Journal of Transport Geography 31 (2013) 267–277

Contents lists available at SciVerse ScienceDirect

Journal of Transport Geography

journal homepage: www.elsevier.com/locate/jtrangeo

Urban sprawl and social interaction potential: an empirical analysis of large metropolitan regions in the United States

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ARTICLE INFO

Keywords:
Social interaction potential
Urban spatial structure
Time geography
Urban sprawl
Spatial interaction

ABSTRACT

This paper investigates the impact of urban spatial structure on the opportunities for people to participate in face-to-face activities. We make use of the Social Interaction Potential (SIP) metric, a tool to measure the average level of opportunity for people to engage in face-to-face activities given some basic constraints on their daily mobility patterns. Generally, this opportunity is a reflection of whether the urban spatial structure – a term that broadly applies to the spatial arrangement of land-uses and the interactions between them – constrains or permits the ability for potential activity partners to be at the same place and time. In this paper, the SIP metric is applied to 42 metropolitan regions in the United States with populations over 1,000,000 people. These measurements are regressed against a set of indicators of urban sprawl to expose the relationship between spatial structure and SIP. The indicators are generated by a factor analysis of a large set of variables describing the scale, centrality and dispersion of land-uses in addition to several other structural and infrastructure-related variables. Cluster analysis is also used to organize the regions into similar groupings with respect to their structural characteristics and the level of SIP they provide. The findings indicate that social interaction potential is hampered by decentralization, fragmentation, and longer commutes in the largest metropolitan regions in the country. Interestingly, the negative effect of decentralization on SIP Efficiency is found to be nearly ten times stronger than that of fragmentation and nearly 20 times stronger than the effect of mean commuting duration.

1. Introduction

Social interaction is a fundamental human need (Maslow, 1943). At the individual level, social contact plays an important role in psychological development and well-being (House et al., 1988). At the community level it is responsible for cohesion and social capital development (Coleman, 1988; Forrest and Kearns, 2001). And economically, it is the basis for innovation and creativity (Storper and Venables, 2004). If the city is an arena in which social interaction takes place, then urban spatial structure can either be an obstacle that constrains Social Interaction Potential (SIP), or an asset that supports it. In this paper, we quantify empirically how SIP is related to regional-scale spatial structure, with a particular focus on the impact of urban sprawl on the ability for people to engage in face-to-face activities.

This research uses the previously developed social interaction potential metric to measure the average quantity of joint time–space accessibility between all commuters in 42 metropolitan regions across the continental United States (Farber et al., in press; Neutens et al., 2008). The calculated SIP metrics for these regions are regressed against characteristics of their spatial structure, revealing the sign, magnitude, and explanatory strength of each factor.

The total set of social contact opportunities is composed of many elements: interactions within the household, interactions between friends, interactions between people who work, interactions between people who don't work, impromptu interactions, planned interactions, etc. This paper focusses on one particular element of this set, after-work interaction opportunities amongst people who commute. Of course, this is a large component representing a high percentage of the population in the United States (e.g. 54.9% of Americans over 16 commute to a workplace outside of their home according to the 2010 American Community Survey 5 year estimates). Restricting this even further, the SIP metric is particularly suited to capture the ability for people to conduct planned face-to-face social contact activities, as opposed to casual, impromptu contact with neighbors or fellow bus-riders, or contact via electronic media. Also, it only looks at one representative, weekday evening time-period. But for working days, the evening time-period is an important time many workers have to perform discretionary social activities. So, while we contend that there is more to understand before having a complete picture of social interaction opportunities in a city, we may begin by adding to

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http://dx.doi.org/10.1016/j.jtrangeo.2013.03.002

our understanding of how the urban spatial structure impacts this rather pervasive component of daily social life – planned evening interactions amongst workers.

The SIP metric attempts to balance the social-contact benefits of living or working in dense neighborhoods with the inherent time constraints associated with the regimen of the daily commute activity. The contention put forward by the SIP body of work is that the effects of marginal density distributions (residential and employment densities) on social contact opportunities are diminished by the burdens of lengthy commutes. Thus, a method that takes both the spatial and temporal implications of urban spatial structure into consideration is required to more accurately represent how the opportunities for social interaction are impacted by metropolitan-scale urban spatial structure.

The remainder of the paper is structured as follows. First we provide an overview of the relevant literature. Following that, the SIP metric is defined, and the data used to measure spatial structure are described. The results of the analysis are put forward in the next section, followed by a discussion and conclusions.

2. Literature review

The literature relevant to this research is split between work motivating the empirical question, that is, the role of spatial structure in social interaction potential, and the work that underpins the methodological approach.

