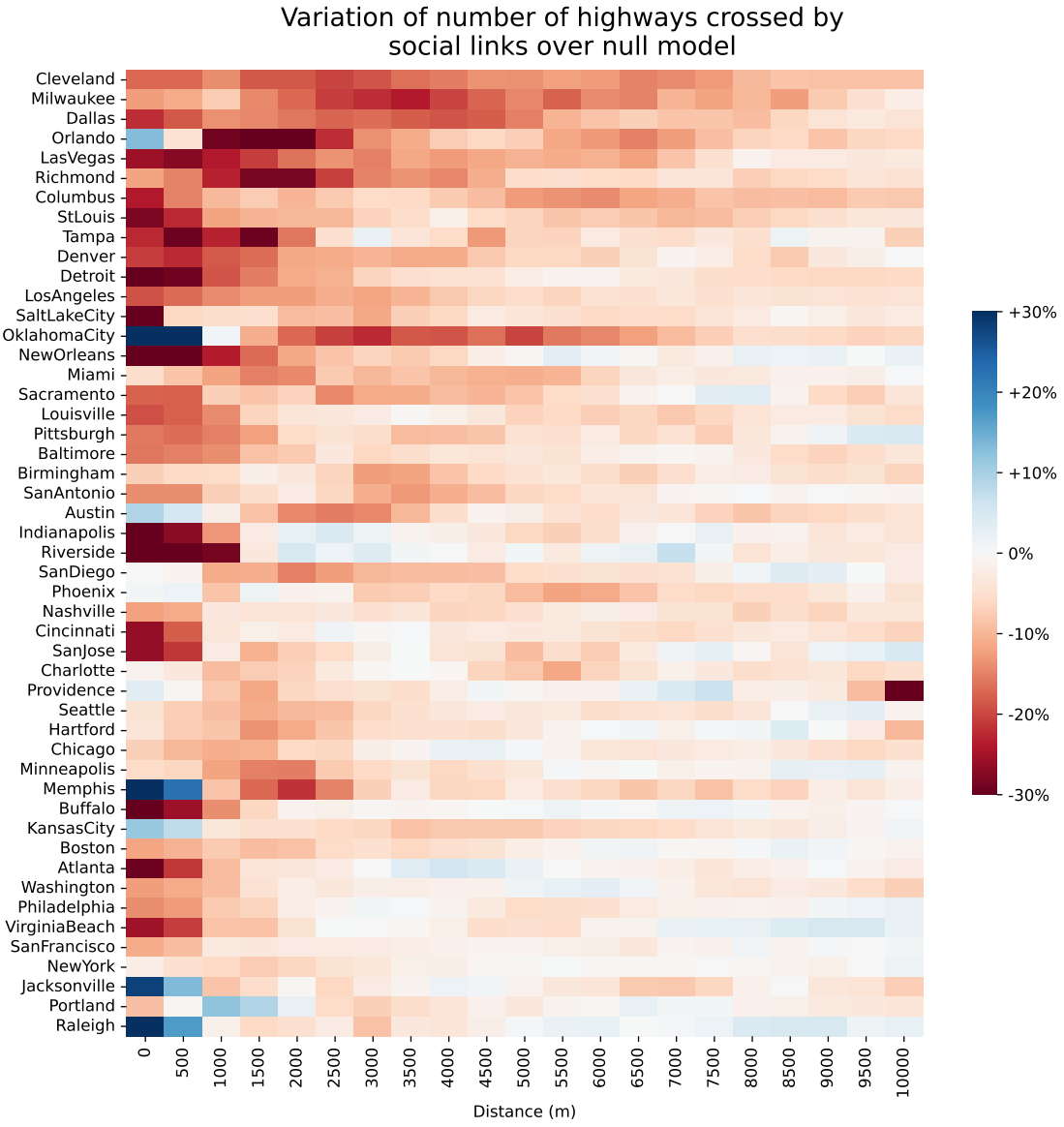

Figure 1: Variation of number of highways crossed by social connections in the real social graph over a random spatial configuration model. Results are aggregated over groups of social links that span a given geographical distance. Links in the real social graph cross fewer highways than the null model, especially when they are short-ranged (3km or less). Results are broken down by city, with cities for which the variation is higher presented on top.