
THE SPACE SYNTAX AND CRIME: evidence from a suburban community

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Perver K. Baran

North Carolina State University

William R. Smith

North Carolina State University

Umut Toker

California Polytechnic State University

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Perver K. Baran

*North Carolina State University,
Box 7701, Raleigh, NC 27695,
USA*

perver_baran@ncsu.edu

William R. Smith

*North Carolina State University,
Box 7701, Raleigh, NC 27695,
USA*

wr_smith@ncsu.edu

Umut Toker

*California Polytechnic State
University, San Luis Obispo, CA
93407, USA*

utoker@calpoly.edu

Abstract

A considerable body of research has examined the relationship between the occurrence of criminal events and spatial configuration as measured by space syntax methodology. Research findings have shown that crime, in particular property crime, tends to cluster in segregated areas. These research findings tend to confirm Jacobs' view that the circulation of people and appreciation of public spaces are crucial elements to the urban vitality and that natural surveillance is a good deterrent to criminal activity. However, not all space syntax research has supported these findings. The discrepant results point to the fact that the relationship between space configuration and crime occurrence is not a simple one. This short paper/poster will report an ongoing study that examines the relationship between syntactical properties of space and the actual crime locations in town of Cary, NC. Data for this research include three-year crime event locations (2001-2003), census data, street network data, and parcel-based land use data. Four crime types (larceny, robbery, burglary, and auto theft) are related to syntactical measures, land use, and more traditional sociological variables at the individual address and at the census block group level to determine if space syntax "matters" after controlling for these other factors. Specific types of land uses and distance to such land uses explain most of the variance in the count of the number of crimes. However, interaction effects are found between space syntax variables and land use variables as well as proximity to land uses.

Introduction and Background

Understanding crime, in particular factors that cause crime, has been focus of researchers both in design and social fields for a few decades. In social sciences, the predominant theory of the spatial location of crime has been social disorganization theory. Three exogenous factors—poverty, racial and ethnic heterogeneity, and residential mobility—are hypothesized to result in a withdrawal in community social control activities and an increase in delinquent and criminal activities (Sampson & Groves, 1989). On the other hand, routine activity theory, the other major theory of the spatial location of crime, claims that criminal event results from motivated offenders, attractive targets (opportunities), and an absence of capable guardianship

against crime converging nonrandomly in time and space (Cohen & Felson, 1979). Previous work from a routine activity-rational choice approach has shown the importance of weak guardianship and ample opportunity (Barclay et al. 1996).

Urban design theory also has addressed the issue of crime. The empirical research within the design field has mainly focused on site-specific and situational features of a place. Starting in 1960s, this body of research has emphasized the role of environmental attributes in crime prevention. Jacobs (1961) argued that the circulation of people and appreciation of public space are crucial elements to the urban vitality and indicated that informal (natural) surveillance ("eye on the street") is a good deterrent to criminal activity.

In the area of urban design, the most influential empirical study that examined the crime-environment connection was conducted by Oscar Newman (Newman, 1972). Newman elaborated the idea of defensible space and its most important elements of territoriality and natural surveillance. Later, the concept of defensible space provided the theoretical grounding for the development of Crime Prevention Through Environmental Design (CPTED). The main limitation of this research has been its heavy reliance on micro-level design and physical changes while understating and marginalizing macro-level (city, neighborhood) (Brantingham & Brantingham, 1981) social-economical and demographic factors (Poyner, 1983).

More recently, urban design researchers that have employed space syntax technique to analyze geographic distribution of crime have started to pay attention to other spatial and socio-demographic factors that could influence crime patterns. This paper adds to the body of this research by focusing on the question of how space syntax is related to four common crime types in a suburban community (Cary, NC) while considering a broader range of social disorganization and routine activity theory variables.

Space Syntax and Crime

A considerable body of design research has examined the relationship between the occurrence of criminal events and spatial configuration as measured by space syntax methodology (Baran, et al., 2006; Nubani & Wineman, 2005; Shu, 1999; Hillier, 1998). Rooted in graph theory and the idea of urban morphology, space syntax theory describes and measures quantitatively the configurational properties of urban space (Hillier & Hanson, 1984). Two space syntax measures, i.e., integration and connectivity, measure the level of accessibility of street segments within a spatial system. The theory posits that the built environment, viewed as a system, affords or carries movement from every space to every other space within the system. Environments that are most directly linked to other environments (i.e., high on integration and connectivity) will tend to attract higher densities of movement. Empirical research has widely supported this view by showing that areas with high syntactical accessibility have a higher number of pedestrians and car users (Penn, et al., 1998; Hillier et al., 1993).

