



# Gang violence predictability: Using risk terrain modeling to study gang homicides and gang assaults in East Los Angeles

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## ABSTRACT

**Purpose:** The current study investigates the application of risk terrain modeling (RTM) to forecast gang violence. RTM is routinely utilized to predict future criminal events in micro-units (i.e., city blocks) based upon features of the physical environment. The particular focus of the current study is RTM's ability to separately predict future gang assaults and gang homicides in the Los Angeles Police Department's (LAPD) Hollenbeck Community Policing Area.

**Method:** Guided by the existing gang literature and knowledge of the region, 22 environmental risk factors are anticipated to spatially influence gang assaults and gang homicides. An RTM is established for 2009 gang assaults and 2009–2011 gang homicides. The RTM is then used to predict 2012 gang assaults and 2012 gang homicides respectively.

**Results:** Places most at risk of experiencing a gang assault are in close proximity to where gang members are frequently observed loitering by police and Metro rail stops while also contending with residential concentrations of local gang members. Areas most at risk of experiencing a gang homicide cope with residential concentrations of local gang members and gang set space. The ability for RTM to successfully forecast future gang violence may be limited.

**Conclusions:** RTM is able to successfully identify and evaluate meaningful environment risk factors that spatially influence gang assaults and gang violence. However, the ability for RTM to successfully forecast future gang violence may be limited.

## 1. Introduction

For over two decades the United States has been experiencing a downward trend in overall patterns of violence. However, throughout many urban centers gang-related violence is a regular occurrence and remains a pressing issue for local law enforcement in many urban centers (Leovy, 2015; Papachristos, 2014; Petersen, 2016). For instance, approximately 85% of gang-related homicides in the United States take place in large cities with a population over 100,000 or in proximate suburban counties (NGC, 2017). Howell and Griffiths (2018) demonstrate this trend by analyzing gang-related homicides from 1996 to 2012 in 248 cities with a population over 100,000 residents. They find that in the majority of sampled cities (65.3%) gang-related homicides account for 30 to 40% of total homicides annually (Howell & Griffiths, 2018). While the overall rate of violence is declining, the persistence of gang-related violence in many urban areas has increased the likelihood that a violent act will be gang-related (Papachristos, 2013; Valasik, Barton, Reid, & Tita, 2017).

Much of the existing research on gang violence focuses its attention

on differentiating between the micro-level characteristics of gang and non-gang homicides, such as the features of the participants or the incident (e.g., Maxson, Gordon, & Klein, 1985). More recent studies have addressed a lacuna in the gang homicide literature by analyzing the relationship of structural covariates with gang homicide at the neighborhood-level (Valasik et al., 2017) and at the city-level (Pyrooz, 2012). While micro- and macro-level studies greatly contributed to a better understanding of gang violence, research on how characteristics of the physical environment influence gang violence remains limited. Given that gangs have a strong geographic/territorial-based orientation it is important to gauge what environmental characteristics contribute to an area being spatially vulnerable to future acts of gang violence. One approach to ascertain which areas are at greater risk to gang violence is by using a spatial diagnostic technique known as risk terrain modeling (RTM).

RTM is “the merging together of key concepts from environmental criminology and spatial analysis” (Caplan & Kennedy, 2016: 11). RTM is an analytical tool capable of identifying statistically significant features of the physical landscape or built environment and their

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interaction with each other in relation to an outcome incident (e.g., gang homicide, robbery, carjacking, etc.) which contributes to risk-level of a place (Caplan & Kennedy, 2016). Environmental criminology (Brantingham & Brantingham, 1995) refers to these risky places as being a crime attractor or a crime generator, which spatially influences the crime patterns in an area. These criminogenic places attract or generate crime when motivated offenders converge in space and time with a suitable target in the absence of a capable guardian (Cohen & Felson, 1979). By calculating a relative risk score, RTM is able to diagnose the spatial influence of those environmental risk factors that significantly influence crime, with larger values corresponding to a greater likelihood that a particular area will experience a criminal event (Caplan, Kennedy, Barnum, & Piza, 2013). Thus, RTM provides a systematic approach that can help provide answers about why particular places are at greater risk of experience crime than others.

The primary use of RTM focuses on predicting future criminal incidents in micro-units (i.e., city blocks) (see Dugato, Calderoni, & Berlusconi, 2017; Garnier, Caplan, & Kennedy, 2018; Giménez-Santana, Caplan, & Drawve, 2018; Kennedy, Caplan, Piza, & Buccine-Schraeder, 2016). Despite gangs having a strong spatial orientation toward a particular area (i.e., their claimed turf) (see Valasik & Tita, 2018), research has not yet utilized RTM to analyze what makes a particular area spatially vulnerable to future acts of gang violence. The current study addresses this gap in the literature by being the first to use RTM to identify the spatial correlates of gang violence, specifically gang assaults and gang homicides.

