Is Crime Higher Around Drug-Gang Street Corners?: Two Spatial Approaches To The Relationship Between Gang Set Spaces And Local Crime Levels

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Environmental criminologists are at the vanguard of a growing interest in establishing the density or intensity of crime events around locations that are the target of crime prevention activities. The traditional approach has often been to count the number of crime events within a certain distance of the target site; however, this approach is fraught with methodological concerns. In this article, we examine the benefits of two different approaches to this problem by estimating the intensity of property and violent crime around drug corners associated with different drug-gangs. The first technique allows for better estimation of crime in the vicinity of gang corners by using an inverse distance weighting approach to crime events around. A second methodology, using Thiessen polygons, allows a statistical test to determine the difference between non-gang, gang, and multi-gang corner locations. Findings indicate that single-gang dominated corners have significantly more crime than non-gang corners, and variation in the crime level in the vicinity of gang corners was found for different gangs. Corners characterized by the presence of multiple gangs have significantly more crime than single-gang locations.

Introduction

While the nature and extent of gangs has been under study since the 1920s, many questions still remain. One of the more recent and prevalent of these questions has been the relationship between street gangs and the distribution of illegal narcotics, with corollary of associated property and violent crime problems. Street gangs, at least in the United States, are now synonymous with the distribution of illicit drugs. Gangs are now blamed for a portion of the street violence that affects inner cities, and the drugs they distribute are blamed for neighborhood property crime levels. For example, a 2004 gang survey of police jurisdictions across New Jersey (USA) found that of all criminal offenses addressed in relation to gang members, involvement in illegal narcotics rated the highest, followed by assault and robbery (NJSP, nd).

Analysis of crime levels in the vicinity of street drug markets has proven to be a difficult undertaking, yet the importance of this task has been growing over recent years. A meta-analysis of the literature of street market intervention tactics aimed at reducing both drug and nondrug problems found greater success associated with proactive partnership collaborations than with

law enforcement solutions (Mazerolle, Soole, & Rombouts, 2007). The report highlighted the value of collaborative approaches to crime reduction that are geographically focused. This suggests the value of approaching street drug markets as more than just a policing issue, and as a problem that requires a carefully targeted response at the micro-level. Increasingly, there have been calls for crime problems to be addressed with a "strategic harm based approach" (Sheptycki & Ratcliffe, 2004: 194) or from a problem-oriented perspective that seeks to reduce or eliminate problems associated with drug crime (Nunn, Quinet, Rowe, & Christ, 2006). Drug problems are now often viewed through the lens of a harm reduction framework, where harm is conceptualized in terms of public health (Maher & Dixon, 1999), or "harm reduction-oriented enforcement" (Newburn & Elliott, 1998) designed to address local crime. Drug markets are thus reconceptualized not as a target due to their primary drug law effects but because of their secondary influence on social harm and community harmony.

Many communities are concerned about the presence of drug markets because of the violence associated with proximity to a drug-selling location. Following their review of the literature, Parker and Auerhahn (1998) state "the strongest evidence is for a link between cocaine use and violence; however, the conclusions of researchers whose findings support this idea universally highlight a social rather than pharmacological basis for this link." They conclude by saying "it is clear that we must look beyond the level of the individual user in order to adequately understand and characterize the relationship (if any) between illicit drugs and violence." If the relationship between drugs and crime is unclear, the relation between drug markets and crime is not. Drug markets have consistently been linked to violence and the deterioration of the inner city (Tonry, 1990). Research suggests that it is not simply the selling of drugs but the selling of drugs in a public venue that is related to higher levels of crime. As Chaiken and Chaiken (1990) note, "Those who sell drugs publicly for example in parks, streets, or back alleys, are likely to commit predatory crimes and to commit them at higher rates than people who commit the same type of offenses but do not sell drugs."

The spatial foci for much of this activity in the United States is thus the street corner drug market. Topalli, Wright, and Fornango (2002) noted that much of the street violence in inner city America revolves around street-corner drug markets, and the policing response has been concentrated at the same locale (Lawton, Taylor, & Luongo, 2005; Muir, 1977). Street-corner drug markets are therefore theorized as responsible for higher levels of violent crime in their immediate vicinities. A review of the extant literature provides no satisfactory or universally-agreed method to determine the amount of crime surrounding a known drug dealing location, nor has any work been conducted to estimate the impact of different types of drug corner on micro-level crime patterns in the vicinity of these locations. Block's (2000) work in Chicago comes closest, and was one of the first to examine the relationship between gangs and crime in a spatial context; however, while he used 150 meter grid squares (which can provide a fair degree of resolution), the gang variable was based on gang-motivated incidents recorded by the police department – a variable that has the potential to record incidents some distance from the gang set space or drug selling locations of gang members. This approach can work for general gang territory, but a less aggregate approach may be needed for corner drug markets. For example, it is important to determine whether a corner dominated by one drug gang is less crime-prone than locations where more than one gang are known to deal.

To better understand and quantify the influence of drug-selling locations on local crime patterns, this article examines the validity of two methodologies to explore local crime patterns in the vicinity of known drug-dealing locations. Two methods are proposed to deal with the

limitations found in other research. The techniques are demonstrated with property and violent recorded crime events mapped to known drug-gang locations obtained from various police and criminal intelligence databases in the City of Camden, New Jersey (USA). In particular, we draw on crime events recorded by the Camden Police Department and locations of drug-gang corners as sourced from the Office of Intelligence Services in the Camden County Prosecutor's Office, Camden County, New Jersey. The data sets used here provide a combination of case-specific gang knowledge and high-volume crime data. Through the combination of these two types of data, it is possible to establish a more complete picture of the relationship between street-corner drug dealing and its correlation with the surrounding crime level.

The next section of the article clarifies the definition of gangs, specifically in their relationship to the ecology of the street, and how these street locations are associated with drug dealing. The section continues with a review of the literature and competing hypotheses concerning the level of crime around known drug dealing sites. We then address the two different approaches to assessing the density and intensity of crime events in proximity to locations of interest; in this case, drug-gang corners in Camden, New Jersey. Finally, the limitations and benefits of these approaches are contrasted. We start by reviewing the literature relevant to gangs, drug-gangs in particular, and the spatial extents of their territories.

Gangs, Set Space and the Violence of Drugs

Defining gangs has proven to be a particularly difficult task (Cromwell, Taylor, & Palacios, 1992). Thrasher (1927) is often cited as the first scholar to undertake extensive investigation into the characteristics and features of gangs. His research made it clear that, at the time of writing, gangs demonstrated a great deal of diversity with regard to actions and makeup. As such, it is difficult to establish a universally agreed definition of a street gang. This being said, there are a number of characteristics that tend to represent common gang behavior. For example, gangs tend to form spontaneously and then integrate through conflict. Secondly, gangs demonstrate organization, planning, and solidarity that can be used towards collective actions. These collective actions can range from "character[istic] of a common festivity such as gambling, drinking, smoking, or sex" to full scale rioting (Thrasher, 1927).

A characteristic central to defining gangs is territoriality (Ley & Cybriwsky, 1974; Thrasher, 1927). Ley and Cybriwsky (1974) conducted some of the earliest research on gang territoriality. Their analysis found that graffiti was often utilized as a means to make claim over a specific area of physical space. Graffiti can denote to both locals and outsiders that an area is unambiguously under the control of a certain group (Fleisher, 1995). Analyses of the graffiti in an area led Ley and Cybriwsky (1974) to speculation about gang conflict. Areas where multiple gangs had made claim to a single area were considered contested locations. They postulated - but were unable to confirm - that these contested areas would be associated with a higher level of violent crime. This facet of gang identity is integral to the current article, and we return to this point in detail below.

Noticeably absent from this list of gang characteristics are discussions of inherent criminality, age, and social class. Within the confines of Thrasher's (1927) early research, planning was not necessarily directed towards criminal actions nor was conflict always demonstrated through violence. Age and social class were not elevated to crucial issues in gang definition until a much later date (Jackson, 2003). More recent definitions of gangs have tended

to be more specific in the qualities deemed necessary to be a gang. After reviewing the literature on gang research, Ball and Curry (1995: 240) compiled a definition of gangs as follows:

> The gang is a spontaneous, semisecret, interstitial, integrate but mutable social system whose members share common interests and that functions with relatively little regard for legality but regulates interaction among its members and features a leadership structure with processes of organizational maintenance and membership services and adaptive mechanisms for dealing with other significant social systems in its environment.

