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NEIGHBORHOOD PERMEABILITY AND BURGLARY RATES*

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This paper explores the effects of permeability on neighborhood burglary rates in Norfolk, Virginia in 1987. It is hypothesized that variation in permeability to heavily traveled throughways will be linked to variation in neighborhood burglary rates. Permeability is found to account for a significant proportion of the variance in burglary rates when structural density, socioeconomic effects, and the influence of adjacent neighborhoods are controlled.

This paper explores the hypothesis that crime rates are in part a function of the physical structure (built environment) of residential neighborhoods. The specific focus of the paper is the permeability of residential neighborhoods and residential burglaries. The concept of permeability, taken from Taylor and Gottfredson (1986), concerns the degree of openness to traffic outside the neighborhood. It is interpreted and discussed here in light of research on the nature of burglary and on the geography of neighborhoods.

Neighborhoods that are more open to traffic may provide more opportunities for crimes and may be more attractive to potential offenders. If this is so, it is anticipated that neighborhoods that are more permeable to automobile traffic will experience higher rates of crime. Two features of the physical environment must be considered: the volume of traffic near the neighborhood and the degree to which the neighborhood is open to traffic. Residential areas adjacent to streets that are more familiar to potential offenders are likely to have higher rates of crime than those which are distant and out of the way of well-traveled roads. Because there is no reason to believe that burglars or other offenders travel to work or to leisure pursuits on streets different from those used

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by the rest of the population, neighborhoods that are closer to high-volume traffic arteries should experience higher rates of burglaries than more distant areas. Further, neighborhoods more permeable (allowing greater access) to high-traffic streets should suffer higher rates of burglary than those with more limited access. This hypothesis is examined for the year 1987 across neighborhoods in Norfolk, Virginia.

REVIEW OF LITERATURE

Burglary and Permeability

Much has been written about the relationship of the physical and social environment to crime (Brantingham and Brantingham 1981; Byrne and Sampson 1986; Davidson 1981; Georges-Abeyie and Harries; Herbert 1982; Newman 1980). The focus in this paper is also influenced by the general theoretical position of "area imaging" (Carter and Hill 1980) and territoriality (Brown and Altman 1983).

Studies on the act of burglary provide specific insights into the process of selecting burglary sites. Bennett and Wright's (1986) study of 309 convicted burglars suggests that the selection of a burglary target is a rational and deliberate act; more than one-half of their sample of burglars engaged in "planned burglaries." Research on burglars (Brantingham and Brantingham 1981; Rengert and Wasilchick 1985) suggests that residential burglars engage in a search process along "activity spaces" in order to select neighborhoods in which to commit burglaries. This process involves the selection of residential neighborhoods based on the burglars' routine activities. Neighborhoods are chosen from those that are near familiar routes, typically taken by burglars to work or to leisure activities. Rengert and Wasilchick found in their interviews with suburban burglars that routes to work sites were more influential than routes to recreation sites in the selection of neighborhoods for burglary, although both were important. In fact, only a small percentage of the residential targets were not close to one or the other of these familiar paths.

These studies imply that the selection of a burglary target follows a process in which the primary decision is the selection of a neighborhood, then of a residential block, and finally of a house or an apartment on the block. This process is based on the perception of risk, convenience, and opportunity to commit a successful crime (Taylor and Gottfredson 1986). It suggests that the choice of the neighborhood is primary and thus perhaps is the most important determination of burglary. It also implies that dwelling units which are less well protected but are in well-insulated neighborhoods will be less likely to be victimized than houses that have more defensive space but are in more obvious and more accessible neighborhoods. Therefore the construction of a theoretical explanation of variation in crime rates between neighborhoods may be crucial in understanding how the "built environment" affects crime.

In this study, permeability is defined in terms of the number of access streets from traffic arteries to the neighborhoods. Permeable neighborhoods may provide less risk of apprehension for offenders because there are more escape routes. In addition, they may be more likely to be selected for burglaries on the basis of chance. If a neighborhood has more avenues of access, the chance of an offender's entering it while searching for a burglary location would be greater.

Research on Crime and Permeability

Neighborhood permeability has been linked to neighborhood crime rates, but the results have not always been conclusive. An experimental study in Hartford, Connecticut (Fowler 1982) found that decreasing the number of entrances to the experimental neighborhood and thereby decreasing the amount of traffic did not reduce robberies and burglaries in the long run, but there was a short-term reduction in crimes. The patterns of victimization moved from less-traveled side streets to the more heavily traveled streets in the district. The study suggests that a reduction in crime could be achieved both when physical permeability is reduced and when the neighborhood is organized socially to prevent crimes. Apparently the physical changes alone were not enough to produce a long-term reduction in crime.

