WHERE OFFENDERS CHOOSE TO ATTACK: A DISCRETE CHOICE MODEL OF ROBBERIES IN CHICAGO*

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Why do robbers choose a particular area to commit an offense? Do they rob close to home? Do they search for areas with suitable and attractive targets? What keeps them away from certain areas? To answer these questions, a model is developed of how robbers choose target areas. The model draws on various theoretical and empirical traditions, which include environmental criminology, journey to crime research, gang research, and social disorganization theory. Testing the model on cleared robbery cases in Chicago in the years 1996–1998, we demonstrate that robbery location choice is related to characteristics of target areas, to areas where offenders live, to joint characteristics of the resident and target areas, and to characteristics of the offenders themselves. The presence of illegal markets and other crime generators and crime attractors make areas attractive for robbers, whereas collective efficacy seems to keep them out. Distance as well as racial and ethnic segregation restrict the mobility of offenders.

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Criminologists have long been interested in the discovery and explanation of spatial patterns of crime and delinquency. Two types of questions have been posed. First, where do offenders live, and what are the characteristics of those communities? A classic example is Shaw and McKay's (1942) work on juvenile delinquency. Second, where do they offend and what are the characteristics of places or communities that attract crime? A classic example is Boggs' (1965) analysis of crime patterns in St. Louis.

These two different sets of questions require different answers. Factors that facilitate the development of criminal motivation are likely to differ from those that create opportunities for crime or facilitate its commission. In particular, the tendency for crime to take place relatively close to where the person committing it lives (indeed sometimes at home) has led many researchers to confuse the origins and the destinations of criminal events.

In the current article, we are interested in the second type of question: What characteristics make a certain area an attractive hunting ground for offenders? To minimize the risk of mixing up motivation and opportunity, where offenders live is not a part of the question that we put forward, it is part of the answer we propose. Thus, given the location of an offender's home in the urban landscape, why does he or she choose a particular area to commit an offense? Why not another? Which criteria play a role? Are offenders directed by proximity and accessibility to their homes? To what extent are they pulled to target areas by the availability of suitable and attractive targets? What keeps them away from certain areas?

To answer these questions, we bring together several theoretical and empirical traditions into a recently developed model of spatial choice. The model is estimated using a unique set of data on cleared robbery cases in Chicago and the offenders involved in them, on the communities where the offenders reside, and on those where they attack their victims.

We introduce two major advances over prior work in this field of study. The first is that we apply a new model of criminal location choice (Bernasco and Nieuwbeerta, 2005) to explore which criteria Chicago robbers use to select target areas, including the distance from their home and the presence of crime generators and attractors (Brantingham and Brantingham, 1995). The second is that we develop a new way to measure qualitative dissimilarity between communities, which helps us to examine how racial and ethnic segregation affects the spatial target choices of Chicago robbers.

THEORETICAL ACCOUNT AND PREVIOUS EMPIRICAL FINDINGS

Our empirical investigation of robbery location choice in Chicago builds on theoretical approaches and empirical studies that deal with the selection of attractive targets, the length of the journey to crime, the effects of racial and ethnic barriers to urban travel, the spatial aspects of gang territoriality, and the collective efficacy of residential communities. We unify these diverse topics in a single framework and derive a set of testable hypotheses.

FORAGING ROBBERS

The approach we take assumes that committing robberies is purposeful behavior and that the choice of locations and victims is not random but is guided by some form of rationality. The offender is viewed as a purposeful forager. Accordingly, street and commercial robbers' attempt to satisfy their needs by forcefully and illegitimately stealing from others, and in doing so make choices that involve estimates of effort, risk, and profit, as well as knowledge of their own territory and possibly of some other parts of the wider urban landscape (Brantingham and Brantingham, 1993; Carter and Hill, 1979). By describing offenders as foragers, we emphasize that there is purpose and logic in the way they search and choose their target areas and their specific targets, but we recognize that emotions, possibly strengthened by an urgent need for drugs or money, may lead to choices that seem irrational, risky, impulsive, and erratic (de Haan and Vos, 2003; Deakin et al., 2007; Wright, Brookman, and Bennett, 2006; Wright and Decker, 1997).

Felson's (2006) application of foraging principles to crime views robbers as predators who search for patches, preferably close to their nest, where nutritious prey are abundant, cannot flee, and are less vigilant. Optimal foraging theory is a theory from behavioral ecology that explains why animals forage as they do. It bears similarities to rational choice theory. The application to criminal target choices asserts that robbers are likely to select targets that are *vulnerable*, *accessible,* and *profitable*, and that they will focus on places where such targets are available.

The assumption of rational elements in the decision making of robbers, in particular of street robbers, is not undisputed. Wright and Decker (1997) underscore rationality, or "bounded rationality," as do Shover and Honaker (1992) and Deakin et al. (2007). But others (de Haan and Vos, 2003; Wright, Brookman, and Bennett, 2006) suggest that the act of robbery itself rarely involves contemplation, and it often serves completely different purposes than material gain. Some stress that robbery and other violent street crime is often intended to gain respect and is sometimes not

instrumental for obtaining anything other than the pleasure or "kick" it provides in itself (Katz, 1988; Schinkel, 2004; Topalli, 2006).

The view of the robbery offender as a purposeful forager also suggests a definitely different emphasis from *routine activities theory* (Cohen and Felson, 1979; Cohen, Kluegel, and Land, 1981). According to routine activity theory, predatory crime is the result of the convergence in time and space of motivated offenders with suitable and unguarded targets. It asserts that the conditions for such convergences are shaped by everyday activities and that crime thus results from "systematic coincidence." Although some robberies may result from an offender coincidentally or unexpectedly hitting on a suitable and vulnerable victim, ethnographic accounts of how offenders prepare themselves mentally for an attack paint a mixed picture of the process (again, see Wright and Decker, 1997). This picture involves offenders who often actively search for optimal locations and victims, and who also occasionally happen to come across an opportunity that they cannot resist.

In sum, our model of robbery locations is a model of criminal choice. Any model of criminal choice should address at least two issues. It should define the set of relevant alternatives that offenders can choose from, and it must specify the various decision criteria that offenders use when selecting a target. After discussing the set of spatial alternatives that robbers choose from, the subsequent sections deal with the criteria that robbers use when choosing an alternative.

SELECTING PLACES AND SELECTING VICTIMS

Various scholars (e.g., Brantingham and Brantingham, 1978; Brown and Altman, 1981; Cornish and Clarke, 1996) argue that criminal target choice is a spatially structured, multistaged, and hierarchical decision process. A distinction is made between the choice of a target area and the choice of a specific target—a person or an object. When searching for a target, the robber first selects a suitable area and subsequently in the chosen area selects a suitable target. In terms of foraging, offenders must find a good hunting ground before starting to chase prey. What makes a good patch for hunting prey includes, but is not restricted to, the type of prey available in the patch. For example, high-school pupils might make good targets for robbers, but high schools themselves may not be good places to rob them because of the surveillance levels (Roncek and Faggiani, 1985; Roncek and LoBosco, 1983). Shoppers may make perfect victims, but the mall may not be the best place to rob them because of the difficulty in escaping the place quickly.

Because of this logical distinction between criteria that make places good patches on the one hand, and criteria that make victims good prey on

the other, we will first discuss general aspects of target areas that make them attractive for robbery, for example in terms of distance from the offender's home and similarity to the offender's own residential area. Subsequently, we will discuss where attractive robbery targets can be found, and whether collective efficacy might keep offenders out of an area. Finally, we argue that the decision of where to rob depends on the age as well as on the racial or ethnic background of the offender himself or herself. The section ends with a list of 11 empirically testable hypotheses.

DISTANCE

Some animals are central-place foragers: They take prey to their nest before it is eaten. Birds who feed their young are a good example. When central-place foragers search for prey, they display a strong preference for patches near their nest (Orians and Pearson, 1979). Thus, when choosing among alternative patches, nearby ones are preferred.