The definition proposed by Ball and Curry (1995) includes a good deal of flexibility while attempting to avoid being over- or under-inclusive, typical of other definitions. What is missing from this definition, but is common in most popularizations of gang characteristics, is a propensity to be associated with violence.

A substantial body of both quantitative and qualitative data supports the link between gangs and violence (Fleisher, 1995; Horowitz & Schwartz, 1974; Thornberry & Burch II, 1997). Thrasher (1927), in the earliest study of gang behavior, noted that "the gang is a conflict group. It develops through strife and thrives on warfare." There is, however, difficulty in operationalizing the concept of gang-related violence. How to define a violent act as related to a gang has varied by both the researcher and the study, and researchers have shown dramatic differences in attempts to explain the reasons behind the high level of gang violence. Explanations range, for example, from the protection and establishment of group territory (Thrasher, 1927) to the restoration of an individual's honor (Horowitz & Schwartz, 1974). Yet, while the causal mechanisms for violence associated with gang behavior vary between group dynamics and individual predictors, the overall conclusion that gangs are related to violence seems beyond question (Hagedorn, 1998).

Early research on the association between drugs and crime identified the need to distinguish between crimes defined by drug use and crimes related to drug use (Blum, 1967; Craddock, Collins, & Timrots, 1994). Drug-defined offenses refer to the violation of laws directly related to the "possession, use, distribution, or manufacture of illegal drugs" (Craddock et al., 1994); however, it is crimes tangentially related to drug use that are often of interest from a social harm perspective. This is especially the case with the study area for this article, the City of Camden, New Jersey. While the most recent version of City Crime Rankings (Morgan Quitno Press, 2006) has Camden as the fifth most dangerous city in the country, the publication labeled the city the most dangerous in America in 2004 and 2005. The annual ranking is based on violent crime frequency and not the number of drug incidents.

To explore crimes related to drug use, Goldstein (1985) presented a three part taxonomy of offense types; (1) offenses related to a drug's pharmacological effects, (2) offenses related to the need for money to support use, and (3) offenses related to the distribution of drugs. In the first instance, crimes resulting from the pharmacological effects are actions while under the influence of a drug. Drugs are known to cause changes in an individual's behavior; so, under this model drugs are seen as a force that changes offender behavior, resulting in behavior that is excitable, irrational, or violent (Goldstein, 1985). The second category of drug related offenses are those committed to support individuals' drug use habit. The most obvious example would be individuals committing property crimes to obtain enough money to get high (Blumstein, 1995). Research has shown that the onset of drug use is related to increases in the level of property crime (Anglin & Speckart, 1988). It is noteworthy that not all economically motivated crimes are

focused on property; crimes with economic motivation can include robbery, assault and homicide. As Goldstein (1985) points out, however, individuals desiring to support a drug habit who engage in violent behavior appear to be the minority, and most offenders in this category attempt to avoid violent crimes.

The majority of violence associated with drug markets appears to fall into the third category – offences related to the distribution of drugs. Violence related to the distribution of drugs often results from individuals who are trafficking in illegal substances. Goldstein (1985) provided a number of examples of what he termed systemic violence. Critical to this study were the crime events that revolved around disputes related to turf. These were criminal events that were directly related to the control over ecological space that could be utilized in the distribution of drugs. Goldstein (1985) argued that violence resulting from systemic conditions were responsible for a majority of the violence associated with drugs. More importantly, systemic violence did not have a constant effect upon violence. Instead, violence was most likely when drug markets were unstable or there were disputes about control over the area (Hagedorn, 1998).

To this three-part framework, Blumstein (1995) added another category. Blumstein (1995) argued that the norms and behavior of the illicit drug market were so prominent in some communities that they were capable of influencing individuals with no direct connection to the market itself (see also Anderson, 1999). For example, gun possession was prevalent among drug dealers. This led others in the community to feel the need to possess guns for self-defense. Thus, a community-wide arms race began to influence those with no direct involvement with drug use or the drug market (Blumstein, 1995; Blumstein & Cork, 1996).

At the center of this highly localized gang activity is the street corner; part of a spatially-restricted fiefdom that can often be used to distribute drugs. It is also the location where disputes over drug deals or territoriality can lead participants resort to violence to resolve issues, theoretically inflating violence and crime levels beyond what the street corner would normally expect. The street corner is therefore the spatial unit of the study that follows.

Violence and Crime around Gang Corners

Gangs often claim large areas of physical space as their domain or turf. The use of the term "set space," however, has been recently used to refer to a much smaller area. Tita, Cohen and Engberg (2005) define set space as "the actual area within the neighborhood where gang members come together as a gang." The geographic domain of a set space is likely to be a derelict property or a street corner. Tita, Cohen, and Engberg (2005) provided two theories on the effect of set space on the surrounding crime level. One theory predicted that crime surrounding set space would be significantly higher than areas not identified as set space; the other approach suggested that the presence of gangs might have a dampening effect on local crime rates.

In addressing the crime increase theory, there are a number of possible reasons for this higher crime level. The illegal nature of the drug market makes it impossible for participants to utilize the legitimate legal system (Blumstein, 1995; Blumstein & Cork, 1996; MacCoun, Kilmer, & Reuter, 2003). Actors must then turn to violence to resolve disputes relating to turf and drug dealing (Blumstein, 1995; Goldstein, 1985; Harocopos & Hough, 2005; Levitt & Venkatesh, 2000). Violence and robbery can therefore be utilized as tools to drive competitors out of business or to protect a dealer's business interest (Chaiken & Chaiken, 1990).

High levels of violence may also be linked to an increased number of people carrying guns in and around drug markets (Blumstein, 1995; Blumstein & Cork, 1996; Goldstein, 1985). These guns serve as protection for the actors in drug transactions and can act as status symbols among individuals not directly involved. Blumstein and Cork (1996) found the presence of guns to be related to higher numbers of youth gun-related homicides; yet given the almost reflexive nature of violence associated with gang set space, the evidence supporting this position is surprisingly sparse. Tita, Cohen, and Engberg (2005: 295) point out that "little is known about the spatial distribution of violent crime or property crimes in and around gang set space".

Kennedy, Braga, and Piehl (1998) found that gang set space was associated with higher levels of several types of crime including assaults, robberies, drug offenses, and youth homicides (Kennedy, Braga, & Piehl, 1998). The methodology employed by Kennedy, Braga, and Piehl (1998) compared gang turf (often covering several blocks) to the community in which they were located. This method, however, could be classified as a meso-level analysis. Drug markets do not have clearly defined boundaries in which their effects can easily be constrained. Within a gang turf, it is likely that some corners will be more violent than others, depending on whether drugs are for sale nearby. Not all corners within a gang turf will be drug corners, and the impact on the micro-level crime patterns may change significantly. Drug markets are more often defined by an individual street intersection.

In Tita et al.'s (2005) alternative theory, set space was posited to reduce crime in the surrounding areas. Under this theory, gangs were believed to exercise social control over the surrounding areas. Gangs with effective control over a set space could prevent other offenders from entering the area (Tita et al., 2005). Drug dealers also had an economic motivation for preventing crime around their set space. In a study of gang finances, Levitt and Venkatesh (2000) found that during periods of gang wars (characterized by high levels of violence) the quantity and price of drugs sold droped by 20-30 percent. The high level of violence caused fear among customers and attracted the unwanted attention of law enforcement. Thus, drug dealers and gangs may have a vested interest in reducing the level of crime surrounding their corners (Cohen & Tita, 1999; Goldstein, 1985; Levitt & Venkatesh, 2000).

Methods

The analysis presented in the following sections aims to clarify the relationship between gang set space used for drug dealing and the surrounding level of crime in the environment. Within the competing hypotheses of drug markets being associated with higher or lower levels of crime, the weight of opinion falls largely toward higher levels of crime. This hypothesis is tested in the present study. Specifically, we test the hypothesis that street corners known to be associated with drug gangs will have greater levels of violence and property crime than non-gang corners. Secondly, it is predicted that corners associated with two or more gangs will have greater localized crime than corners associated with a single gang.

Data

The definition of gangs utilized in this study was established by the Camden County Prosecutor's Office. Recognizing the unique nature of crime in Camden, two definitions were created: one to define gangs and another to define drug organizations. A gang, for operational purposes in Camden, is defined as:

> A group of five or more people with (1) some type of structure, (2) a common identifier, (3) a goal or philosophy that binds them and (4) whose members are individually or collectively involved in criminal activity (City of Camden, n.d.).

A drug organization is defined as:

> A group of five or more people with (1) some type of structure, (2) who exist for the purpose of distribution of controlled dangerous substances and (3) whose members are individually or collectively involved in criminal activity (City of Camden, n.d., p. 2-3).