Space syntax theory is also relevant to one of the social theories of the spatial location of crime, i.e. routine activity theory (Cohen & Felson, 1979). Part of that theory refers to the accessibility of potential victims (person and places) as an opportunity to motivate offenders. Social science studies that have tested the relationship between accessibility and crime from a routine activity theory perspective have operationalized accessibility either as number of "turnings" into a street segment (Beavon et al., 1994) or as the number of access streets from traffic arteries to the neighborhoods (White, 1990).

Because of availability of adequate computational tools, the advantage of space syntax method is that it allows us to calculate the relative degree of accessibility for each street segment relative to the whole, or to its surroundings, for an entire city street network.

Most of the space syntax research has shown that crime, in particular property crime, tends to cluster in segregated areas, particularly in those “unconstituted enclosed clusters which Newman considered to be the key to increase local surveillance and hence to exclude causal intrusion by non-residents” (Shu, 1999; Hillier, 1988). Hillier (1988) argues that if the spatial configuration makes the natural movement of pedestrians more difficult, there will not be a sufficient number of people to generate the perception of a well appropriated and used space. Empirical research has supported this idea by showing that places with higher accessibility tend to have lower crime rates, while places with low accessibility, i.e. segregated places, have higher crime rates (Shu, Huang, 2003; Shu, 1999; Jones, Fanek, 1997). These research findings also confirm Jacobs’ (1961) view.

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However, not all space syntax research has supported these findings (Baran, et al., 2006; Nubani, Wineman, 2005; Reis, et al., 2003). The discrepancy between the findings, to certain degree, is result of differences in units of analysis used in the studies and residents’ lifestyle in the study areas (Nubani, Wineman, 2005). In addition, differences in crime types studied have contributed to the inconsistencies in the research findings. All these, point to the fact that the relationship between space configuration and crime occurrence is a complex issue.

Methods

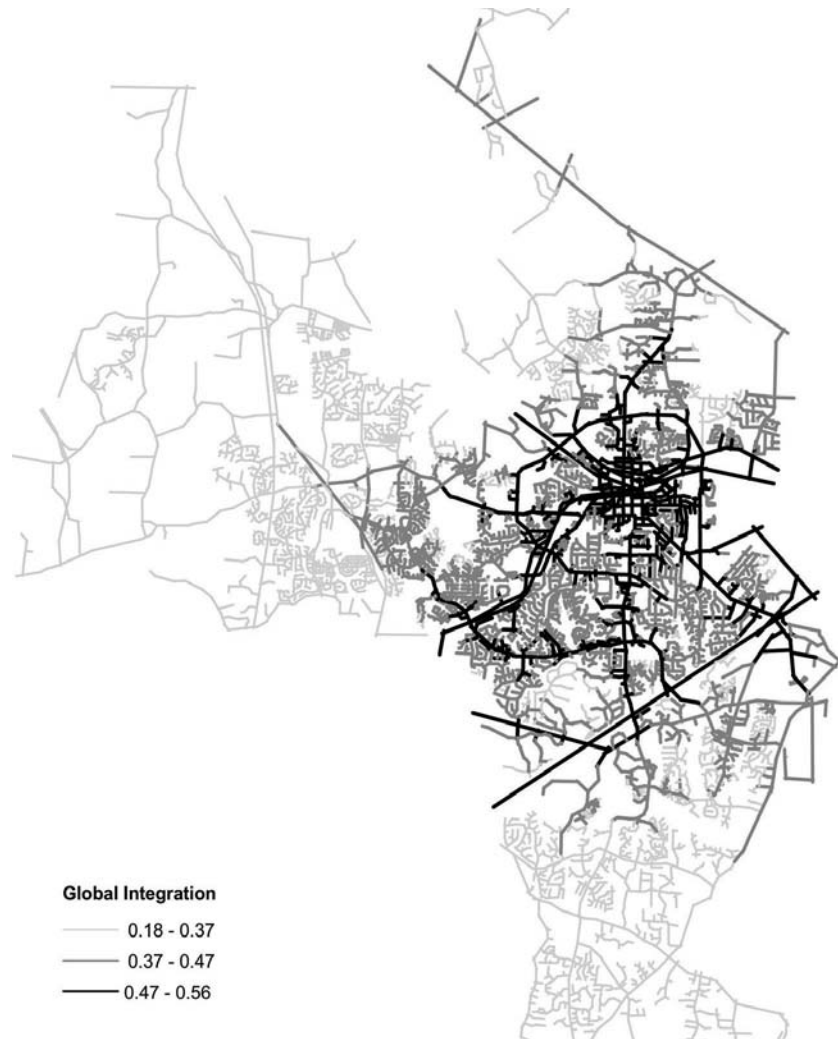
In the present paper we focus on the “city” of Cary, NC (population approximately 95,000 in 2000, 116,000 in 2006). Despite the large population growth, Cary was recently named (2005) the “tenth safest city” of 369 large cities in the US [12th Annual Morgan Quitno Safest (And Most Dangerous) City Award] (Town of Cary, 2006). Although among the safest cities, there is some crime in Cary, including serious crimes, such as robbery (a robbery every 3 days, approximately) and burglary (roughly three burglaries a day), as well as property crimes, such as vehicle theft and larceny. These are the crime types studied in the present analysis.