With the possible exception of the homeless, and of those who alternate between anchor points (e.g., parents' home, friend's home, or hotel), most individuals have a single home: the place where they return at the end of the day. Journey to crime research explores the distance between where offenders live and where they commit their offenses.

In accordance with the principle of least effort (Zipf, 1949), many studies confirm that the frequency of offenses decreases with the distance from the offender's home (Wiles and Costello, 2000). It also has been established that differences are observed in the average distance of the journey to crime between offense types (Baldwin and Bottoms, 1976; Hesseling, 1992; Rhodes and Conly, 1981), and between offenders (Block, Galary, and Brice, 2007; Canter and Larkin, 1993).

The generally limited action radius of offenders suggests the choice of a robbery location is governed by the attempt to minimize effort. Alternatively, it has also been suggested that criminal location choice is limited in the first instance to the awareness space of offenders, which includes the area around their homes and other places they have explored and learned to know through their daily routines (Brantingham and Brantingham, 1993). Although awareness space may imply a limitation of potential areas for committing offenses, Deakin et al. (2007) emphasize that offenders tend to become familiar with previously unknown places quickly. Thus, they suggest that unfamiliarity could be a very transient disadvantage that is easily solved as new areas are explored, partially through co-offending with others who have a different awareness space.

The short distances between the homes of offenders and crime targets could be related to the fact that many of them lack access to a car. Without

access to a car, venturing into distant areas may be costly and time consuming, and it may hinder quick escape and thus increase the risk of apprehension.

The tendency of robbers to commit their offenses within the boundaries of small spatial areas is confirmed by several ethnographic studies (Deakin et al., 2007; Feeney, 1986; Wright, Brookman, and Bennett, 2006; Wright and Decker, 1997). But they also acknowledge that some robbers tend to travel further away to destination areas where they expect "good" targets.

To understand why an offender chooses this particular location rather than other possible locations, the distance to the chosen location should be compared with the distances to alternative locations. In addition, the chosen location should be compared with other possible locations in terms of attributes, such as the availability of suitable targets and the presence of surveillance by capable guardians. In other words, in a model of location choice, distance should be treated not as the outcome of choice (i.e., a dependent variable) but as an independent variable besides other choice criteria. For example, the observation that the proceeds of robberies tend to be related to the distance traveled to them (Capone and Nichols, 1975; Pettiway, 1982; Tita and Griffiths, 2005; van Koppen and Jansen, 1998) suggests a tradeoff between the distance to be traveled to the target, on the one hand, and the value of the proceeds, on the other. Similar findings with respect to burglary have been reported by Snook (2004). The remainder of this literature review discusses other criteria that have been found to affect the outcomes of robbery location choices.

RACIAL AND ETHNIC BARRIERS

The existence of racial and ethnic dissimilarities between the places where offenders live and the places where they might commit crimes is likely to represent another criterion that influences the spatial decision making of robbers.

Like most other U.S. cities, Chicago is spatially segregated along racial and ethnic lines. Chicago has been among the four most racially segregated cities of the United States since 1980 (Logan, Stults, and Farley, 2004; Massey and Denton, 1993). Most of its citizens live in communities characterized by a nearly homogeneous racial or ethnic composition. This is particularly true for African Americans, who live isolated from other racial and ethnic groups. Most African Americans live in communities with a population that is over 75 percent African American (Kaufman, 1998). Racial and ethnic segregation applies to a somewhat lesser degree to the other two largest racial and ethnic categories, Hispanics and non-Hispanic whites. Most non-Hispanic whites live in communities that are mostly non-Hispanic white, and many residents of Hispanic origin live in

mostly Hispanic communities. Both groups, however, also live in racially and ethnically mixed communities that also include other minority racial or ethnic categories. These well-documented features of U.S. cities, including Chicago (e.g., Johnston, Poulson, and Forrest, 2003; Massey, 1990; Wilson, 1987), are likely to restrain the mobility of its population, including offenders, and can be considered as a "social barrier" (Rengert, 2004).

Pettiway (1982, 1985) studied the mobility of burglars and robbers in Milwaukee and distinguished three types of areas on the basis of the racial composition of the population: the black ghetto area, the white non-ghetto area, and an interstitial area around the ghetto (where the composition was more racially mixed). He observed that those who lived in the black ghetto would overwhelmingly offend there, whereas those who did not offended outside the ghetto.

There may be a cognitive aspect to the tendency to stay away from areas that are racially different. Like most people, offenders tend to stay within the boundaries of places that are part of their awareness space. Carter and Hill (1979) showed that the mental images that juvenile offenders have of their city are not only incomplete but also strongly influenced by their racial background. These limitations to the awareness space are amplified in the case of offending. For individuals who participate in legal activities, moving into unknown terrain may be an unpleasant experience, but for individuals who plan illegal activities, it may be outright dangerous. Strangers "stand out" more easily in unknown territory, that is, in places where they do not know the customs and rules of the street and possibly dress and behave in ways that attract the attention of the local residents. This concept is most obvious in the case of race and ethnicity. In segregated cities, those who cross racial or ethnic boundaries cannot blend in easily and are likely to be recognized as strangers in the community and be subjected to the "social eyes" of the local population. For this reason, street robbers may avoid neighborhoods that have a different racial/ethnic composition than their own neighborhoods. As one of the armed robbers interviewed by Wright and Decker (1997: 75) notes,

> [I]can go in a black neighborhood, [an] all-black neighborhood, and I don't stand out, as opposed to me going out there to [a shopping center in the county] where I might stand out.

Although the existence of a racial and ethnic barrier between two areas is related to their distance, the two are not the same. On the one hand, an offender who resides in an African-American community could travel many miles to commit a robbery without crossing a racial or ethnic barrier, and the same is true for Hispanic and non-Hispanic white offenders. On the other hand, the racial or ethnic composition of the population can change within two blocks; in which case, a short distance includes a racial

or ethnic barrier. Historically these barriers were very well protected in Chicago (sometimes violently), as is portrayed in Lorraine Hansberry's semiautobiographical play "A Raisin in the Sun." In a European context, where the spatial segregation of ethnic categories tends to be less pronounced, Reynald et al. (2008) empirically show that in addition to distance, differences in social and ethnic composition between communities function as barriers for crime trips, as they restrict the movements of offenders.

GANG TERRITORIAL BARRIERS

Another criterion for choosing a location for robbery could be related to the geographic distribution of gang turf. What is true for all citizens regarding the boundaries between racially and ethnically segregated neighborhoods holds true in a much more violent way for the boundaries between gang turfs for those who are gang members. Ever since the first studies on gangs (Thrasher, 1927; Whyte, 1937), gangs have been known to claim and control their own territories (gang turf) and violently defend it against rival gangs. Indeed, maintaining territorial control has been viewed as part of the definition of a gang (Bursik and Grasmick, 1993).

Gang territorial barriers are likely to be effective only for offenders who are gang members. Because according to victim assessments, only 10 to 45 percent of the robberies nationwide are committed by robbers who are gang members (Harrell, 2005), gang territorial barriers should be expected to affect the destination choice of only a small proportion of robbery trips, and the effect might be small and wiped out by factors that affect all robbers. Furthermore, reviewing various ethnographic studies, Tita and Ridgeway (2007) suggest that some gangs may provide protection to the residents of the communities that they control, and thus, they deter all motivated robbers, not only those who are members of rival gangs. Thus, the expectation that gang territorial dissimilarities between communities function as a barrier to the mobility of robbers is interesting but should be framed tentatively.

CRIME ATTRACTORS: ILLEGAL MARKETS, SCHOOLS, AND RETAIL BUSINESSES

According to the adage of routine activities theory, criminal acts require that motivated offenders converge in space and time with potential targets. Thus, when robbers choose a place to rob, they choose one where they can expect potential victims: Without targets, there are no opportunities. Thus, areas with large residential or transient populations may be attractive for robberies.