A number of features are common to both definitions. First, five or more people are required. The minimum size is justified on the basis that smaller groups would be over-inclusive of loose collections of non-gang groups. Furthermore "some type of structure" has been intentionally left vague to deal with the various methods of gang management (including solitary leaders, formal hierarchies, and committee ruled). Criminal activity is required for both gangs and drug organizations. For gangs, criminal activity is a necessity. If a gang is not associated with crime, it would not be considered a gang. Instead, the group would more appropriately be called an organization. For a drug organization, evidence of criminal activity beyond drug dealing is not a necessity. Instead, the crime tends to be systemic in nature. This definition recognizes that drug crime and non-drug crimes (i.e. murder, money laundering and fencing stolen goods) usually go hand in hand.

Drug Gang Corners

Data on the drug corners were provided by the Office of Intelligence Services in the Camden County Prosecutor's Office (CCPO) in the summer of 2006, covering the period for the preceding two years. For this analysis, gang members known to sell drugs at residential locations were excluded. The focus instead is upon the distribution of drugs in a public venue. This analysis, therefore, focused on the corner dealer involved in open-air drug markets. The street corner is the unit of analysis for this study. These data were collected through a number of sources including patrol officer observations, the display of gang tattoos, association with other known gang members, and offender self-reports. The data reflect locations where the individuals were known to sell or purchase drugs.

Drug corners were separated into two groups: single gang (dominated) corners and disputed corners. A corner was classified as a dominated corner if the records provided by the CCPO indicated that members of only one gang had been associated with the corner (n = 110). A corner was classified as disputed if multiple gangs had been known to deal drugs at the location (n = 70). The number of disputed locations may appear high, but it should be borne in mind that Camden has some of the most established and therefore potentially valuable drug corners in the region. Interviews conducted by intelligence officers suggested that turf battles were not uncommon as control of corners almost guaranteed a respectable revenue stream. Furthermore, a small number of corners transmuted from being a heroin corner to a crack-cocaine corner throughout the course of a day due to the changing demands of the market. These multi-drug corners were often disputed because different gangs ran the corner for the different drug types.

Thus, the corner changed gang possession during the day. These corners were, however, in the minority. All known drug corners were geocoded to a level in excess of 97%.

Non-drug Gang Corners

To test the first hypothesis of the paper, that there was a greater level of crime in the vicinity of drug gang corners, it was necessary to compare these sites with corners not associated with street drug activity. This was achieved by mapping all street intersections not identified as gang corners. A program was written in ArcGIS to generate the map coordinates of every street intersection in the city. The final file of intersections was mapped and checked manually. This was necessary because the program would occasionally map an intersection of an interstate route and a local road, whereas local knowledge was able to ascertain that in reality the local route passed over or under the interstate and there was no actual junction at the site. The map of all street intersections was compared to the known gang locations, and the gang locations removed from the file, leaving 1,571 street intersections as the total population of street corners with no recorded gang activity.

Recorded Crime Incidents

The crime data used in this study were collected from the Camden Police Department (CPD) records management system (RMS). The RMS is a computer database of all crime events reported to, and recorded by, the police. It is important to note that the events under study were not calls for service. For a crime event to be included in analysis, the event must have been substantiated by a responding officer, and only those crime events that could be classified as a crime according to the Federal Bureau of Investigation's (FBI) Uniform Crime Report (UCR) standards were considered in this analysis. Confirmed crime records from January 1, 2005 through December 31, 2006 were considered in this analysis. These two years of crime information contained over 12,000 unique crime events. The analyses that follow employ two dependent variables: UCR Part One violent crime (hereafter referred to as violent crime) consisting of all counts of murder, rape, robbery, and assault for 2005 and 2006; and UCR Part One property crimes (hereafter referred to as property crime) which includes all counts of burglary, theft, auto theft, and arson for 2005 through 2006.

Geocoding the data collected from the RMS could best be described as disappointing. Increasing the geocoding match rate required extensive work with the data. There appears to be no firm rule regarding a minimum acceptable hit rate though Monte Carlo simulation of degrading geocoding patterns suggests that hit rates greater than 85 percent appear to be adequate (Ratcliffe, 2004). A final hit rate in excess of 95% was achieved, and the records that were not geocoded were manually checked to confirm that no identifiable pattern of ungeocodable crime locations could be identified. It was determined that the remaining ungeocoded records were of a random spatial distribution and their omission would not significantly influence the outcome of the study.

Analysis

The following analysis occurs in two stages. The first component will utilize intensity value analysis (IVA) to estimate the intensity of crime around street corners. IVA uses an inverse

distance weighting procedure to analyze the crime surrounding a location, in this case either a drug corner or non-drug corner (Ratcliffe, 2007). The technique is similar to a buffer analysis; however where a buffer analysis simply estimates a crime count or density by counting all crime events occurring within a certain distance of a street corner, the IVA incorporates a factor to account for the relative distance of each crime event to the corner. Events are allocated a weight according to distance from the street intersection. The sum of these weightings provides an intensity measure. In this way, a measure of crime intensity rather than a simple estimate of crime density is established. Using this method, all crime occurring within a certain distance of a street corner (a distance termed a "bandwidth") are inversely weighted such that events farther from the corner contribute a lower value to the final sum for the intersection.

Because the buffers of corners will often overlap it is impossible to apply any statistical techniques to determine if differences are statically significant. For example, if street intersections are spaced at distances of around 400 or 500 feet, a common block distance in the US, then a bandwidth of 1,000 feet around each intersection will result in some crime events falling within the bandwidth of more than one corner and thus contribute a weighted value to the intensity value of more than one intersection. This violates the assumption of independent observations that is critical to the validity of most statistical tests. This does not necessarily diminish the value of IVA, however. This type of analysis provides a description of the crime surround a corner, and is particularly suited to direct comparison of street corners because the calculation criteria are identical for every intersection under examination. In other words, while direct statistical comparison is not possible, the value for each intersection is directly comparable and a visual display of crime intensity in the immediate vicinity of street intersections can be of value to policy makers and crime prevention practitioners seeking place-specific criteria for resource allocation.

A solution to the problem of observation independence is provided in the second component of the analysis. The allocation of crime events to Thiessen polygons solves the problem of statistical independence by allocating every crime event to one - and only one - intersection in the city, as well as allowing for a more detailed examination of the crime surrounding a corner. A Thiessen polygon is a special class of polygon that encloses all space that is closer to that polygon's centroid than any other polygon's centroid. A point falling within a Thiessen polygon will be closer to the polygon's centroid than to the centroid of any other polygon (Boots, 1980). Both IVA and Thiessen polygon analysis produce results that can be compared to non-gang corners. We begin with the IVA.

Intensity Value Analysis (IVA)

A standard technique in crime analysis is to estimate the number of crimes in the immediate vicinity of a location, such as a street intersection, school, or tavern (Chainey & Ratcliffe, 2005). This technique requires an analyst to construct a buffer that extends a predetermined distance from the location under examination (a distance termed a bandwidth) and count the number of crime events falling within that bandwidth. There are two significant limitations with this approach; bandwidth distance selection is arbitrary, and all crime events within the bandwidth distance contribute the same value to the final count irrespective of their distance to the location. With regard to distance selection, while environmental criminology research has emphasized the tendency for crime to cluster in proximity to certain crime attractors (Brantingham & Brantingham, 1995; McCord & Ratcliffe, 2007), little research exists from

which to justify choosing one bandwidth over another (although the use of location quotients associated with distance bands is one possibility, as demonstrated in Rengert, Ratcliffe, & Chakravorty, 2005). As a result, the selection of a bandwidth appears to be a matter of simple choice. It is this choice, however, that is a factor in the second limitation with buffer analysis.

The second limitation is that all crime events falling within the specified distance of the bandwidth are assigned the same value (usually one, if the buffer is used to simply count the number of crimes within the bandwidth). Thus, crimes at the full extent of a 1,000 foot bandwidth from an intersection would contribute the same amount to the final value for the corner as a crime that occurred right at the intersection. This lack of spatial sensitivity is often a concern for crime analysts and academic researchers alike.

To minimize the effects of these two problems, we employ IVA using a program to calculate an inverse weighting value. The program reads in locations (in our case street intersections) as x,y coordinate pairs, and crime events (also as x,y coordinate pairs). The user selects a bandwidth and a distance-weighting algorithm, and then the program assigns a crime intensity value to each intersection under examination. The value a location receives depends upon four factors: (1) the number of crime events surrounding the point, (2) the distance those events are from the point, (3) the algorithm utilized to calculate the effect of distance, and (4) the choice of bandwidth.