In a study pairing high- and low-crime neighborhoods in Atlanta, Greenberg and Rohe (1984) found that neighborhoods characterized by low crime rates were less accessible to traffic than neighborhoods with higher rates. Although it is true that these neighborhoods differed in a constellation of physical features, the authors concluded that physical features were more important than social factors in discriminating between high- and low-crime neighborhoods.

A study of 66 neighborhoods in Baltimore (Taylor, Schumaker, and Gottfredson 1985) found moderate and significant zero-order correlations between land use and crime rates. When the sociodemographic characteristics of the neighborhoods were controlled, however, the variations in land use were no longer related significantly to variations in crime. The researchers concluded that physical features were related only spuriously to crime rates. Variation in the socio-economic characteristics of neighborhoods exerted the more important effects on crime.

METHODS

The city of Norfolk is composed of approximately 86 neighborhoods (planning districts) that are roughly equivalent to census tracts in size. Eighty-two of these planning districts contain 50 or more households. City services, planning activities, and demographic statistics are organized around these neighborhoods, which are recognized in a social sense as well. Although residents and others are not likely to know the numbers of the planning districts, they are familiar with the names associated with the districts. Neighborhoods also provide a social identity for the inhabitants. It is not unusual for a merchant to ask a customer what neighborhood he or she lives in before cashing a check.

Burglary Rates

I constructed burglary rates by dividing the number of burglaries reported in each district by the number of households in that district and multiplying the result by 1,000. This rate represents the number of burglaries per 1,000 households for the year. The Norfolk Police Department provided the number of reported burglaries in each neighborhood for 1987. Neighborhoods containing fewer than 50 households were excluded from the analysis because burglary rates in these neighborhoods are unstable.

The difficulties of using official crime records are well known and have been discussed at length elsewhere (see Gove, Hughes and Geerken 1985). The important caveat here concerns biases in recording burglaries across planning districts. If reporting errors are correlated with the variables used in the analysis here, the conclusions may be in error. Although there is no reason to suspect problems other than random error, we do not have a measure of the validity of the data; thus we must proceed with the caution that always should accompany the use of official crime records.

The count of households in each neighborhood was taken from the 1987 household count conducted by the Norfolk City Planning Department (City of Norfolk 1987). The mean burglary rate per 1,000 households is 41.65 (sd = 22.1) overall for the city. The rate ranges from a low of 5.67 to a high of 107.30 per 1,000 households. Measures of skewness (0.87) and kurtosis (0.32) suggested that the departure from normality might present problems in interpretation of the significance tests. Accordingly I transformed the burglary rates by taking the square root of the values, thus producing a distribution with skewness (.30) and kurtosis (−.43) closer to a normal distribution (Draper and Smith 1966; Kirk 1982). I used the transformed distribution throughout the analysis.[1]

Permeability

The number of access lanes leading from each artery into the neighborhood indicates permeability. This number provides a measure of the extent of opportunity for movement between the traffic arteries and neighborhoods. I counted all access lanes to all arteries; the number of lanes ranges from a low of zero to a high of 77, with a mean of 16.0 (se = 15.6).[2] Of course, the number of access lanes typically is larger where the arteries cross the middle of neighborhoods because arteries in the interiors of neighborhoods usually have connecting access lanes from both sides. Because there is considerable variation in the number of households across neighborhoods, I constructed permeability as a rate of the numbers of access lanes per 1,000 households. A rate provides a standard indication of the amount of risk to households.[3]

Control Variables

The amount of traffic flow through a neighborhood may be related to the demographic characteristics of the neighborhood; therefore the relationship between permeability and burglary may be spurious. For this reason I introduced demographic variables indicating instability, housing density, and the economic well-being of the neighborhood.

Several studies have shown a relationship between economic conditions and crime (e.g., Blau and Blau 1982; Bursik 1986; Byrne and Sampson 1986; Schuessler 1962; Shaw and McKay 1942). Because the physical features of neighborhoods and the relative location to high-traffic throughways may be correlated with economic level, it is important to control for the economic conditions in order to avoid confounding the analysis of physical permeability with that of economic status. I used percentage of households below poverty, and median value of owner-occupied housing as indicators of the economic well-being of the neighborhoods. Taylor and Covington (1988) determined that both of these indicators exhibited

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[1] Although the values of the coefficients and t statistics changed as a result of the transformation, substantive interpretations were not changed.