Axial map for the city was constructed using the street and parcel data in Geographic Information Systems (GIS) software. The axial map was subject to syntactical analysis and the space syntax measures were calculated as defined by Hillier and Hanson (1984). The distribution of global integration values is shown in Figure 1. All street level syntactical measures were linked to the parcel database in GIS. This allowed us to assign all three street level syntactical measures to each parcel based on its location in the street network.

Regression analyses at the address (parcel) and census block group level are conducted in which the logged counts of the number of robberies, burglaries, vehicle thefts, and larcenies in 2001 through 2003 constituted the dependent variables in four separate models. Independent variables include various land use variables, sociodemographic variables as well as both global integration and connectivity (local integration and control were found to be rather highly collinear with the other syntactical measures and were dropped from further analysis). In addition, distance to certain land uses (called “magnate one” land uses: movie theaters, hotels/motels, gas stations/garages, and restaurants; and “magnate two” land uses: store, shopping center, and mall) were measured and included in the analysis.

Figure 1:

Axial map of Cary, NC; the 10% global integration core shown in heavy black and the 50% globally most segregated lines shown in light gray



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Results and Discussion

Bivariate analyses reveal that all four crime types tend to be concentrated in the high globally integrated areas, and somewhat less so in highly connectivity areas. In a similar way so too are many commercial land uses concentrated (more in highly globally integrated areas than in high connectivity areas).

There are several main findings from the analysis. Firstly, the results for all four crime types showed that in general there was a direct positive independent effect of global integration on the logged count of each crime type, net of all of the other variables in the model. Connectivity was not found to be statistically significant in any of the models. Secondly, various land uses were found to be predictive of some crime types more than others. For example, robbery is associated with shopping centers, malls, and apartment complexes. Burglary is associated primarily with apartment complexes and to a lesser extent with shopping centers and malls, as well as negatively with distance to both magnate one and magnate two commercial land uses. Motor vehicle theft is also found primarily at apartment complexes, but also at motel/hotels, as well as shopping centers and malls. Distance to commercial areas (magnates one and two) also is associated negatively with vehicle theft. As for larceny, it is better predicted than any of the other three crime types and found to be concentrated in the following land uses rank ordered from the highest effect: apartments, shopping center, mall, school, store, distance to shopping, motel/hotel, and distance to magnate one uses.

Thirdly, socio-demographic characteristics of the surrounding areas to a land parcel were not found to be strongly related to any of the four crime types. In fact, socio-demographic variables did not add to the explained variance to any crime type count. Moreover, interaction effects were tested between space syntax variable and the two magnate land use variables. For all four crime types, synergistic effects (or multiplicative effects) of global integration are found with magnate one land uses (restaurants, gas stations, movie theaters, etc). That is, if a movie theater, or gas station or other magnate one land use was located in a more globally integrated area, there would be more of each crime type relative to what would be predicted assuming only linear additive effects. Synergistic effects of connectivity were also found with magnate two land uses (shopping centers) for all four crime types. Thus, global integration seems to encourage crime for land uses associated often with night time activities (restaurants, bars, movie theaters – but also places not so associated with nighttime activities such as gas stations), while connectivity seems to encourage more crime in/at stores and shopping centers. Additionally “compensatory” interaction effects of connectivity on magnate one land uses are found for burglary, vehicle theft, and larceny (for example, either connectivity or a magnate one land use brings about crime – the presence of one reduces the effect of the other on burglary, vehicle theft, and larceny). Finally, it is found that the frequency of crime “decays” the further a parcel is from commercial land uses.

In conclusion, contrary to Hillier’s hypothesis (1988), global integration is positively associated with each crime type’s occurrence, and even seems to magnify the effect of some land uses on crime (magnate one land uses). In support of Hillier, however, are results that indicate that connectivity reduces the effect of magnate one land uses (restaurants, bars, movie theaters, etc.) on burglary, auto theft, and larceny (not robbery). However, again contrary to Hillier’s hypothesis, connectivity increases the effects of magnate two land uses (shops) on all four crime types. These results suggest that offenders select targets for crime from among land parcels that are “easy to get to” in terms of accessibility/proximity or part of their “routine activities” (concepts associated with global integration). Connectivity is often associated with escape routes, which presumably would encourage crimes to occur, but may also be associated with “approachability” of squad cars such that most crime types are less likely to occur at magnate one land uses if those land parcels are better connected (i.e., are on street segments with many cross streets nearby). However, stores/shopping centers that are well “connected” generate more crimes (all four types), not less. More research needs to address these speculations.

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