The necessity for the user to select a bandwidth does not eradicate the problem of an arbitrary bandwidth selection discussed above; but the use of the inverse distance algorithm does minimize the over-influence of points far from the street intersection. The program was written to offer a number of different inverse distance algorithms, including a linear option (where the weighting each crime event receives declines in a linear fashion from one at the street intersection to zero at the full extent of the bandwidth) and a quartic approach, a non-linear inverse distance algorithm favored in crime hotspot surface maps (Bailey & Gatrell, 1995; Chainey, Reid, & Stuart, 2003; Ratcliffe & McCullagh, 1999). The declining influence of crime points closer to the edge of the bandwidth effectively reduces their influence in the final intensity value for the intersection and thus reduces the influence of varying bandwidths, a problem commonly associated with the Modifiable Areal Unit Problem (Bailey & Gatrell, 1995; Openshaw, 1984; Unwin, 1996). Increasing the bandwidth would gradually include more crime locations, but their influence on the intensity value would only increase marginally. Furthermore, the IVA minimizes the impact of geocoding errors. For example; if a point close to the bandwidth of a simple buffer analysis was located within the bandwidth, it would receive a value of one; however, if it were geocoded incorrectly and fell just outside the bandwidth it would be assigned a value of zero. With IVA, the point falling outside the bandwidth would still be assigned a zero score; however the point within the bandwidth would receive only a small, fractional value. The error value between correctly and incorrectly geocoded points is thus much smaller than in a traditional buffer.

This process is demonstrated in Figure 1, where grey lines indicate a grid-like road network, a black square indicates an intersection of interest, a light grey disc indicates a bandwidth around the intersection, and small dark circles show crime event locations. The superimposed graph in (a) shows that all three crime events along the road from the intersection are assigned a value of one in a traditional buffer inquiry; however, the IVA approach (b) assigns lower scores to crime events that are farther from the intersection.

The reason events should be inversely distance weighted is because the analysis conducted here is attempting to determine the relationship between drug corners and the amount

of crime around them. Implicit in this analysis is the hypothesis that drug corners may have some influence on the crime level in the vicinity of the corner (either raising or suppressing crime), with a decaying influence as distance increases. This proposed relationship is embodied in Tobler's First Law of Geography: "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970)[1]. Qualitative research examining drug corners has found street activity and illicit business to be highly localized in nature (Simon & Burns, 1998). It therefore makes sense conceptually and theoretically that a drug corner will have a decaying effect on local crime patterns as distance from the dealing location increases. The weighting procedure utilized here is designed to capture this relationship.

Figure 1
IVA Analysis Diagram
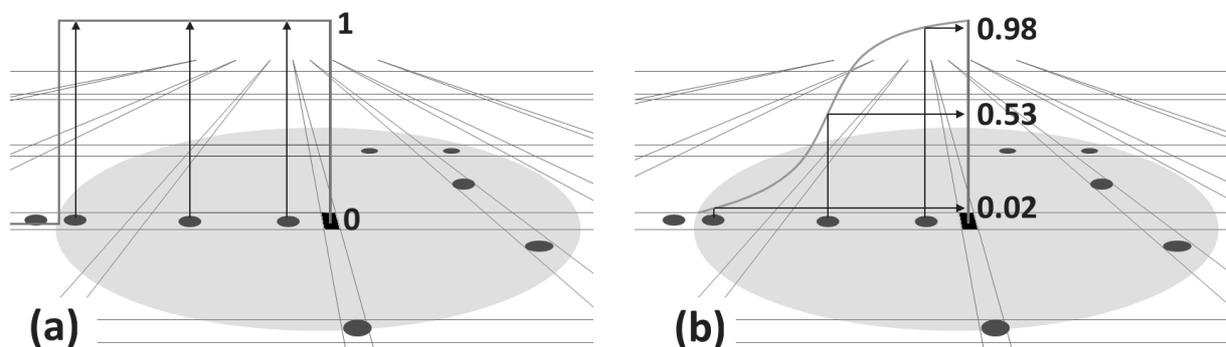
In the results that follow, we employ a 1,000 foot bandwidth representative of approximately 2½ city blocks in Camden, NJ, and a quartic non-linear distance decay algorithm. In reality, as with inverse distance weighting algorithms applied to region-wide surface maps of point events, the choice of algorithm is not crucial (Bailey & Gatrell, 1995) and analyses with different algorithms produced similar results.

IVA Results

As stated above, this analysis utilized a 1,000 foot buffer around street intersections and applied a quartic weighting technique to establish an intensity crime value around each corner. Table 1 demonstrates that from the population of all corners in the City of Camden, the mean intensity value for both violent and property crime is greater around single-gang (dominated) corners than non-gang corners, and greater again around disputed corners than around dominated gang corners.

From the perspective of the mean values, the violence around corners dominated by single gangs was 68 percent greater than corners with no drug gang activity. Disputed corners had a violence level higher by a further 41 percent, in total 137 percent greater than non-gang corners. Property crime showed a similar, though less dramatic pattern. Dominated corners were 29 percent greater than non-gang corners, and disputed corners had a mean property crime intensity value just under 50 percent greater than non-gang intersections.

[1] See also Miller (2004) and Tobler (2004)

Table 1
Mean Intensity Values for Non-Gang, Dominated and Disputed Corners

Corner Status	Violent Crime	Property crime
Non-Gang	11.48 (9.21)	32.51 (28.11)
Dominated	19.31 (16.54)	41.49 (36.38)
Disputed	27.32 (18.60)	48.15 (41.66)

Median values shown in parenthesis. Intensity values are not an indication of the volume of crime within the bandwidth of corners, but are instead a combination of crime event volume and proximity.

Figure 2 presents the frequency distribution of values for violent and property crime, showing the substantial positive skew found in both distributions. Figure 2 also shows that, even in a city such as Camden, the intensity value for violent crime is low around most corners and that violent events are concentrated around a small number of corners. The property crime intensity values have a distribution that tends to suggest property crime is a more common occurrence around more corners in Camden.

Figure 2
Frequency Distribution of Distance-Weighted Values for Violent and Property Crimes.
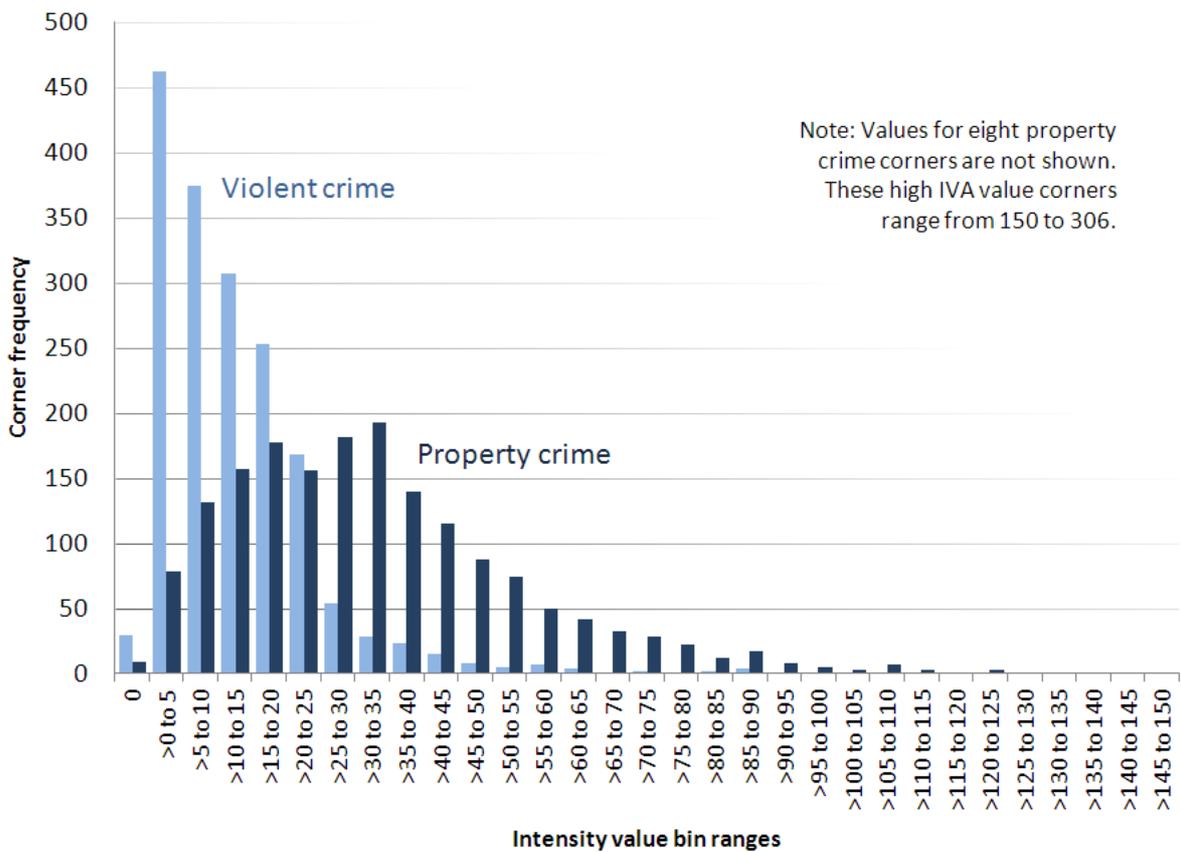
Intensity value analysis provides a unique view into the criminal activity surrounding the location under study by providing an intensity value for each corner. Where, until now, only density values have been available, this analysis is capable of determining where crime is higher or lower in relation to some comparison group (i.e. non-gang corners). In this regard, intensity value analysis could prove to be particularly useful to police operations and the direction of crime prevention resources. We were able to use this approach to estimate crime intensity values for different gangs. Table 2 shows that this approach can be used to estimate the intensity of crime around drug-gang corners in Camden. The figures show that the corners forming the set space of different gangs have differing levels of violent and property crime. For example, it can be seen in Table 2 that the intensity of robbery is greater around Latin King gang corners than around corners of other gangs. Furthermore, based on the drug findings alone, one might be tempted to target the Neta gang over the Five Percenters gang, Neta corners have a lower intensity of burglary and robbery.