The choice of an area for robbery is likely to depend not only on the number of potential targets, but also on the availability of "good" or "suitable" targets. Who are good robbery targets? In terms of revenues, the best targets for robbery possess items that are concealable, removable, available, valuable, enjoyable, and disposable (CRAVED) (Clarke, 1999; Felson, 2006: 127; Wellsmith and Burrell, 2005). Cash is the best example of such an item. Thus, victims and commercial premises that carry large amounts of cash are attractive targets, and places where such targets are abundant are likely to be attractive places for robbery. The visual signs of affluence alone do not make a person or establishment an attractive target for robbery. Well-dressed businessmen in suits may just carry credits cards and checks that are not as tangible and useful as cash (Wright and Decker, 1997). Robbery is more common in deprived areas, which are often cash economies, than in wealthier neighborhoods. However, visible affluence may attract robbers if the signs of wealth are themselves valuable to the prospective offender, as could be the case for cell phones, jewelry, laptops, iPods, and other electronic gadgets.

Following the same line of reasoning, the proximity of check-cashing outlets, automatic teller machines (Holt and Spencer, 2005), pawn shops, and other cash-intensive places such as bars and taverns (Roncek and Maier, 1991) makes the surrounding area good hunting grounds for robbers. In an ethnographic study of a Chicago police beat, St. Jean (2007: 149–65) found that robbers were attracted primarily to locations with these types of businesses, which function as an "ecological disadvantage" to the surrounding area. The robbers interviewed by Wright and Decker (1997: 76–8) provide many examples of how they are attracted to places where cash flows. They found that 60 percent of the armed street robbers they interviewed "said that they preyed on individuals who themselves where involved in lawbreaking" (1997: 62). For a variety of reasons, most robbers preyed on drug dealers or their customers because both dealers and customers are likely to carry either drugs or money, and both items are valuable. Furthermore, in many cases, the reason for the robbery is that the offender is craving drugs. In these instances, CRAVED takes on a very literal meaning as the offender actually prefers drugs over money because they are immediately enjoyable. Individuals involved in other "vices," such as prostitutes and their customers, and people involved in illegal gambling are also likely to be preferred robbery targets because they tend to carry cash.

Another reason that those involved in lawbreaking tend to be attractive robbery targets is their disinclination to report to the police, because their victimization story itself would be evidence of their own involvement in lawbreaking. Thus, from the offender's perspective, individuals involved in illegal activities are excellent robbery victims because they are likely to

carry cash or drugs and are unlikely to report to the police, even though they may be more dangerous (e.g., likely to carry weapons) than law-abiding victims.

Robberies sometimes take place in the illegal context of transactions in illegal markets. If a conflict develops and a dealer, a prostitute, or a customer resorts to violence, then the victim typically will not report to the police but more likely will retaliate on a future occasion (St. Jean, 2007: 160; Topalli, Wright, and Fornango, 2002). Unfortunately, the current study uses police records and, thus, excludes unreported robberies; therefore, it may underestimate the attraction value of illegal markets for robbers.

Robbers interviewed in a study in Manchester, England, by Deakin et al. (2007), mentioned "students" as good targets because they were recognized as not being streetwise, which is indicated by their visibly carrying iPods and other valuables and by not being vigilant in places they should be. The authors suggest that the offenders refer to the vulnerability of college and university freshmen with a rural background who have recently arrived in the city. Students as potential victims are not specifically mentioned in the American ethnographic literature, but crime levels have shown to be elevated in the proximity of high schools (Roncek and Faggiani, 1985; Roncek and LoBosco, 1983) and colleges (Block and Block, 1999), which indicates that pupils may be involved both as victims and as offenders in various types of lawbreaking.

COLLECTIVE EFFICACY

In one of the classic works in criminology, Shaw and McKay (1942) investigated the spatial distribution of the homes of juvenile delinquents across Chicago and other U.S. cities. They and many others after them found that delinquency is related to various structural characteristics of a community's population. Delinquency was common in poor and racially mixed communities that were characterized by high levels of population turnover and social disorganization.

Social disorganization theory explains how these structural community characteristics foster delinquency and crime (Bursik and Grasmick, 1993; Kornhauser, 1978). This perspective presumes that poverty, cultural differences between community residents, and high residential turnover rates make it difficult for community residents to build up a socially well-organized community. Social disorganization undermines the creation and maintenance of enduring relations, actively shared norms, and the willingness to live up to them; thus, delinquent activities are more likely to occur.

Since Shaw and McKay (1942), the relation between social disorganization and crime has been reshaped in the literature. Shaw and McKay studied where juvenile delinquents lived, not where they committed their crimes. However, the core elements of social disorganization theory apply as well to lawbreaking by local youth as to lawbreaking by outsiders in the local community.

Most studies on social disorganization and crime have assumed that social cohesion and informal social control in communities are the mediating factors that link deprivation, residential instability, and ethnic heterogeneity, with delinquency and crime. Sampson and his colleagues (Sampson, Raudenbush, and Earls, 1997) have attempted to measure these intermediating social processes. They replaced the concept of social organization with "collective efficacy," which is defined as "social cohesion among neighbors combined with their willingness to intervene on behalf of the common good" (Sampson, Raudenbush, and Earls, 1997: 918). Collective efficacy subsumes processes by which residents themselves actively safeguard their own neighborhood. For example, citizens secure external sources of crime control (Velez, 2001), report suspicious behavior to the police, or intervene directly against certain emerging forms of delinquency themselves (Warner, 2007). The claim that collective efficacy helps to discourage offenders is supported by quantitative research (Sampson, Raudenbush, and Earls, 1997) as well as by ethnographic studies among active offenders. For example, a street robber interviewed by Wright and Decker (1997: 75), who reflected on differences between the city and the surrounding county, made the following assertion:

> People in the city . . . are not too apt to call the police too often, and then a lot of them don't seem too concerned about what they see. They be like "It ain't my business and don't make it yours cause you might get caught up in it." In the county [though], it's all totally different.

Thus, collective efficacy in a community discourages not only delinquent behavior by the residents themselves but also all potential offenders from committing offenses within the boundaries of the community. Although collective efficacy is clearly not as observable as the racial and ethnic composition of a community or the presence of drug dealing and prostitutes that advertise their services, potential offenders may use signals of physical and social deterioration and neglect ("broken windows") to estimate how likely it is that bystanders will interfere in robberies or other offenses (for a critical discussion of the offender's point of view on "broken windows" and collective efficacy, see St. Jean, 2007). In short, we expect potential robbers to avoid patches characterized by high levels of collective efficacy.

AGE AND RACIAL OR ETHNIC BACKGROUND OF INDIVIDUAL ROBBERS

On the basis of theoretical arguments and according to the literature on target choice in robbery, we should expect various systematic differences in target area choice among categories of robbers, in particular between juveniles and adults, and among robbers of various racial and ethnic backgrounds.

Because adults generally have better access to automobiles and other motorized vehicles than juveniles, distance is likely to impede the mobility of juveniles more than the mobility of adults. Consequently, and reflecting a more general pattern in mobility, when youth commit crimes, they will generally commit them closer to home than adults do.

Above, we argued that patterns of ethnic spatial segregation may generate "social barriers" that restrict movement between communities. Although this hypothesis is interesting in its own right, it can be refined at a disaggregated level, by exploring whether the racial and ethnic origin of offenders themselves (rather than the ethnic and racial composition of the community where they live) has an independent effect on the type of community where they commit offenses. An African-American offender who lives in an ethnically mixed community, for example, may be only weakly discouraged by barriers between his own community and black-majority communities but strongly discouraged by barriers between his own community and white or Hispanic communities.

The same reasoning applies to gang membership, and we should expect gang members to be influenced more strongly by gang turf boundaries than non-gang members. Unfortunately, a robber's gang membership is not available in our data.