2.1. Urban form and social interaction

The degree to which urban form hinders or fosters social interaction is most commonly investigated at the local scale. Much of the existing research emanates from the proponents of New Urbanism, who propose that dense, mixed-use development coupled with architectural and civic design strategies can be used at the local scale to induce impromptu neighborly interaction (Talen, 1999). The findings of this body of research are mixed, partly due to the complexity of heterogeneous tastes, perceptions, and behaviors (Sander, 2002). The research, however, is consistent in finding that automobile use is among the significant factors predicting reduced levels of social participation. Placing the emphasis on travel behavior rather than land use, Freeman (2001) found that land use density in a neighborhood was not related to the number of social ties between neighbors, upon controlling for the strong negative impact of automobile dominance in the neighborhood. Leyden (2003) concluded that households rating their neighborhoods as more walkable were also "more likely to know their neighbors, participate politically, trust others, and be socially engaged" (p. 1546). Similarly, Lund (2003) found the perception of walkability to be positively related with participating in social activities with neighbors, but concluded that personal characteristics and attitudes played significant roles as well. Finally, over the last 15 years, Grannis (1998, 2005, 2009) has shown overwhelming evidence that local walkability supports the development of strong local communities.

The above studies suggest that residential walkability leads to higher incidences of social connectedness at the neighborhood level, but they are all cross-sectional in design, suggesting that reverse causality and self-selection may confound the interpretation of their results (Cao et al., 2006). For example, it is important to recognize that these claims echo significant changes in people's housing preferences. In fact, a recent Brookings paper reports on growing evidence that the supply of automobile oriented neighborhoods far exceeds the ever diminishing demand, citing changing preferences amongst home-buyers as a significant causal factor (Leinberger, 2011). This echoes earlier, pre-recession findings, of the existence of latent demand for more walkable, cohesive neighborhoods (Levine et al., 2005). It is plausible that the set of preferences that make people want to relocate in more walkable neighborhoods also make these individuals more likely to form strong social ties within the neighborhood. This raises the question of whether or not a more walkable local neighborhood "causes" people to become more socially active.

Furthermore, while these studies identify urban sprawl – or rather those *local-scale* urban form elements typical of sprawling cities – as a culprit in reducing community-level social interaction, they do not consider the potential *metropolitan-scale* effects of sprawl and automobility on time–space trajectory dispersion. Urry (2002) and Sheller and Urry (2000) hypothesize that the automobile has simultaneously individualized, fragmented, and dispersed time–space trajectories, thus making synchronization of social interaction activities difficult to accomplish for many people. Moreover, Wellman (2001) identifies automobile oriented suburbanization as a causal factor in the spatial thinning of social networks. These two sociological arguments speak to a growing difficulty for people to engage in planned social activities with members of their social network; cities have expanded, social networks have become more spatially dispersed, and individuals are carrying out more individualistic and less routine daily space–time patterns than ever before.

These sociological hypotheses were examined empirically by Farber and Páez (2009, 2011a,b) in a series of time-use studies of social activity participation. The findings contradict time-geography's traditional conceptualization that the extra velocity provided by the automobile should enable increased access to opportunities and therefore more activity participation. Rather, the studies were in support of the sociological theories of Urry and Welman. They found that increased automobile use was associated with lower rates of social activity participation even after controlling for demographic, household, and socio-economic factors. Also, the increase in overall duration of mandatory automobile travel from 1992 to 2005 was associated with a significant decline in social activity participation amongst Canadians in the same time period. They logically reasoned that metropolitan-scale activity dispersion limits the opportunity for social interaction in urban areas, but this could not be directly examined by those authors using time-use data alone.

2.2. Contact fields and activity spaces

A contact field is a geometric estimation of the interaction potential for an individual at a fixed location. The interaction potential is predicated upon an individual's trip-distance preference function and an areal distribution of population density. In the early part of geography's quantitative revolution, contact fields were used to investigate processes that result from interaction between populations with different spatial distributions (Dacey, 1971; Moore, 1970; Moore and Brown, 1970). They helped researchers understand and predict spatial behavior within cities through geometric reasoning and analysis (Golledge et al., 1972). The intellectual prominence of contact fields diminished once disaggregate travel behavior models derived from random utility theory broadly supplanted the quantitative geographical approaches (Domencich and McFadden, 1975). Still, they are the starting point in a decades-long quest to understand how the urban spatial structure impacts opportunities for spatial interaction (Beckmann et al., 1983a,b). Indeed, the relationship between spatial (and network) structures and access to interaction opportunities remains a relevant topic, with the research area receiving attention in a recent special issue of Networks and Spatial Economics, a journal dedicated to understanding the impacts of human infrastructure on economic outcomes (Reggiani and Martín, 2011).