Table 2
Average Crime Intensity across Crime Types for Different Gang-dominated Corners

Average Crime Intensity 2005-2006	All Crime	Burglary	Drug	Robbery	Violent
Bloods corners (40)	148.42	10.50	28.81	9.92	22.10
Five Percenters corners (10)	138.53	9.34	21.38	8.22	18.75
Latin Kings corners (10)	146.52	8.11	38.30	11.27	22.86
Neta corners (28)	122.02	7.31	28.37	6.79	16.71
Non-gang corners (1571)	83.57	6.88	9.59	5.31	11.48

Numbers in parenthesis indicate the number of dominated corners associated with each gang. Only the most numerous four gangs shown, along with the mean score for non-gang corners.

While this procedure provides both a more robust method for assessing the intensity of crime around street corners and an approach that has direct operational benefits for targeted crime control activity, it does have one minor limitation. It is usually unable to produce values that can be used in a more rigorous statistical distinction between drug corners and non-drug corners. One of the basic requirements of any statistical analysis is the independence of the underlying observations. Values created with the IVA method often cannot meet this statistical assumption. For example, the bandwidth distance of two neighboring drug corners will very often overlap. Any crime event falling within this overlapping bandwidth area will contribute some value to both corners, and often more corners if a wide bandwidth is chosen. Because the values produced are not independent, IVA results should not be used in any statistical test unless it can be guaranteed that individual crime events will not fall within more than one bandwidth circle. If more stringent statistical tests are desired (say, for example, to compare mean differences or to control for neighborhood characteristics), other methods of allocating crimes to corners must be used. Thiessen polygons solve this problem of independence.

Thiessen Polygon Analysis

All space internal to a Thiessen polygon is closer to that polygon's centroid than to any other polygon's centroid (Aurenhammer, 1991; Boots, 1980; Byers, 1996; Chainey & Ratcliffe, 2005). It is possible to use every street intersection as the centroid of a Thiessen polygon and thus create a lattice of polygons that enclose each street corner. In the context of crimes and drug

corners, Thiessen polygon will encircle all crime events that are closest to the corner under study (as shown in Figure 3).

Figure 3
Example of Thiessen Polygon
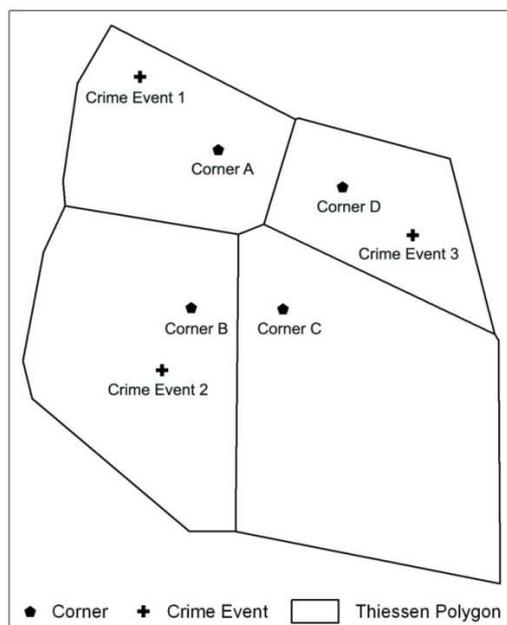
In Figure 3, the territory surrounding four street corners (indicated by pentagon corners A-D) is disaggregated by Thiessen polygons based on the street corner data points that are new territories in which all internal spaces of the polygon are closer to the internal street corner than any other corner. In this way, each crime event (shown as a cross) is assigned to one, and only one, corner; its nearest corner. In Figure 3, four Thiessen polygons have been created around four street corners. Crime events thus fall within one, and only one, polygon and in this way can be assigned to the nearest corner. With an IVA analysis, crime events 2 and 3 might have fallen within the bandwidth of corner C if the user selected a wide bandwidth; the use of Thiessen polygons, however, corrects for this possibility of overlap.

For this study a Thiessen polygon was constructed around each street intersection in the City of Camden. Individual crime events were then counted within each polygon. Unlike the earlier analysis, this analysis summed the crime events within each polygon because the compact urban environment of Camden creates polygons that are quite small in size, and generally much smaller than the area of a 1000 foot bandwidth buffer. This allocation process enabled further statistical analysis; however, because the count distribution of crime surrounding the corners did not follow a normal distribution, the crime values generated by the Thiessen polygons were analyzed using negative binomial regression. The purpose of this was to cope with an overdispersion of zero values due to a large number of corners that did not have any crimes in close proximity.[2] Negative binomial regression was chosen over a Poisson model because of the

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[2] The presence of a large number of zero cases often, but not always, indicates that the model should be specified as zero-inflated. A zero-inflated analysis specifies separate models for cases with zero values and cases with values other than zeros. Statistical tests indicated that a zero-inflated model was not appropriate for the dataset analyzed here.

presence of overdispersion among the violent crime ($G^2 = 2353.49$, p < 0.001) and property crime ($G^2 = 7897.51$, p < 0.001) dependent variables[3] (Long & Freese, 2006).

To determine the contributing effect of corner status, two dummy variables were created. A single gang dummy variable was coded so that 0 = non-gang or multi-gang (disputed) corners and 1 = sing-gang dominated corners. A multi-gang dummy variable was coded so that 0 = non-gang corners and single-gang dominated corners and 1 = multi-gang (disputed) corners. Using this coding scheme the non-gang corners become the reference group from which other corner classifications are compared. The single-gang dominated dummy represents the unique effect of being a single gang corner. The disputed dummy represents the unique effect of being associated with multiple gangs.

Two further measures were included in the analysis: an area measure to control for polygon size, and a spatial lag value to control for spatial autocorrelation. To confirm the need for a spatial lag variable, a univariate global Moran's I was performed on both violent crime and property crime dependent variables. The global Moran's I for violent crime (0.083, p < 0.001) and property crime (0.060, p < 0.001) indicate significant positive spatial clustering. We therefore corrected for spatial clustering through the use of a two-stage least squares spatial lag described by Land and Deane (1992). The first stage assigns each polygon a crime value based on the number and distance to all crime events in the population (termed the generalized population-potential). In the second stage, the generalized population-potential is predicted with variables theoretically unrelated (the generalized clean instrument) to the study being conducted. The predicted values from this regression model are saved and utilized as the spatial lag term.

The generalized clean instrument for the violent crime spatial lag model was comprised of a police sector dummy, the median year the building/structures were built, the percentage of households with five or more rooms, the percentage of people living in family households, the percentage of households occupied by three or more people, a dummy variable for commercial land use, and the x-centroid of the Thiessen polygon. The R-squared for the violent crime regression model was 0.631. The generalized clean instrument for the property crime lag variable was comprised of police sector dummy variables, the median year the building/structures were built, the percentage of households with five or more rooms, the percentage of people living in family households, the percentage of households occupied by three or more people, the percentage of people with commute time less than 30 minutes, a dummy variable for commercial land use, and the x-centroid and y-centroid of the Thiessen polygon. The R-squared for the property crime regression model was 0.590.