HYPOTHESES

Having reviewed the varied literature that informs our analysis of the criteria that robbers use in deciding on a robbery location, we now explicitly enumerate the hypotheses that we derived from the literature. All hypotheses deal with the likelihood of a certain area being selected for a robbery by an offender who lives in a given area and who is motivated to rob.

1. The closer a potential target area is situated to the home of the offender, the more likely is the offender to select it for robbery.
2. The larger the number of potential victims in the area, the more likely the offender is to select it for robbery.
3. The more similar the racial and ethnic composition of a potential area is to the racial and ethnic composition of the area where the

offender lives, the more likely is the offender to select it for robbery.

4. The more similar a potential area is to the area where the offender lives, in terms of the gangs that control the area, the more likely is the offender to select the area.
5. The more intensive a potential area's drug market is, the more likely is an offender to select it for robbery.
6. The more intensive a potential area's prostitution market is, the more likely is an offender to select it for robbery.
7. The more high-school pupils frequent a potential area to attend school, the more likely is an offender to select it for robbery.
8. The more retail activities a potential area hosts, the more likely is an offender to select the area for robbery.
9. The higher the level of collective efficacy in a potential area, the less likely is an offender to choose it for robbery.
10. Relative to adults, proximity is more important to juvenile robbers. Therefore, the positive effect of proximity on target choice is stronger for juveniles than for adults.
11. Offenders prefer to rob in areas where people of their own racial or ethnic background are majorities. Thus, independently of where they live themselves, African-American offenders prefer to rob in African-American majority areas, non-Hispanic white robbers prefer to rob in white-majority areas, and Hispanic offenders prefer to rob in Hispanic-majority areas.

DATA AND METHODS

UNITS OF ANALYSIS

In the spatial choice model, the spatial unit of analysis applies to the definition of what it is that offenders choose when they decide where to offend. In line with many other studies of spatial choice (Block and Block, 1995; Boggs, 1965; Velez, 2001), we use the census tract as our unit of analysis of location choice. Although smaller units of analysis minimize within-unit heterogeneity, the census tract was chosen as the spatial unit of analysis because it was the lowest level of aggregation for which the "collective efficacy" measure was available and because computationally the use of the resource-intensive discrete choice model with smaller spatial units of analysis would have required a drastic reduction in sample size.

Furthermore, our reading of the empirical literature that addresses the modifiable area unit problem in the context of crime (e.g., Hipp, 2007; Wooldredge, 2002) is that effects tend to be fairly robust across geographic levels of aggregation.

Finally, there is also an empirical aspect to the question of the appropriate unit of analysis. No less than 73 percent of the Chicago robberies were committed *outside* the census tract in which the offender lived.

In addition to destination census tracts, we distinguish measures of tract attractiveness for robbery that are conditional on where the offender lives. These measures apply to tract dyads and relate characteristics of the tract where the offender lives to characteristics of all potential destination tracts (which are all tracts, including the tracts where the offender lives). Consequently, they vary across origin tracts as well as across destination tracts. A natural example is the distance matrix of all tracts in the city. As the analysis uses 844 census tracts, it involves 356,168 ($844^2/2$) tract-to-tract distances. We use a measure of racial and ethnic dissimilarity and a measure of gang territorial dissimilarity of census tract dyads, and both metrics obviously involve 356,168 tract-to-tract values.

Finally, as it was postulated that the choice outcome may not only depend on the tract where the offender lives but also on individual characteristics (age and racial or ethnic background), the third measurement level is the individual offender.

CENSUS TRACT MEASURES

Data on the *population size* and the *racial and ethnic composition* of the 865 census tracts in the city of Chicago in 2000 were taken from the public files of the U.S. Census Bureau.[1] The 2000 census tract data were chosen because this census was closest in time to the period (1996–1998) over which the robbery data were available. Tracts with a population below 100 were not used in the analysis, which applies to 21 tracts (2.4 percent); the other 844 census tracts are considered in the analysis. As a consequence of the exclusion of the 21 tracts, 105 robberies (.58 percent) are excluded from the analysis.

Data on *numbers of drug-related arrests* and *numbers of prostitution-related arrests* per census tract were aggregated from incident files of the Chicago Police Department (CPD). Although some illegal market activities may be pursued indoors and go unnoticed by the public and the police, the numbers of drug and prostitution arrests reflect the amount of street-level drug dealing and prostitution solicitation in a tract.

Data on the presence of private and public *high schools* in a tract were based on lists compiled by the Chicago Public Schools. *Retail employment*, which represents the number of persons employed in a retail business in a tract, was aggregated from marketing information collected by Claritas (www.claritas.com) on every business in the city and used as an indication of the availability of shops and other commercial businesses in the tract.

1. Website address: http://www.census.gov, accessed June 22, 2007.

The *collective efficacy* measure was created by Sampson and his colleagues (Sampson, Raudenbush, and Earls, 1997) and was provided to us for use in this research. The measure is based on a population survey among a neighborhood cluster sample, in which Chicago residents answered questions on the perceived extent of social cohesion and social control in their local communities (for details of the instrument, see Earls et al., 1997). Note that this survey-based measure was aggregated to the census tract level, and therefore, it has a greater error of measurement than other measures in the analysis (Raudenbush and Sampson, 1999).

The descriptive statistics and correlations among these variables at the census tract level are presented in table 1. The only two correlations with an absolute value above .50 are those between the percentage of African Americans and the percentages of non-Hispanic whites and Hispanics. These correlations illustrate the spatial isolation of African-American communities in Chicago and have led us to use a single racial and ethnic classification variable rather than separate variables to represent tract population percentages for racial or ethnic group. This racial and ethnic classification is a simplified version of the one used by Sampson, Raudenbush, and Earls (1997) to categorize Chicago neighborhood clusters on the basis of the percentages of residents of African-American, non-Hispanic white, and Hispanic origin. It uses the 2000 census and distinguishes between census tracts where any of these three categories form a majority of more than 75 percent and a single "mixed" category. In 314 of the 844 tracts (37.2 percent), African Americans were a 75 percent majority; in 111 tracts (13.2 percent), non-Hispanic whites were a 75 percent majority; and in 76 tracts (9.0 percent), Hispanics were a 75 percent majority. The other 343 tracts (40.6 percent) were mixed-census tracts in which none of these three racial and ethnic groups formed a majority of more than 75 percent.

Police-designated gang crimes were used to estimate gang territoriality. For each census tract and for each of eight largest and most active Chicago gangs,[2] the number of gang-related incidents that took place within the tract between 1993 and 1996 was counted. Following the comparatively stringent definitional approach of the CPD, an incident is classified as gang-related only if positive evidence suggests that gang activity or gang membership is a motive for the incident (Block and Block, 1993; Maxson and Klein, 1990). Examples are retaliation, territorial defense, recruitment, internal conflict involving leadership, visually or verbally representing the gang, and street-level distribution of narcotics organized by the

2. The Black Gangster Disciples, Vice Lords, Latin Kings, Black Disciples, Two Sixers, Spanish Cobras, Black P. Stones, and Latin Disciples (also see Block and Block, 1993).

Table 1. Tract Characteristics: Means, Standard Deviations, Numbers of Observations, and Correlations

	Mean	SD	*N*	1	2	3	4	5	6	7	8
1 Population (×1000)	3.43	2.58	844								
2 Annual drug arrests	34.60	59.39	844	.04							
3 Annual prostitution arrests	9.26	24.14	844	.08	.08						
4 High school in tract (0/1)	.12	.33	844	.09*	.02	.01					
5 Retail employment (×100)	2.01	4.12	844	.17*	–.12*	.05	.03				
6 Population percentage African American	41.99	43.35	844	–.19*	.43*	.02	.04	–.24*			
7 Population percentage Hispanic	22.34	28.32	844	.15*	–.18*	.04	–.03	–.02	–.60*		
8 Population percentage non-Hispanic white	28.65	31.23	844	.09*	–.38*	–.06	–.03	.30*	–.73*	–.06	
9 Collective efficacy	3.17	.16	786	.02	–.36*	–.12*	.00	.06	–.31*	–.08	.48*

ABBREVIATIONS: SD = standard deviation.
*p < .01 (two-sided).

gang. Note that gang membership alone does not define an incident as gang related. Most incidents are nonlethal violent offenses. Robberies account for 2.8 percent of the gang-related incidents. Gang members do commit robberies, but the crime will only be registered as gang related if explicitly motivated by gang activities or membership (also see Block and Block, 1993).