[2] I eliminated one neighborhood from the analysis at this point. It was adjacent to two of the largest shopping centers in Norfolk. The position is so unusual that the method of determining access could not be applied logically here.

[3] Arteries carrying fewer than 30,000 cars per day were the best predictors of burglary rates, accounting for 26 percent of the variation. Access to all arteries accounted for 22 percent of the variation in neighborhood burglary rates.

substantial loadings on a "low-status neighborhoods" factor in principal components analysis of Baltimore neighborhoods. The percentage below poverty was taken from *Current Demographic Profiles '84* (1985), an update of the 1980 census based on a household canvass of Norfolk neighborhoods completed in 1984. The mean percentage of households below poverty level in 1984 was 15.6 percent, ranging from a low of 2.0 percent to a high of 55.5 percent in the poorest neighborhood. Certainly, the assessment of the values of owner-occupied housing has increased since the 1980 census, but it is doubtful that the relative differences between neighborhoods have changed much across the city. In 1980 the median value of owner-occupied housing was $40,958 (U.S. Bureau of the Census 1980). The values in neighborhoods range from a low of $16,800 to a median of $97,500 in the most expensive neighborhoods.[4] The indicators of economic status, median value of owner-occupied houses, and the percentage of household below the poverty level are correlated at a relatively high level ($r = -.56$). Thus I combined them into a single index of neighborhood economic status, using principal-component factor analysis.[5] Higher scores on the economic factor represent higher economic levels. This strategy serves to reduce the number of variables in the analysis and to reduce problems of collinearity.

It is likely that neighborhood instability is related to burglary rates. Neighborhoods with high mobility and high proportions of renters are likely to be characterized by diminished guardianship by surveillance (Cohen and Felson 1979). Residents of these areas are less familiar with neighbors and their habits and thus are less likely to determine the presence of strangers than are people who live in more stable neighborhoods. In addition, moving household belongings perhaps is more typical in an area with a large percentage of renters.

I selected two indicators of neighborhood instability: percentage of households that are rented rather than owned and proportion of vacant households (*Current Demographic Profiles '84* 1985). The proportion renting varied from a low of 9 percent to a high of 98 percent across Norfolk neighborhoods. The proportion of vacant households ranged from less than 1 percent to 20 percent. The correlation between these two indicators is relatively high ($r = .66$); therefore I constructed a single index of instability by

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[4] Two planning districts had too few owner-occupied households to provide a reliable median value. In these two cases the value assigned was the average of the median values of all the immediately adjacent neighborhoods.

[5] The final communality estimates were 0.779 for both the median value of owner-occupied houses and the percentage of households below poverty level.

using principal-component factor analysis.[6]

The relationship between housing density and crime is not clear. Gillis (1974) found that structural density (the proportion of multiple dwellings) was the best predictor of juvenile delinquency. More recently, Sampson (1983) showed that structural density was correlated positively with rates of assaults and robberies. Schichor, Decker, and O'Brian (1980) found that density was related positively to property crimes but negatively to assaultive offenses. I used percentage of households contained in structures of five or more dwelling units as an indication of density of housing (see Sampson 1983). This value is an indication of structural density of the neighborhood provided by the Norfolk City Planning Department (City of Norfolk 1987). Not only has structural density been found to be correlated with property crime; it also may well be correlated with the number of access lanes in a neighborhood. If the population in a neighborhood is structurally dense, more access lanes may be present to handle a large population. Thus it is important to attempt to separate the effects of structural density from those of permeability by controlling for density. The percentage of five-household dwelling units ranged from a low of zero in some neighborhoods to a high of 98 percent in the high-density districts.

It is not surprising that the percentage of structures with five or more households is correlated with renting ($r = .70$) and with vacancy ($r = .35$) and thus with the instability factor ($r = .58$). Clearly, the measure of structural density also indicates instability. In attempt to prevent the density variable from overlapping with instability, I used the residual of "the percentage of dwelling structures with five or more households" as the indicator of density after it was regressed on the instability factor. Again, this step reduced problems that may be associated with collinearity.