Thiessen Polygon Analysis Results

While the IVA indicated differences between the types of corner existed, negative binomial regression was utilized to determine if statistically significant differences existed between non-gang, single-gang, and multi-gang corners. The coefficients from this regression can be converted into incident rate ratios (IRR), as is shown in Table 3. IRRs are useful for their ease of interpretation. For the violent crime analysis, the single-gang dummy variable had an IRR value of 2.104. This indicates that being classified as a single gang increases the chance of

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[3] The G^2 statistic is computed to test for overdispersion. The G^2 statistic is computed with the formula $G^2 = 2(\text{lnLNBRM} - \text{lnLPRM})$ where lnLNBRM is equal to the log likelihood-ratio of the negative binomial model and lnLPRM is equal to the log likelihood-ratio of the Poisson model.

having a violent crime within the Thiessen polygon by 110 percent when compared to non-gang corners. The effect of multi-gang corners is even larger. Multi-gang corners are 187 percent more likely to have a violent crime event in the Thiessen polygon when compared to non-gang corners.

Table 3
Results of Negative Binomial Regression with Violent Crime as Dependent Variable

Violent Crime Count	IRR	Std. Error	Z	95% Confidence Interval	
Dominated dummy	2.104*	0.285	5.50	1.613	2.742
Disputed dummy	2.866*	0.477	6.34	2.069	3.970
Spatial lag	1.232*	0.043	5.92	1.150	1.320
Area	1.000	1.38E-06	0.58	1.000	1.000

* $P < 0.001$ Coefficients have been converted to incident rate ratios to simplify interpretation.

This relation also holds for property crimes (Table 4). Single-gang corners show a significant increase in the probability of a property crime when compared to non-gang corners. Disputed corners have an even greater probability of having a property crime within the borders of a corner's Thiessen polygon.

Table 4
Results of Negative Binomial Regression with Property Crime as Dependent Variable

Property Crime Count	IRR	Std. Error	Z	95% Confidence Interval	
Dominated dummy	1.636*	0.199	4.05	1.289	2.077
Disputed dummy	1.780*	0.270	3.80	1.322	2.396
Spatial lag	1.167*	0.034	5.26	1.102	1.236
Area	1.000*	1.40e-06	3.61	1.000	1.000

* $P < 0.001$ Coefficients have been converted to incident rate ratios to simplify interpretation.

The differences between non-gang corners and the dominated and disputed gang corners can be demonstrated graphically, as shown in Figure 4. The modal class for non-gang corners can be seen to be in the range of intensity values greater than 0 but less than 5, while dominated corners peak at the >15 to 20 range of intensity values. Although disputed corners have a modal range of >10 to 15, there are a greater number of disputed corners in the higher ranges, explaining the finding from the Thiessen polygon analysis.

Discussion and Limitations

The findings of both types of analysis support the same conclusions: that crime around single-gang corners is higher than crime around non-gang corners and crime around multi-gang. Furthermore, crime around disputed corners is even higher than crime around single-gang corners. This relationship is true of both UCR Part One violent crimes and UCR Part One property crimes. These findings support qualitative research suggesting violence is likely around areas where conflict over territory exists (Hagedorn, 1994).

Law enforcement tactics have often focused on disrupting and incapacitating illegal gangs. The primary focus of these strategies is upon the gang member and the gang as a unit (see for example Ratcliffe & Guidetti, 2008). The results of the current analysis suggest alternative

approaches to dealing with illegal gang activity. Instead of focusing upon the gang, law enforcement may be better served by focusing upon the location. Law enforcement focus upon a single gang is likely to have a number of influences on local crime. Disruption of one gang is likely to leave their corners in limbo, possibly creating disputes over territory. While removal of the original gang might initially seem like a victory, failing to address the reasons why that corner was attractive to the sale of drugs will leave an attractive drug retail location available to the dynamics of the open market. The corners formerly controlled by a single gang may become disputed territory. The results here suggest that if corners were to become disputed territory, a significant increase in crime is likely to occur. This suggests that, rather than a focus on disrupting a gang, a focused program of location denial strategies may be more effective in controlling high crime locations.

Figure 4
Frequency Distribution of Distance-Weighted Values for Violent Crime around Non-Gang, Dominated and Disputed Corners (Percentages of Each Series Indicated)
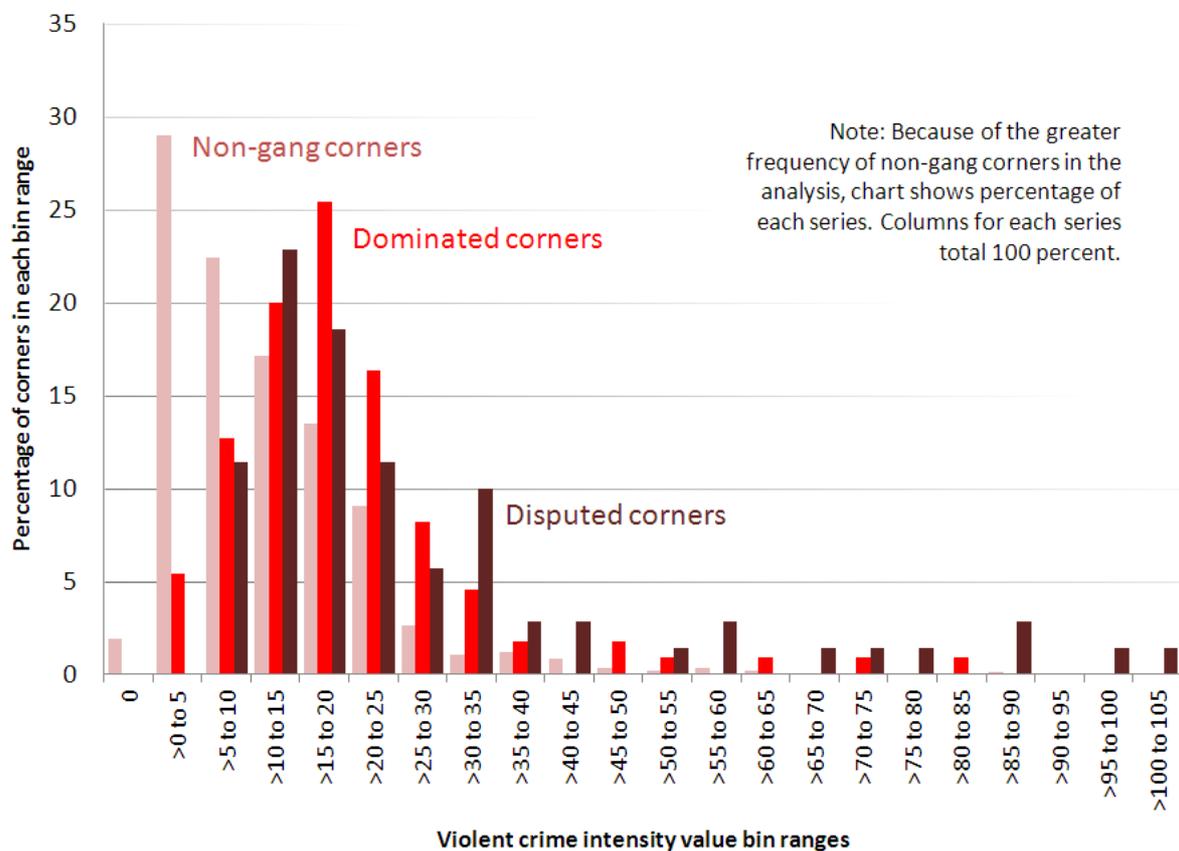
Location denial strategies can come in a number of different forms. While a detailed review of these police methodologies is beyond the scope of this paper, some methods are worth addressing. Methods of location denial run the spectrum of cost and practicality. Traditional methods of location denial include placing a police officer at a specific location 24 hours a day (Lawton et al., 2005), though the cost of such programs can quickly become prohibitive. Other techniques include improving lighting and landscaping in an effort to make locations less desirable for criminal activity (Clarke, 1995; Painter & Farrington, 1999; Pease, 1999). More

inventive municipalities have attempted to reduce the presence of gangs at specific locations through the use of classical music ("Tacoma hopes Brahms drives the bad guys away," 2007, July 31); and closed circuit television cameras have also been utilized in an attempt to keep specific locations secure from crime and criminals (Ratcliffe, 2006).