These gang- and tract-specific numbers of incidents are interpreted to reflect the relative strength of the different gangs in that tract. If, for example, all gang-motivated incidents that take place in a certain tract are attributed to members of a single gang (e.g. the Vice Lords), then it indicates that the tract is part of their territory and may be unattractive and even dangerous to members of other gangs but relatively safe for Vice Lords members.

Summing up, we infer gang territoriality from the locations of gang-related crime, assuming that threats and violence, in addition to graffiti and other symbolic signs of territoriality, make gangs and gang members reluctant to enter each other's turf. Admittedly, this measure may confound territorial dispute and territorial control. First, some gang-related incidents may involve offenders and victims from rival gangs (Block and Block, 1993). Although they are attributed to one of the two gangs involved, such incidents are actually indicative of gang rivalry and possibly territorial disputes. Second, incidents may not adequately tap the level of control that gangs have over their territories. Powerful gangs may indeed require little overt violence to maintain control over their turf. As a consequence, the level of gang-related crime is intended to measure territorial control but may to some extent also measure territorial dispute.

TRACT-TO-TRACT MEASURES

Tract-to-tract measures reflect a relation between the origin tract, where the offender lives, and the destination tract, where the robbery is committed. Thus, they are measures at the tract dyad level, and we use them to measure impedance or travel barriers between two tracts.

Distance is the most natural impedance variable. We used the Euclidian distance in meters to measure distances (all analyses were repeated using Manhattan distances instead of Euclidian distances, with virtually exactly the same results). In the descriptive analyses, the distance is the distance between the centroids (geographic midpoints) of both census tracts. In the multivariate analysis, where we analyze actual crime trips, we used the distance between the home of the offender and the centroid (geographic midpoint) of a potential destination tract. As a consequence, all distances between the offender's home and the crime site are zero or greater,

whether or not the robbery was committed in the offender's own tract of residence or home address.

To operationalize the hypothesized barrier effects between tracts with varying racial and ethnic distributions and between territories of different gangs, measures of heterogeneity were created in terms of racial and ethnic composition and gang membership between pairs of tracts. These pairwise measures are generalizations of the index of qualitative variation (Agresti and Agresti, 1978) that is often used as a measure of variation in the distribution of a nominal variable within a single group, neighborhood, or network. Although the index of qualitative variation is not used in our analysis, we address it here to introduce a new measure that is a generalization of it.

Using the racial and ethnic composition of tracts as an example and using the symbols B, H, and W for the three mutually exclusive categories black, Hispanic, and non-Hispanic white, respectively, and O for a fourth category of various other racial and ethnic origins, the index of qualitative variation for a single census tract is defined as

$$1 - \frac{B^2 + H^2 + W^2}{(B + H + W + O)^2} \tag{1}$$

The measure varies between 0 and 1 and can be interpreted as the probability that two random tract residents have a different ethnic background. Note that the O category appears in the denominator, because the denominator contains all possible pairs of tract residents. It is not included in the numerator, however, because the numerator contains only pairs of the same racial and ethnic background, and it is assumed that approximately none of two random members of the O category will be of the same racial and ethnic background. Thus, leaving the members of this category out of the numerator is a useful approximation if it is known or can be assumed that the category is a heterogeneous category composed of many different racial and ethnic groups (for example, Asian, Native Americans, etc.).

A generalized measure, which also ranges from 0 to 1, can be constructed with respect to two tracts. The measure reflects the probability that a random resident from one neighborhood has different racial or ethnic background than a random resident from the other tract (i.e., that a simultaneous draw from the two tracts yields a heterogeneous pair). Using 1 and 2 to identify the two tracts and assuming heterogeneous other categories O as in equation 1, this measure of racial or ethnic dissimilarity is

$$1 - \frac{B_1B_2 + H_1H_2 + W_1W_2}{(B_1 + H_1 + W_1 + O_1)(B_2 + H_2 + W_2 + O_2)} \tag{2}$$

Our measure of gang territorial dissimilarity is analogous, in which the role of the three racial and ethnic groups is replaced by the eight gangs listed above. This measure thus represents the probability that two random gang members, one from each tract, are in different gangs. Note that 2 percent of the tracts did not have gang-related crime, 31 percent suffered at most one incident per quarter, and 58 percent suffered at most one per month. It therefore seemed potentially problematic that the measure would only depend on the relative proportions of different gangs among the gang incidents for a tract, without regard for the overall prevalence of gang incidents. Because differential gang composition should be expected to present more of a barrier between a pair of tracts with much gang activity than a pair where either or both have little, in the analysis we added dichotomous interaction terms to test this assertion.

Table 2. Tracts Dyads ($N = 844 \times 844 / 2 = 356{,}168$ dyads): Means, Standard Deviations, Correlations (below diagonal), and Partial Correlations (above diagonal) of Distance Measures Defined for Tract Dyads

Distance Measure	Mean	SD	1	2	3
1 Euclidian distance between tract centroids (km)	12.55	7.41	1.00	.10*	.17*
2 Gang territorial dissimilarity	.80	.20	.17*	1.00	.36*
3 Racial and ethnic dissimilarity	.69	.31	.22*	.38*	1.00

*$p < .01$ (two-sided).

The three tract-to-tract measures discussed above—distance, racial and ethnic dissimilarity, and gang territorial dissimilarity—measure different aspects of the physical and psychological distance that separates two places and discourages and impedes travel between them. Table 2 presents the means and standard deviations of these three variables and their correlations and partial correlations. Although all three are positively correlated, which indicates that distant tracts tend to be dissimilar both in terms of racial and ethnic composition and in terms of the gang's territory, the correlations are less than .40. Thus, each measure reflects a different type of barrier.

INDIVIDUAL MEASURES: ROBBERIES AND ROBBERS

Data on robbery incidents and arrests during the years 1996–1998 were generated from CPD records. In all, 75,078 incidents had a geocodable address. More than 99 percent were successfully geocoded. Of these, 12,872 incidents resulted in an arrest of at least one offender who had a

geocoded home address in Chicago. Both the address where the incident occurred and the address of the offender were assigned to 1 of the 865 census tracts of Chicago.

Because more than one offender can be involved in a single incident, the data contains 18,017 offender–offense pairs. In about half of the 12,872 incidents (52 percent), a single offender was arrested; in about a quarter (28 percent), two offenders were arrested; in 11 percent, three offenders were arrested; and in the rest, even more offenders were arrested. The data do not allow us to identify with certainty the same robbers across multiple incidents. Thus, we cannot ascertain whether the same person is arrested for multiple robberies.

The data include the time and place of the incident and some basic characteristics of the offender, including age, sex, and ethnic origin. We excluded .59 percent of the cases in which the robber was not non-Hispanic white, African American, or Hispanic, and we excluded 1.44 percent of cases in which the age of the offender was not recorded by the police.

The estimation of discrete choice models requires a considerable amount of computer resources when both the number of observations (choices) and the number of alternatives per choice are large. The product of choices and alternatives per choice defines the number of rows in the data matrix. For example, 10,128,000 rows of data are needed to analyze 12,000 robberies across 844 census tracts. Recognizing that the available hardware and software could not analyze all cases simultaneously, we decided to use this limitation to our advantage. To decrease the risk of chance capitalization on the outcomes of the model testing and to discipline ourselves, a method known as cross-validation (Picard and Berk, 1990) was used. Cross-validation partitions sample data into subsets such that the initial analysis is performed on a single subset (sometimes called the training set), whereas the other subsets are retained for subsequent use in confirming and validating the initial analysis (the testing set). For model development, a random sample of 3,000 robbery cases was used. For the final testing, we used 6,000 other random cases in a single estimation run, which resulted in the findings discussed below.