RESULTS

I regressed neighborhood burglary rates (square root transformed) on the measure of permeability (the number of access lanes to traffic arteries) and on each of the demographic variables. Altogether these variables account for 34 percent of the variation in burglary rates ($F = 11.40$). I examined the outcome distribution for disproportionate influences of outlier neighborhoods. Dffits scores devised by Belsley, Kuh, and Welsch (1980) provide a measure of the amount of influence exerted by each observation on

[6] The communality estimates are 0.83 both for proportion of renters and for proportion of vacant households.

the regression analysis by comparing the predicted values before and after each observation is removed. Larger dffits values indicate larger influences on the analysis. Following Cook and Weisberg (1982) and Bursik (1986), I considered as problematic neighborhoods with dffits scores greater than the absolute value of 1. Two neighborhoods exceeded this criterion (dffits = 1.83, −1.41).[7] I ran the analysis again after omitting these outliers. The results are presented in Table 1.

Permeability is a significant influence on neighborhood burglary rates when neighborhood economic factors, instability, and structural density are controlled. All independent variables influence burglary rates significantly. Burglary rates are higher in neighborhoods at lower economic levels, with lower density, that are more stable, and that are more permeable. Examination of the standardized coefficients (Bs) shows that the permeability of the neighborhood has an effect equivalent to that of the demographic variables (B = 0.31).

Table 1. Neighborhood Demographics and Burglary Rates (Square Root Transformed)

Variables	Beta	b	t	Sig. T	Adj-R^2	F	Sig. F
Model:					0.41	14.6	0.0001
Permeability	0.31	0.03	3.19	0.002			
Economic	−0.29	−0.50	−3.22	0.002			
Density	−0.16	−0.01	−1.69	0.095			
Instability	0.27	0.45	3.01	0.004			
The Effects of Adjacent Neighborhoods							
Model:					0.42	10.6	0.0001
Permeability	0.26	0.03	2.70	0.009			
Economic	−0.22	−0.37	−2.23	0.029			
Density	−0.15	−0.01	−1.53	ns			
Instability	0.32	0.54	3.37	0.001			
Burglary	0.24	0.03	1.90	0.062			
Permability	−0.12	−0.01	−0.98	ns			

Effects of Adjacent Neighborhoods

It is important to control for the effects of spatial auto-correlation (Cliff and Ord 1973; Odland 1988). The burglary rates in a neighborhood may be due to the spread of problems from adjacent

7 The first outlier neighborhood is a small area containing fewer than 200 households within an industrial park. It is in no respect a typical residential neighborhood. The second is also a small and atypical neighborhood, mixed with an expanding commercial shopping area which has changed considerably in the last three years.

neighborhoods. Thus the effects attributed to permeability may be contaminated by the diffusion of burglaries because some of the adjacent neighborhoods share the same traffic arteries. For this reason I controlled for spatial diffusion, by constructing controls both for burglary rates and for permeability of adjacent neighborhoods. I computed mean burglary rates for all planning districts adjacent to each neighborhood (Taylor and Covington 1988). In addition, I constructed mean permeability scores for adjacent neighborhoods and entered both indicators of adjacent spatial effects into the regression equation as control variables. I used ordinary least squares to estimate the parameters.

The burglary rates of adjacent neighborhoods influence neighborhood burglary rates ($p < .01$)., but the permeability of adjacent neighborhoods does not. Permeability of the neighborhood continues to exert a significant effect on burglary rates in neighborhoods when these effects of adjacent neighborhoods are controlled. The demographic variables, economic status, and instability retain a significant influence on burglary rates after adjacent effects are included. Structural density, however, the weakest influence, does not do so. Perhaps neighborhoods with high structural density are attractive targets for burglars who are active in adjoining neighborhoods. The inclusion of adjacent effects produces only a slight increase in the explained variance. The results are included in Table 1.[8]

DISCUSSION

It appears that variation in permeability across neighborhoods is a significant in accounting for variation in neighborhood burglary rates. The analysis suggests that it is as important as variation in economic conditions, neighborhood instability, and housing density in determining these rates, and it remains significant when the characteristics of adjacent neighborhoods are controlled. The degree to which residential areas are accessible to automobile traffic may create the appearance of openness and vulnerability which makes them attractive to potential burglars. Location near a major traffic artery may lead to initial familiarity; then the discovery of convenient, efficient escape routes provides obvious attractions to offenders.

Although the physical texture of the neighborhood affects the burglary rate, permeability does not interact with the demographic variables to influence burglaries. Inclusion of interaction terms

[8] I examined interaction terms for permeability with each of the demographic variables. None was significant at $p < 0.10$. The addition of the interaction terms resulted in an increase of less than 1 percent of explained variance.

for permeability with all the remaining variables yielded no statistically significant results, nor did the interaction model increase significantly the amount of explained variance. Thus permeability appears to have a uniform effect across all neighborhoods.