Several limitations of the present analysis should be pointed out. From a methodological point of view, while a significant improvement over previous attempts, the approaches used in the present research are not ideal. The first, and most important, limitation is the inability of the methodologies to provide causal ordering. One theory argues that the presence of a drug corner increases the amount of crime in the surrounding area. Alternatively, it is also plausible that a high level of crime leads to the development of the drug markets. This second conception would argue that gangs set up drug distribution in areas specifically chosen because of the lack of informal social control mechanisms (Tita et al., 2005). A cross-sectional approach is unable to remedy this limitation; however, the most likely theoretical explanation is a combination of both views. Broken Windows Theory (Wilson & Kelling, 1982), for example, states that crime is likely to occur in areas with low informal social control. People are unwilling to engage their neighbors in social contact. This leads to the development of further crime problems and a further weakening of informal social control. In Camden, the lack of social control may have contributed to the establishment of drug dealing corners, thereby further weakening the community's ability to regulate crime.

As with any analysis, the result can be only as good as the data on which it is based. The limitations of official records of crime are well-documented (Biderman & Reiss, 1967; Gottfredson, 1986). Other limitations revolve around the realization that there is little way to associate a crime event with a drug corner. Crimes may arise that have no association at all with the drug corner. Proximity to the drug corner, however, is enough to be included in the analysis even though proximity to the corner is potentially incidental. We are unable to partial out the effects of crimes related (directly or indirectly) to the drug corner with those that have no relationship to the illicit activities undertaken at the target site. It is also not possible to determine if the crimes are occurring during times when drug sales are actively taking place. It may be that a corner is particularly active and it is, therefore, reasonable to ascribe crimes occurring at any time to that particular corner. It may be, however, that a corner is only active for a short amount of time per day or only a fixed period of time during the year. In this case, it may be less reasonable to ascribe all the surrounding crime to the "drug corner effect."

Other issues with data surround the veracity of the information on drug distribution locations. The drug dealing locations were identified, in part, through the self-report of the gang members involved in the distribution (though mainly through arrest records and the observations of law enforcement officers). Though there is no way to assess the accuracy or honesty of reporting gang members, research in other areas has found promising results as to the accuracy of self-report data from gang members. For example Webb, Katz, and Decker (2006) found self-reported drug use among gang members to be a valid measure of actual drug use (determined through urinalysis testing). While in no way conclusive, evidence such as this provides support for the accuracy of the data used here.

A more damning, if not more supportable, criticism is that drug dealers (and drug users, police officers, social workers, etc) only have a limited knowledge of the drug market. As Coomber (2004) states "the problem arises when one considers exactly what these individuals actually 'know' about the drug markets in their respective areas… which in reality can amount to very little." A defense, and the one taken here, is that gang members were only asked about the

location at which they, as an individual, dealt drugs. Gang members were not asked to provide locations about every location of drug dealing within the city. Instead, specific questions about their own individual drug dealing locations were asked. To dismiss this knowledge as unreliable is, in reality, to dismiss all self-report data.

From the perspective of the spatial methodology, both techniques employed here have limitations, but also bring strengths to the analysis of street corner drug gang activity and crime. The IVA approach reduces the influence of arbitrary buffer selection by reducing the differential between the aggregate score contribution of crime events that are close to either side of the bandwidth distance. Whereas with a traditional buffer, a point within the buffer scored one and a nearby point a few feet away on the other side of the buffer scored zero, the approach used in the present research minimizes the difference between these values. This solution, while elegantly solving problems of abrupt bandwidth effect and geocoding errors, does not entirely resolve the issue of an appropriate bandwidth choice. The decision is still an arbitrary one, albeit one where changes in bandwidth have a reduced influence on final intensity values. The benefits of the present approach – the effective creation of an intensity value rather than a simple density measure – are still significant.

The Thiessen polygon approach resolves issues of independence that inhibit most statistical tests; however, again the Thiessen polygon approach is not ideal. The sizes of polygons are dictated by the size and distribution of the street network. Therefore, while this approach removes the arbitrary buffer distance choices facing the user, the result is a polygon creation process that is unable to incorporate any subjective knowledge or experience of the user. In effect, street planners, from the time of creation of the city street network, determine the eventual size of polygons. In the absence of a technique such as the Thiessen polygon approach shown here, standard circular buffers may be acceptable for a city of a rigid grid square layout. Most cities have rectangular or irregular blocks however. The advantage of the approach shown here is that the Thiessen polygon method adapts to the shape of the urban environment and is suitable for any city or town.

With these important caveats in mind, the current study has still been able to approach the issue of crime in the immediate vicinity of known drug-gang corners with two different approaches to spatial interpretation that may be an improvement over traditional buffer approaches. The next breakthrough in this field is likely to be a robust methodology to estimate the spatial range that locations such as drug-gang corners have over local crime levels. Such knowledge would help determine appropriate bandwidth distances for IVA parameters and would inform crime prevention tactics.

Conclusion

Gangs have been recognized as a persistent crime problem in America for the better part of a century. Investigation of gangs and their relationship to drug distribution has also been well established. What remains less investigated is the relationship between open-air drug dealing and its influence on the community. This article has presented two methods with which to investigate this relationship. Neither method provides a perfect view on the relationship between markets and crime, yet each provides valuable information about the relationship that other methods are not able to tease out. Further work is still required to control for neighborhood demographics and socio-economic conditions, and more importantly, to quantify the spatial range over which drug-gang activity maintains an influence on community quality of life. The answer to the latter may

be one of the most valuable contributions that spatial criminologists can make to focused crime prevention tactics.

Acknowledgements

References

Anderson, E. (1999). *Code of the street: Decency, violence, and the moral life of the inner city*. New York: W.W. Norton & Company.

Anglin, M.D., & Speckart, G. (1988). Narcotics use and crime: A multisample, multimethod analysis. *Criminology, 26*(2), 197-233.

Aurenhammer, F. (1991). Voronri diagrams- A survey of a fundamental geometric data structure. *ACM Computing Surveys, 23*(3), 345-405.

Bailey, T.C., & Gatrell, A.C. (1995). *Interactive Spatial Data Analysis* (Second ed.). London: Longman.

Ball, R., & Curry, G.D. (1995). The logic of definition in criminology: Purposes and methods for defining "gangs". *Criminology, 33*(2), 225-245.

Biderman, A.D., & Reiss, A.J.J. (1967). On exploring the "dark figures" of crime. *Annals of the American Academy of Political and Social Science, 374*(Combating Crime), 1-15.

Block, R. (2000). Gang activity and overall levels of crime: A new mapping tool for defining areas of gang activity using police records. *Journal of Quantitative Criminology, 16*(3), 369-383.

Blum, R.H. (1967). Drugs, behavior, and crime. *Annals of the American Academy of Political and Social Science, 374*, 135-146.

Blumstein, A. (1995). Youth violence, guns, and the illicit-drug industry. *The Journal of Criminal Law & Criminology, 86*(1), 10-36.

Blumstein, A., & Cork, D. (1996). Linking gun availability to youth gun violence. *Law and Contemporary Problems, 59*(1), 5-24.

Boots, B.N. (1980). Weighting Thiessen polygons. *Economic Geography, 56*(3), 248-259.

Brantingham, P., & Brantingham, P. (1995). Criminality of place: Crime generators and crime attractors. *European Journal of Criminal Policy and Research, 3*(3), 5-26.

Byers, J.A. (1996). Correct calculations of Dirichlet polygon areas. *The Journal of Animal Ecology, 65*(4), 528-529.

Chaiken, J.M., & Chaiken, M.R. (1990). Drugs and predatory crime. *Crime and Justice, 13*, 203-239.

Chainey, S., & Ratcliffe, J.H. (2005). *GIS and crime mapping*. London: John Wiley and Sons.

Chainey, S., Reid, S., & Stuart, N. (2003). When is a hotspot a hotspot? A procedure for creating statistically robust hotspot maps of crime. In D.B. Kidner, G. Higgs & S.D. White (Eds.), *Socio-Economic Applications of Geographic Information Science* (pp. 21-36). London: Taylor and Francis.

City of Camden. (n.d.). *Section 1: Our definitions*.

Clarke, R.V. (1995). Situational crime prevention. *Crime and Justice, 19*, 91-150.

Cohen, J., & Tita, G. (1999). Diffusion in homicide: Exploring a general method for detecting spatial diffusion processes. *Journal of Quantitative Criminology, 15*(4), 451-493.