Because 48 percent of the robberies involve more than one offender, the estimation results could be biased if we were to analyze the choices of offenders involved in the same robbery as independent observations. To alleviate this problem, we selected at random one offender per robbery for all multioffender robberies. The age and racial and ethnic composition of this sample is displayed in table 3.

Table 3. Age and Racial and Ethnic Origin of Robbers in the Test Sample (*N* = 6,000)

Variable	Frequency	Percentage
Age in Years		
8–17	1,466	24.4
18–27	2,433	40.6
28–37	1,489	24.8
38–77	612	10.2
Racial/Ethnic Origin		
African American	4,770	79.5
non-Hispanic white	353	5.9
Hispanic	877	14.6
Total	6,000	100

MODELING SPATIAL CHOICES

We model the spatial choices of Chicago robbers using a general microeconomic framework for the analysis of discrete choice, that is, choice among a limited set of alternatives. The framework is known as *random utility maximization* in economics and has been introduced and developed by 2000 Nobel laureate McFadden (1973). The framework is attractive for various reasons, which include the strong link between the theoretical formulation and its statistical counterpart, the conditional logit model. It has been applied in many fields and to a wide variety of discrete choice problems, which include problems of location choice (Ben-Akiva and Lerman, 1985). Bernasco and Nieuwbeerta (2005) and Bernasco (2006) applied the framework to the location choice of offenders, in their case burglars in the city of the Hague.

The point of departure is an actor who is faced with a choice among several discrete spatial alternatives, of which he must choose only one. In our model, the actor is a motivated robber who must choose an area for searching out victims to rob. The spatial unit of analysis is a census tract, so that in the model, each robber has a choice among the 844 census tracts of Chicago included in the analysis. The actor is supposed to evaluate the utility (net gain, profits, and satisfaction) that he would derive from choosing each alternative. The utility derived by actor i from alternative j is given by the following equation:

$$U_{ij} = \beta_1 z_{1ij} + \beta_2 z_{2ij} + \beta_3 z_{3ij} + ... + \beta_v z_{vij} + \varepsilon_{ij} \quad (3)$$

In this equation, the z_{ij} variables are attributes that vary across the census tracts and possibly across individuals as well. The β symbols are the

estimated coefficients that indicate the relative importance of the attributes in the outcome of the evaluation. Finally, ε_{ij} is a random error term that contains unmeasured relevant attributes of actors and alternatives as well as measurement error.

To make this more concrete, the first nine hypotheses formulated above translate directly into the utility equation

$$U_{ij} = \beta_x X_{ij} + \beta_E E_{ij} + \beta_G G_{ij} + \beta_D D_j + \beta_P P_j + \beta_S S_j + \beta_H H_j + \beta_R R_j + \beta_C C_j + \varepsilon_{ij} \quad (4)$$

where

X = distance
E = racial and ethnic dissimilarity
G = gang territorial dissimilarity
D = annual drugs arrests
P = annual prostitution arrests
S = size of resident population
H = high school present in tract
R = retail employment
C = collective efficacy.

The last six choice criteria (variables) apply only to the potential robbery destination tract and have a j subscript only. Thus, they are assumed to affect the choice of all offenders in the same way. The first three choice criteria also depend on characteristics of the tract where the offender lives: distance, racial and ethnic dissimilarity, and gang territorial dissimilarity. These three criteria apply to pairs of tracts and thus have both a j subscript and an i subscript. As mentioned, the β coefficients are to be estimated empirically on the basis of the observed location choices. The values and standard errors of these estimates are used to test the first nine hypotheses.

To formalize the hypotheses that specify differences between juvenile and adult offenders and between robbers of different racial and ethnic groups, the terms for interactions between census tract attributes and robber attributes are inserted into the utility function (i.e., juvenile × distance and adult × distance interactions), and nine interaction terms that relate African-American, non-Hispanic white, and Hispanic offenders to census tracts with African-American, non-Hispanic white, and Hispanic majority residential populations (with nonmajority or mixed-census tracts as reference categories).

To test hypotheses on the effects of choice criteria, the theoretical choice model needs to be linked to a corresponding statistical model. Assuming that robbers choose the tract they favor most after taking into account the pros and cons, the choice model can be derived to take the form of the *conditional logit model* (Greene, 1997; McFadden, 1973). In this model, which is also known as the *multinomial logit model*, the

probability of a robber *i* choosing alternative *j* is based on utility equation 3

$$\Pr(Y_{\mathrm{i}} = \mathrm{j}) = \frac{e^{\beta_1 z_{1\mathrm{ij}} + \beta_2 z_{2\mathrm{ij}} + \beta_3 z_{3\mathrm{ij}} + \ldots + \beta_v z_{vij}}}{\sum_{\mathrm{j}=1}^{J} e^{\beta_1 z_{1\mathrm{ij}} + \beta_2 z_{2\mathrm{ij}} + \beta_3 z_{3\mathrm{ij}} + \ldots + \beta_{\mathrm{v}} z_{\mathrm{vij}}}} \quad (5)$$

where Y_i is the choice actually made by robber *i*. The values e^{β} can be interpreted as multiplicative effects of a unit increase in some attribute of a potential target on its odds of being chosen by the offender. For example, if z_y represents the distance in kilometers between a potential target and the offender's home, and if the corresponding $\beta = -0.70$, then the odds of the target being attacked by the offender declines by a factor $e^{-0.70} = 0.50$ for every kilometer farther away it is located from the offender's home base. All models were estimated using the *clogit* procedure that is part of the general-purpose statistical software *Stata* (StataCorp, 2005).

FINDINGS

Although our analysis includes the multivariate test of all hypotheses simultaneously, the findings are best presented in three steps. In the first step, we estimate an adjacency model of robbery location. In step two, hypotheses 1–9 are tested simultaneously using a robbery location choice model that includes measures of distance and population, social barriers, attractions, and guardianship but that excludes the effects of age and racial and ethnic background on the offenders. In the third step, the individual level interactions as well as hypotheses 10 and 11 are tested.

As a first step in the analysis and to emphasize the role of distance, table 4 presents the results of a conditional logit analysis that models the choice of a target tract for robbery solely in terms of distance between origin and destination as measured by the minimum number of borders to cross between them. Adjacency was defined according to the queens criterion (Cliff and Ord, 1973), which means that two tracts are adjacent if their boundaries have at least a single point in common. The parameters are odds ratios that represent the increase of the odds of a tract being chosen, which results from a one-unit increase in the independent variable. For example, table 4 shows that the odds of the tract of residence of being chosen for a robbery is 822 times the odds of a distance tract that is five or more borders away from the tract of residence (the reference category). For an adjacent tract (i.e., one border away from the tract of residence), the odds of being chosen are still 99 times the odds of a distant tract. Although the effects are large and highly significant, the values level off

Table 4. Conditional Logit Model of Choice of Robbery Destination Tract. Test Sample: *N* = 6,000 Robbery Incidents 1996–1998, *N* = 844 Chicago Census Tracts

	Odds Ratio	*z*-Value
Tract of residence	821.87*	110.73
Adjacent tract (1 border away)	99.08*	71.72
Tract 2 borders away	20.65*	36.37
Tract 3 borders away	10.22*	25.05
Tract 4 borders away	5.24*	15.28
Tract 5 or more borders away	1.00	
Tracts	844	
Robberies	6,000	

* $p < .01$ (one-sided).

very quickly. In the pilot modeling phase (on another sample of 3,000 robberies), we found that part of this exponential decay could be well captured with a logarithmic transformation of distance, which generates a pattern that is close to linear. However, the logarithmic distance transformation does not wipe out the strong positive effect of choosing your own residential tract as the robbery destination tract. Therefore, it was decided to use both the logarithm of distance as well as an indicator dummy variable for the offender's resident tract, in the subsequent models.