Perhaps future research can explore additional features of neighborhoods, such as proximity to shopping areas, convenience stores, and bars, which may be related to crime in surrounding areas. In view of the indication of the effects of adjacent burglary rates discussed here, further exploration of the means by which burglaries spread from adjacent neighborhoods could provide help to illuminate how the physical environment interacts with the social characteristics of neighborhoods to encourage or impede criminal activities.

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Physical Environment and Crime

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EXCERPT:

The internal layouts, boundary characteristics, and traffic patterns of neighborhoods may encourage or discourage different types of crime. By implication, changes in land uses, boundaries, and traffic patterns may result in higher or lower crime rates because they affect both potential offenders and users. They may alter exposure to potential offenders because they more or less integrate the locale into the offenders' orbits of activity (Rengert and Wasilchick, 1985).

Neighborhood level. At the neighborhood level, planners classify the relevant features into movement generators, such as high-volume streets, and attractors and nonresidential land uses, such as shopping, that will draw outsiders. Movement generators result in more people moving through a residential locale; attractors and nonresidential land uses generate more people traveling to a residential locale.

…residents living on blocks with
higher levels of nonresidential land use are more

concerned for their personal safety and less likely to intervene if they see something suspicious; they experience higher victimization rates and call the police more often. These links have been supported by evidence from numerous studies conducted in different cities around the country (Kurtz, Koons, and Taylor, 1995; McPherson, Silloway, and Frey, 1983; Perkins, Florin, Rich, Wandersman, and Chavis, 1990; Roncek and Bell, 1981; Roncek and Faggiani, 1985; Taylor, Kurtz, and Koons, 1994).

"FEARRINGTON PLACE"

Businesses already in the area. The "Fearrington Place" proposed project is **NOT** necessary in area where Conditional Use permit is being applied for, in a residential subdivision.

CHATTHAM DOWNS- located at 15/501 and Lystra Rd. Distance 2.3 miles north
-Grocery Store –Harris Teeter
-Ace Hardware Store
-Curves Fitness Center
-Nail and Spa Center

GAS STATIONS/CONVENIENCE MART (5) - all within 6.3 miles of Fearrington Village/ Morris Road
-Exxon- ¼ mile
- Cole Park Plaza – BP, Citgo, Texaco,-3.5 miles
- (Texaco-Cole Park Plaza) to be enlarged to 12 bays plus Automated Car Wash
-Smith Level Road- Phillips 66 – 4.7 miles
-15/501S and 64 East – Citgo 6.3 miles

GROCERY STORES
-Harris Teeter- 2.3 miles
-Lowe's Foods 3.5 miles
-Weaver Street Market-Southern Village 6.3 miles
-Chatham Mills Marketplace 7+ miles south

RESTAURANTS/ FAST FOODS
Allen & Sons 2.5 miles
Captain Johns 3.5 miles
Mexican Food 3.5 miles
Pizza (3) 3.5 miles
Michael's 3.5 miles
Chinese Food 3.5 miles
Subway 3.5 miles
NEW Burger King to be built at Cole Park
Town Hall Grill Southern Village- 6.3 miles
Merlion Restaurant-Southern Village 6.3 miles
Pazzo Southern Village 6.3 miles
Café Southern Village 6.3 miles
Pizzeria-Southern Village 6.3 miles
Ice Cream Store

BANKS
-Bank of America 3.5 miles
-Wachovia 3.5 miles
-State Employees Credit Union 3.8 miles
-Harrington Bank 6.3 miles

SERVICE SHOPS- All within 6.3 miles
-Chapel Hill Tire Company
-Auto repair Shops (3)
-Nail Salon and Day Spa (3)
-Pac-Mail Services (2)
-Dry Cleaners (2)
-Video Store
-Electronics Store
-Hair Salon
Lighting Store
Thrift Store- 2
Pet shop
Veterinary Clinic
Fitness Centers- 2, Curves, Millennium 3.5 miles
U.S. Post Office
ABC Liquor Store
Carpet & Flooring Store
Floral Expressions
Garden Shop/Landscape Centers (4)
Bookstores (3) –including Fearrington Bookstore
Craft Shops (3)
Financial Services ad Insurance
Cinemas

Medical Facilities- Clinics or Medical Practices

Cole Park (2) UNC and Chiropractic
Southern Village (3) Pediatrics, Children's clinic, Family Clinic
Nutrition Store-Cole Park Plaza
Dentist Offices (2) Cole Park and Southern Village