Coomber, R. (2004). Drug use and drug market intersections. *Addiction Research and Theory, 12*(6), 501-505.

Craddock, A., Collins, J.J., & Timrots, A. (1994). *Fact sheet: Drug-related crime* (Vol. NCJ-149286). Washington D.C.: Bureau of Justice Statistics.

Criminal Intelligence System Operating Policies, 28 CFR Part 23 (1981).

Cromwell, P., Taylor, D., & Palacios, W. (1992). Youth gangs: A 1990s perspective. *Juvenile & Family Court Journal, 43*(3), 25-32.

Fleisher, M.S. (1995). *Beggars & Thieves*. Madison, WI: The University of Wisconsin Press.

Goldstein, P.J. (1985). The drugs/violence nexus: A tripartite conceptual framework. *Journal of Drug Issues, 39*, 143-174.

Gottfredson, M.R. (1986). Substantive contributions of victimization surveys. *Crime and Justice, 7*, 251-287.

Hagedorn, J.M. (1994). Neighborhoods, markets, and gang drug organizations. *Journal of Research in Crime and Delinquency, 31*(3), 264-294.

Hagedorn, J.M. (1998). Gang violence in the postindustrial era. *Crime and Justice, 24*, 365-419.

Harocopos, A., & Hough, M. (2005). Drug dealing in open-air markets. *Problem-Oriented Guides for Police; Problem Specific Guides Series, 31*.

Horowitz, R., & Schwartz, G. (1974). Honor, normative ambiguity and gang violence. *American Sociological Review, 39*(2), 238-251.

Jackson, M.S. (2003). Law enforcement officers' response to illegal street gang activity. In A.R. Roberts (Ed.), *Critical Issues in Crime and Justice* (2 ed.). Thousand Oaks, CA: Sage Publications, Inc.

Kennedy, D.M., Braga, A.A., & Piehl, A.M. (1998). The (un)known universe: Mapping gangs and gang violence in Boston. In D. Weisburd & T. McEwen (Eds.), *Crime Mapping & Crime Prevention* (Vol. 8, pp. 219-262). New York: Willow Tree Press, Inc.

Land, K., & Deane, G. (1992). On the large-sample estimation of regression models with spatial effect terms: A two-stage least squares approach. *Sociological Methodology, 22*, 221-248.

Lawton, B.A., Taylor, R.B., & Luongo, A.J. (2005). Police officers on drug corners in Philadelphia, drug crime and violent crime: Intended, diffusion, and displacement impacts. *Justice Quarterly, 22*(4), 425-451.

Levitt, S.D., & Venkatesh, S.A. (2000). An economic analysis of a drug-selling gang's finances. *The Quarterly Journal of Economics, 115*(3), 755-789.

Ley, D., & Cybriwsky, R. (1974). Urban graffiti as territorial markers. *Annals of the Association of American Geographers, 64*(4), 491-505.

Long, J.S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata* (Second ed.). College Station, TX: Stata Press Publication.

MacCoun, R., Kilmer, B., & Reuter, P. (2003). Research on drugs-crime linkages: The next generation. *In Toward a Drugs and Crime Research Agenda for the 21st Century* (pp. 65-95). Washington, D.C.: U.S. Department of Justice.

Maher, L., & Dixon, D. (1999). Policing and public health: Law enforcement and harm minimization in a street-level drug market. *British Journal of Criminology, 39*(4), 488-512.

Mazerolle, L., Soole, D., & Rombouts, S. (2007). Drug law enforcement: A review of the evaluation literature. *Police Quarterly, 10*(2), 115-153.

McCord, E., & Ratcliffe, J.H. (2007). A micro-spatial analysis of the demographic and criminogenic environment of drug markets in Philadelphia. *Australian and New Zealand Journal of Criminology, 40*(1), 43-63.

Miller, H.J. (2004). Tobler's first law and spatial analysis. *Annals of the Association of American Geographers*, 94(2), 284-289.

Morgan Quitno Press. (2006). *City Crime Rankings 2006* (13th ed.). Lawrence, KS: Morgan Quitno Press.

Muir, W.K. (1977). *Police: Streetcorner Politicians*. Chicago: University of Chicago Press.

Newburn, T., & Elliott, J. (1998). Police anti-drug strategies: tackling drugs together three years on. *Police Research Group: Crime Detection and Prevention Series, Paper 89*, 1-55.

NJSP. (nd). *Gangs in New Jersey: Municipal Law Enforcement Response to the 2004 and 2001 NJSP Gang Surveys*. Trenton, NJ: New Jersey State Police Intelligence Services Section.

Nunn, S., Quinet, K., Rowe, K., & Christ, D. (2006). Interdiction day: Covert surveillance operations, drugs, and serious crime in an inner-city neighborhood. *Police Quarterly, 9*(1), 73-99.

Openshaw, S. (1984). The modifiable areal unit problem. *Concepts and Techniques in Modern Geography, 38*, 41.

Painter, K., & Farrington, D.P. (1999). Street lighting and crime: Diffusion of benefits in the Stoke-On-Trent project. *Crime Prevention Studies, 10*, 77-122.

Parker, R. N., & Auerhahn, K. (1998). Alcohol, drugs, and violence. *Annual Review of Sociology, 24*, 291-311.

Pease, K. (1999). A review of street lighting evaluations: Crime reduction effects. *Crime Prevention Studies, 10*, 47-76.

Ratcliffe, J.H. (2004). Geocoding crime and a first estimate of a minimum acceptable hit rate. *International Journal of Geographical Information Science, 18*(1), 61-72.

Ratcliffe, J.H. (2006). Video surveillance of public places. *Problem-Oriented Guides for Police; Response Guides Series, 4*, pp. 100.

Ratcliffe, J.H. (2007). Buffer Intensity Calculator (Version version 2.3) [Computer Program]. Philadelphia, PA: Temple University.

Ratcliffe, J.H., & Guidetti, R.A. (2008). State police investigative structure and the adoption of intelligence-led policing. *Policing: An International Journal of Police Strategies & Management*, 31(1).

Ratcliffe, J.H., & McCullagh, M.J. (1999). Hotbeds of crime and the search for spatial accuracy. *Geographical Systems, 1*(4), 385-398.

Rengert, G.F., Ratcliffe, J.H., & Chakravorty, S. (2005). *Policing Illegal Drug Markets: Geographic Approaches to Crime Reduction*. Monsey, NY: Criminal Justice Press.

Sheptycki, J., & Ratcliffe, J.H. (2004). Setting the strategic agenda. In J.H. Ratcliffe (Ed.), *Strategic Thinking in Criminal Intelligence* (pp. 194-216). Sydney: Federation Press.

Simon, D., & Burns, E. (1998). *The corner: A year in the life of an inner-city neighborhood.* New York: Broadway.

Tacoma hopes Brahms drives the bad guys away. (2007, July 31). *Seattle Post-Intelligencer, 2007,* Retrieved August 1, 2007 from: http://seattlepi.nwsource.com/local/6420AP_WA_Bus_Stop_Mozart.html.

Thorberry, T.P., & Burch II, J.H. (1997). Gang members and delinquent behavior. *Office of Juvenile Justice Delinquency and Prevention: Juvenile Justice Bulletin.*

Thrasher, F.M. (1927). *The gang: A study of 1,313 gangs in Chicago* (4th ed.). Chicago: The University of Chicago Press.

Tita, G., Cohen, J., & Engberg, J. (2005). An ecological study of the location of gang "set space". *Social Problems, 52*(2), 272-299.

Tobler, W.R. (1970). A computer movie simulating urban growth in the Detroit region. *Economic Geography, 46*, 234-240.

Tobler, W.R. (2004). On the first law of geography: A reply. *Annals of the Association of American Geographers*, 94(2), 304-310.

Tonry, M. (1990). Research on drugs and crime. *Crime and Justice, 13*, 1-8.

Topalli, V., Wright, R., & Fornango, R. (2002). Drug dealers, robbery and retaliation: Vulnerability, deterrence and the contagion of violence. *British Journal of Criminology, 42*(2), 337-351.

Unwin, D.J. (1996). GIS, spatial analysis and spatial statistics. *Progress in Human Geography, 20*(4), 540-551.

Webb, V.J., Katz, C.M., & Decker, S.H. (2006). Assessing the validity of self-reports by gang members: Results from the Arrestee Drug Abuse Monitoring Program. *Crime & Delinquency, 52*(2), 232-252.

Wilson, J.Q., & Kelling, G.L. (1982). Broken windows. *The Atlantic Monthly, 249*(3), 29-37.