In the second step, we test hypotheses 1–9. The results of a model that includes all tract-level variables is presented in table 5. This table, as well as table 6, only includes the 786 census tracts (of 844) for which a collective efficacy measure was available. A model without collective efficacy was also estimated on this selection of 786 tracts as well as on all 844 census tracts. The estimates and standard errors of all other variables in both models were virtually identical to those presented in table 5 and are not separately presented here.

The estimated coefficients show, first, that the two distance measures have negative effects. An increase of one unit in the log of distance in kilometers reduces the odds of a tract being chosen for robbery by a factor of .21 (a reduction of nearly 80 percent). Obviously, the distance to the centroid of the offender's tract of residence is usually smaller than the distance to the centroid of any other tract. Therefore, one may expect no additional effect of a tract being the tract of residence of the offender. However, the tract of residence seems to be chosen for additional reasons: not being the home tract of the offender reduces the odds of being chosen by a factor of .67 (thus, by 33 percent). Furthermore, as predicted, the size

Table 5. Conditional Logit Model of Choice of Robbery Destination Tract. Test Sample: *n* = 5,847 Robbery Incidents 1996–1998, *n* = 786 Chicago Census Tracts

	Odds Ratio	*z*-Value
Distance and Population		
Log distance (km)	.21**	–98.69
Not home tract (0/1)	.67**	–8.77
Population (×1,000)	1.17**	30.48
Social Barriers		
Racial and ethnic dissimilarity (0–1)	.42**	–12.35
Gang territorial dissimilarity (0–1)	.50**	–7.80
Attractions		
Annual drug arrests (×100)	1.15**	6.94
Annual prostitution arrests (×100)	1.14**	2.54
High school present in tract (0/1)	1.15**	3.56
Retail employment (×100)	1.44**	12.43
Guardianship		
Collective efficacy	.84*	–1.78
Tracts	786	
Robberies	5,847	

*$p<.05$; **$p<.01$ (one-sided).

of the resident tract population, as a crude measure of the number of opportunities available, has a positive effect. The odds of being chosen increase by 17 percent for every additional 1,000 residents in the tract population.

The model includes two measures of social barriers. Both measures vary between 0 and 1, and both have effects of about the same size in the expected direction. When the racial and ethnic dissimilarity between the potential target tract and the offender's tract of residence changes from 0 (completely similar) to 1 (completely dissimilar), the odds that the tract is chosen for robbery decrease by a factor of .42 (58 percent). This robust finding confirms that the strong racial and ethnic segregation of Chicago communities is reflected in the travel patterns of offenders. Robbers tend to offend in census tracts that are racially and ethnically similar to the tracts they live in themselves.

For gang territorial dissimilarity, which is the other social barrier, the decrease is .50 (50 percent). Thus, complete gang territorial dissimilarity between the two tracts (which occurs if one tract is completely within the territorial boundary of one gang and the other tract is completely within

the territorial boundaries of another gang) reduces the likelihood of a census tract being chosen by 50 percent, compared with complete similarity (when both tracts are in the territory of a single gang). This result is in line with the hypothesis, but the size seems remarkable given the fact that theoretically this type of barrier should be expected to be effective only if substantial gang-related activities take place in both areas and only if the offender himself or herself is gang-affiliated. To explore the effect, we used interaction terms to test whether the gang territoriality effect was stronger between pairs of tracts that both had many gang-related incidents and to test whether it was stronger for juveniles than for adults, as juveniles are more likely to be gang members.

The results, which are not shown in the tables for lack of space but are available upon request, show that the gang territorial barrier reduces robbery travel slightly more if the barrier is between pairs of census tracts with high levels of gang activity than between pairs that suffer less gang-related incidents. However, the differences are not significant. The results of additional tests show that gang territorial barriers do play a larger role for juvenile robbers than for adult robbers, which suggests that gang turf barriers deter juvenile robbers more than they deter adult robbers, possibly because more juveniles than adults are gang members. Unfortunately, we cannot test this explanation because we have no information on the gang affiliations of the robbers. Taken together, the findings on gang territory tentatively suggest that gang territory boundaries may affect the location choice outcomes of gang-affiliated robbers.

The model includes four measures of the presence of attractive targets in the potential robbery tract: drug dealers and their customers, prostitutes and their customers, high-school students (all "good" street robbery victims), and number of employees of retail establishments as an indicator of the overall amounts of retail activity. As hypothesized, the presence of allegedly attractive targets in a tract increases the odds that the tract is chosen for robbery. This finding is true despite the negative bivariate correlation between drug arrests and retail employment (table 1). Thus, although tracts that host drug markets generally have less retail employment, both drug markets and retail activities attract robbery.

Finally, the model includes collective efficacy as a measure of informal guardianship. The results provide some support for the hypothesis that the level of collective efficacy in a tract reduces its attraction to robbers, although the effect is small and is the only one not to reach the 1 percent significance level. Taking into account that this one-sided test was performed on a sample of nearly 6,000 incidents, this evidence that collective efficacy deters robbers is not convincing. As this variable has greater measurement error because it is an aggregated survey measure, it is likely to be attenuated relative to others. Furthermore, it is only a partial test of the

theory of social organization or collective efficacy: Our spatial choice model is conditional on the offender being motivated to rob, whereas the theory of collective efficacy (and social disorganization) is broader than location choice and incorporates effects of social structure on how criminal motivation itself develops.

The third step in the multivariate analysis is the test of individual level interactions, which are hypotheses 10 and 11. First, it was hypothesized that the proximity criterion would be more important for juvenile offenders than for adult offenders. Accordingly, the model presented in table 6 allows the two distance variables to have different effects on juveniles than on adults. We find only partial support for the hypothesis. As expected, for juveniles and adults, both distance measures decrease the odds of a tract being selected for robbery. In support of the hypothesis that distance is more limiting for juveniles, the effect of log-distance is stronger (further below 1) for juveniles than for adults [.17 versus .23, respectively, chi square = 66.05, degrees of freedom (d.f.) = 1, $p < .01$]. However, in contrast to the hypothesis, it is adults and not juveniles who are more likely to commit a robbery in the tract where they live. For adults, the odds of a tract being chosen decreases by a factor .64 if it is not their home tract. For juveniles, they decrease by only .82, this difference is just statistically significant (chi square = 3.50, d.f. = 1, $p < .05$). This finding would suggest that distance limits juveniles more than adults at larger distances than average within-tract distances. Within a single tract, typical distances are up to a few blocks, and the advantage of having access to a motor vehicle may not be very large. Another possible cause that is not studied here is that juvenile offenders tend to co-offend in robberies. If co-offenders live in different census tracts, some of them must necessarily rob in other tracts than their own. For example, they may gather at a central place, which may serve then as a base camp for their journeys to crime. Still another tentative explanation is that juveniles are subject to higher levels of supervision and monitoring and, to avoid detection, move away from their home environments to rob elsewhere.