### 1.1. Review of the literature

#### 1.1.1. Spatial distribution of gang violence

The importance of space in influencing the geographic distribution of crime and violence has been a steadfast topic in the field of criminology. This has particularly been the case for gang research dating back to Thrasher (1927). However, it is not until the early 1990s and the emergence of desktop geographic information system (GIS) software that allows researchers, practitioners, and policymakers the ability to expediently map the distribution of crime to begin to examine the presence of spatial relationships with other neighborhood features (e.g., the turfs of local street gangs) (Anselin, Cohen, Cook, Gorr, & Tita, 2000; Block, 2000). This advancement in GIS technology concurs with the homicide epidemic, the number of yearly homicides in the United States rose to a high of 24,700 in 1991, and the spreading of street gangs within “chronic” gang cities and to “emergent” gang cities (Howell, Egley Jr., Tita, & Griffiths, 2011; Howell & Griffiths, 2018; Spergel & Curry, 1993). Improvements in GIS allow researchers to investigate the impact gangs have on the diffusion of violence, particularly homicide (Cohen & Tita, 1999; Rosenfeld, Bray, & Egley, 1999; Morenoff & Sampson, 1997; Tita & Cohen, 2004). The use of spatial analysis to better understand gang-related violence is appropriate because of two defining features: 1) gangs have a strong geographic orientation (i.e., territorial focus) and 2) the retaliatory nature of gang violence (Tita & Radil, 2011; Valasik et al., 2017).

The focus of gang scholars on the spatial clustering of gang violence has resulted in the majority of attention being paid to the macro-level predictors of gang behavior. Such studies analyze the influence of gangs not only on the correlates of gang violence at the neighborhood- or city-level (Curry & Spergel, 1988; Maxson, Curry, & Howell, 2002; Papachristos & Kirk, 2006; Rosenfeld et al., 1999) but also on aggregate levels of violence (Pyrooz, 2012). Criminological explanations at the neighborhood-level stress the geographic concentration of individual and community features in order to understand patterns in gang homicide (Bursik & Grasmick, 1993). Curry and Spergel (1988) use a social disorganization framework and hypothesize that neighborhoods characterized by residential instability and weak social control are more likely to experience gang homicides, while economically deprived areas are more associated with gang crime and delinquency. Curry and

Spergel's (1988) findings correspond with prior research (Short & Strodtbeck, 1965) suggesting that gang homicides are a distinct ecological problem within a local community and conform to traditional theories of poverty and social disorganization. For instance, Valasik et al. (2017) show that in disadvantaged communities particular types of homicide (i.e., gang-related) remain stubbornly affixed over decades while other types of homicide (i.e., non-gang) are more responsive to interventions.

The existing gang literature routinely attests that controlling for the presence of gangs in an area, both spatially and temporally, is necessary to discern why gang violence clusters and spreads across space (see Valasik & Tita, 2018). Researchers often invoke the presence of gangs in a neighborhood to explain why violence is concentrated in specific communities, yet often do not explicitly measure them (for exceptions see Huebner, Martin, Moule, Pyrooz, & Decker, 2016; Katz & Schnebly, 2011). Such studies suggest gang rivalries may be responsible for the diffusion or spillover of gang violence from one neighborhood into an adjacent neighborhood over some time period. Tita and colleagues (Tita & Greenbaum, 2009; Tita & Radil, 2011) more explicitly account for the presence of gangs and the diffusion of violence by mapping gang set spaces and collecting social network data on gang rivalries. Combining these data sources allows for the construction of a weights matrix tying together spatial areal units of analysis (e.g., census tracts, neighborhoods) only if a pair of places have the turf a rival gang present. While some gang rivals occupy adjacent areal units, other rivalries may span greater distances. Geography plays an important role in forecasting gang violence but so does “social distance” (Radil, Flint, & Tita, 2010). For example, Papachristos, Hureau, and Braga (2013) report that rival gangs sharing an adjacent territorial border are more likely to experience reciprocal violence. However, gang that lack a shared boundary but prior violent interactions exist between the two strongly predicts future acts of gang violence. Additionally, Papachristos et al. (2013) find an interactive effect between the reciprocity of intergang violence and spatial adjacency, suggesting that the combination of spatial proximity and social interactions amplifies intergang violence. Clearly, geographic space matters in understanding the dynamic nature of gang violence, but research also demonstrates the need to incorporate the social spaces that connect gang members to places to be better able to forecast gang-related violence (Brantingham, Tita, Short, & Reid, 2012; Papachristos, 2009; Papachristos, Braga, Piza, & Grossman, 2015; Tita & Radil, 2011).

#### 1.1.2. Risk terrain modeling

RTM is “statistically valid way to articulate vulnerable places” by developing a risk of crime score based upon criminogenic characteristics from the physical landscape, including the built environment, of an area (Caplan & Kennedy, 2016: 12). Specifically, RTM not only identifies the particular environmental risk factors that are associated with crime but also how their spatial influences collocate to heighten the vulnerability that an area experiences a criminal event. Thus, it is not only the physical existence of these environmental risk factors that contributes to a place's level of risk but spatial influence of these particular features (Caplan & Kennedy, 2016). RTM reestablishes the interest in how the physical environment influences spatial crime patterns. Brantingham and Brantingham (1995) stress the importance of the interaction between an individual's activity patterns and the context of a criminal event. Specifically, that crime attractors, features of the environment that appeal to offenders to commit crimes in a particular place, and crime generators, places where the opportunity to commit a crime in aggravated due to an increase in the probability of that type of behavior, are directly tied to the features in the environment (Brantingham & Brantingham, 1995). Research has also shown that compared to a variety of retroactive techniques (e.g., hot-spot analysis), RTM is able to reliably predict crime across micro-units (Drawve, 2016). Overall, RTM provides law enforcement with a technique that can empirically identify areas that are at spatially vulnerable and at

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