Second, it was hypothesized that offenders prefer to rob in places where most residents match the racial or ethnic background of the offenders themselves. To test this hypothesis, the model presented in table 6 allows the effect of the racial and ethnic composition of destination tracts to vary between African-American, non-Hispanic white, and Hispanic offenders. This hypothesis can be interpreted as a more specific measure of the racial/ethnic social barrier effect: The ethnic composition of the robbery destination is now compared with the racial and ethnic background of the offender, instead of with the ethnic composition of the tract where the offender lives. Therefore, in this model, the interaction effect replaces the racial and ethnic dissimilarity measure (at tract dyad level). For African-

Table 6. Conditional Logit Model of Choice of Robbery Destination Tract. Test Sample: *n* = 5,847 Robbery Incidents 1996–1998, *n* = 786 Chicago Census Tracts

	Odds Ratio	*z*-Value
Distance and Population		
Adults		
Log distance (km)	.23**	–86.81
Not home tract (0/1)	.64**	–8.24
Juveniles		
Log distance (kilometers)	.17**	–58.78
Not home tract (0/1)	.82*	–2.24
Population (×1,000)	1.17**	29.37
Social Barriers		
African-American offender		
African-American majority tract (0/1)	1.38**	6.53
Hispanic majority tract (0/1)	.56**	–5.92
Non-Hispanic white majority tract (0/1)	.68**	–3.60
Mixed tract (reference)	1.00	—
Non-Hispanic white offender		
African-American majority tract (0/1)	.25**	–5.09
Hispanic majority tract (0/1)	.67*	–1.99
White majority tract (0/1)	1.03	.16
Mixed tract (reference)	1.00	—
Hispanic offender		
African-American majority tract (0/1)	.14**	–8.97
Hispanic majority tract (0/1)	1.24**	2.38
White majority tract (0/1)	.47**	–3.80
Mixed tract (reference)	1.00	—
Gang territorial dissimilarity (0-1)	.47**	–8.76
Attractions		
Annual drug arrests (×100)	1.18**	8.28
Annual prostitution arrests (×100)	1.13**	2.39
High school present in tract (0/1)	1.16**	3.71
Retail employment (×100)	1.39**	11.30
Guardianship		
Collective efficacy	.81*	–2.19
Tracts	786	
Robberies	5,847	

*$p<.05$; **$p<.01$ (one-sided).

American and Hispanic offenders, the outcomes strongly support the hypotheses, whereas moderate support is found for non-Hispanic whites.

To appreciate this, consider first the three effects under the header "African-American offender." Offenders of African-American origin display a strong preference for tracts where African-American residents form a majority. The odds of such tracts being chosen are 1.38 times the odds of a racially and ethnically mixed tract being chosen. Tracts that have a Hispanic or a non-Hispanic white majority, however, have lower odds of being chosen than mixed tracts (odds ratios are .56 and .68, respectively). In sum, when applying controls for other relevant choice criteria, the picking order of African-American offenders is African-American majority tracts, mixed tracts, non-Hispanic white majority tracts, and Hispanic majority tracts. For offenders whose origin is Hispanic, the pattern is similar with the racial and ethnic categories shifted. Thus, offenders of Hispanic origin prefer Hispanic majority tracts (1.24), then mixed tracts, then non-Hispanic white majority tracts (.47), and finally African-American majority tracts (.14).

For non-Hispanic white offenders, which comprise only 5.9 percent of the sample, the results point in the same direction, although they are not all significant. Thus, non-Hispanic white offenders do not significantly more often choose white majority tracts than mixed tracts, but the odds of them choosing an African-American majority tract or a Hispanic majority tract are significantly lower. Overall, these results support the hypothesis on the role of the racial and ethnic origin of the offender. Moreover, they are more specific than the more general "racial and ethnic dissimilarity" measure that is defined at tract dyad level.

DISCUSSION

In the current article, we demonstrated that patterns of robbery location choice are related to the theoretically meaningful characteristics of the target areas, to the areas where offenders live, to the joint characteristics of the two areas, and to the characteristics of the offenders themselves. Applying discrete choice analysis, we found that the presence of illegal drug and prostitution markets as well as other crime generators and crime attractors, such as high schools and retail businesses, makes areas attractive for robbers. We found some support for the idea that collective efficacy keeps robbers out, although the effect was small and hardly reached statistical significance. In addition to distance, we found that social barriers of racial and ethnic segregation, and possibly also gang territoriality, restrict the mobility of offenders. In a sense, we statistically verified previous ethnographic research on targeting decisions of robbers.

Admittedly, statistical support is not proof that the "stories" that lie behind the hypotheses are always the correct ones. It is a credible story that drug dealers and drug users are attractive robbery targets, and that

robbers travel to drug markets to find them. However, the decision to commit a robbery at a place where drugs are sold may not always be an issue of foraging for victims. Robbers might also be foraging for drugs, and the robbery could be the end result of a failed transaction (Jacobs, Topalli, and Wright, 2000). Similarly, some prostitutes rob their customers when a transaction fails or reap an excellent opportunity without having considered this option beforehand (Miller, 1998). They were foraging for customers, not robbery victims. In the same vein, it may be a wise decision of African-American robbers not to attempt robbery in communities where they stand out as the only African Americans around, but the reason why they mostly rob in majority black census tracts could just as well be that this is the place where they live, work, and meet friends. High schools may be places where good targets can be found, but they could be nodes in the routine activities of offenders as well. The pupils themselves may be victims, the offenders, or both. One advantage of the discrete choice model is that it presents an easy way to test alternative stories, in particular because it is a disaggregated model that allows the use of individual characteristics. For example, if we know whether an offender is a drug user or a high-school pupil, then alternative models can be tested, as we did in this article for age and racial or ethnic background.

We did not address co-offending. According to our data, 48 percent of the robberies are committed by two or more offenders, and we agree with those who have observed the "single mindedness" in criminological theory, in general (Warr, 2002), and in theory on decision making in robbery, in particular (Hochstetler, 2001), that it deserves more attention. Using the spatial choice model, Bernasco (2006) demonstrated that co-offending burglars used the same criteria as solitary burglars to select a target area. Future research could investigate this issue for other offender groups and offense types.

We have also neglected temporal variation. Great places for robbery in the morning may be pretty useless places at night. An entertainment district may be an excellent place to rob in the weekend, but less so on other days. Temporal variations and temporal constraints are generally neglected in criminological research (Ratcliffe, 2006), and our inquiry is no exception. In principle, however, the discrete spatial choice model could be used for this purpose, by replacing spatial choice by spatiotemporal choice. For example, if we reduce the time dimension to a choice among three daily shifts (morning, afternoon, and night), then we can model the spatiotemporal choice not as a selection of 1 of 844 spatial opportunities (census tracts), but as a selection of 1 of 844×3 (spatiotemporal) opportunities. Such an analysis could show, for example, that the presence of high schools only attracts afternoon robberies (when the schools go out) but not morning and night robberies. Should we find that the presence of high

schools attracts night robberies, we would have no theoretical rationale for the relation, and we would probably consider the possibility that the relation was spurious. Thus, the inclusion of temporal alternatives in the spatial choice model could improve our understanding of spatial target selection.

In future work, it might be advisable to use smaller units of spatial aggregation. Using census tracts, 28 percent of the offenders committed a robbery in their home census tract. Thus, for 28 percent of them, where they live completely explains where they offend. In those as well as other cases, a more refined spatial scale, block groups, or blocks may yield improved insights because more within-tract heterogeneity and within-tract distances are incorporated.

The research presented here confirms the discrete choice model as a useful tool for modeling criminal location choice, in part because it distinguishes the residence of the offender from the place where the offense takes place. Resident area is one explanatory variable to estimate the offender's choice of incident area. By considering geographic distance as part of a tradeoff between various "pros" and "cons," the discrete choice model integrates journey to crime research with research that explores the geographic distribution of criminal opportunities. Furthermore, because the model is based on the explicit formulation of choice criteria that individual offenders are expected to use, the link among theory, model formulation, and hypothesis testing is short. We specified and tested hypotheses easily on differences between offenders. Although our data allowed us to consider only age and racial and ethnic origin, the model could also be used to test other offender-based hypotheses, for example, most obviously, the offender's membership in a specific gang.

Offender mobility is affected not only by distance, which is a physical barrier between the offender's home and a crime location, but also by social barriers. Social barriers reflect dissimilarities between the community where the crime is committed and either the offender's community or the offender himself or herself. We have shown a social barrier to exist between census tracts with dissimilar racial and ethnic compositions. The remarkable thing about these social barriers is that they discourage offender travel in addition to the impeding effect of the distance between the origin and the destination tract. In short: If offenders do not commit offenses in the vicinity of their own homes, then they are most likely to search for targets in nearby areas. When they must subsequently choose among various nearby areas, they will choose one that is most similar to where they themselves live.

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