Evaluating the Efficacy of Crime Mapping as a Law Enforcement Tool

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The completion of this paper represents the end of one journey and the beginnings of another; a task not to be taken lightly as there certainly are responsibilities. For the past five years, after having been away from the world of academia for twenty years, I was held responsible for not only learning new information, but also developing skills. Obtaining an advanced degree is not merely the gaining of new knowledge; rather, the process additionally works towards developing ones critical thinking, writing and communication skills. The new beginning then becomes putting what was gained through the process into professional practice.

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Abstract

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Eric Larsen

Under the Supervision of Dr. Sabina Burton

Crime mapping in law enforcement is not a new practice for good cause. Early studies established that certain social factors contributory to crime also displayed geographical relations. Later research found a spatial link in crime and determined that crimes tend to cluster in specific places advancing the concept of hot spots, or areas of concentrated crime. Studies in offender behaviors found that many offenders, particularly those that commit serial crimes, tend to commit crimes in the areas they frequent providing geographical patterns of behavior for law enforcement to investigate.

The evolution of crime mapping creates an opportunity for law enforcement to more readily focus efforts on specific problems rather than general calls for service. The purpose of this paper is to determine the success of modern crime mapping and its use as a practical tool for law enforcement. Given that a foundation exists to believe that crime has geographic attributes, and the technology exists to link the two, this paper will explore the hypothesis that the use of crime mapping programs is a practical and successful tool in addressing crime.

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I. Introduction

Records of man creating and using maps date back to the earliest documentation of human civilization (Ehrenberg, 2006). Early maps told the story of how events happened by providing a visual depiction of what occurred, where an event occurred and even explanations as to why an event occurred (Reinhartz, 2012). Symbols served as defining points to provide the reader with insight and meaning (Ehrenberg, 2006). As time passed, while the context of maps may have changed, the basic premise has not. Maps serve as an integral information source for us on a daily basis. In a most utilitarian sense, the modern road map provides direction to the traveler. Symbols allow the traveler to understand what direction they will take, the type of road taken, and the cities and sights which will be traveled through while en route to their ultimate destination.

Not unlike other maps, crime maps provide a visual depiction of a given area and the crime that occurs within its boundaries. These maps too are no new phenomenon, in fact, the mapping of crime served researchers as early as the 1900's and led to the seminal research of Shaw and McKay. Expanding upon Burgess' geographic depiction of Chicago as concentric zones, Shaw and McKay (1942/2006) found that social disorganization and crime could be visually depicted within zones, with the innermost zones reflecting greater levels of social disorganization and the outermost or suburban areas, reflecting lesser amounts. This research later became the foundation for social programming in the City of Chicago. Law enforcement also found utility in the use of pin maps, literally placing push pins in maps to identify where individual crimes occur. From these crime maps, crime is given dimension beyond officers responding to addresses and forming opinions of where greater attention needs to be given to

combat crime, rather a bird's eye view provides officers with the bigger picture of crime as, within locations, crime can be examined (Farrell et. al. 2005). However, this method is burdensome, especially for dense areas of population.

The last thirty years may be described as a period of rapid change for mapping. The development of global positioning systems (GPS) and geographical information system (GIS) computer programs put the ability to map in the hands of the common man (Ehrenberg, 2006). With the progression of technology, and the integration of mapping systems with law enforcement databases, mapping crime becomes as easy as a few keystrokes. However, the power of modern mapping techniques is not just to place points on a map, rather, the ability to filter and analyze the data (Manning, 2001).

Maps and the plotted criminal activities are significant for effecting neighborhood change however simply creating and distributing crime maps does little to assist officers in addressing crime (Andresen & Malleson, 2011). Studies have found that when merely provided with maps of crime, law enforcement officers retain their previous perceptions of where crime occurs (Paulsen, 2004). In other words, the map did not affect perceptions. Similarly, law enforcement historically has known, or believes it knows, where crime exists within its jurisdictional boundaries. Logically one would think the beat officer knows his beat. Yet, studies have found that law enforcement does not necessarily recognize where crime occurs (Haining & Law, 2007). In other words, law enforcement may not know the true locations of crime, and when provided with the information, the information is discounted.

Unlike a road map which provides the traveler with direction to his destination, by way of highway, crime maps do not necessarily provide the guidance as to the meaning of the crime that is mapped. Guidance, rather, is provided by way of theory based upon the common

characteristics of crimes and the criminals that commit them. Theory thus unifies the separation of the knowledge of where crime occurs and the strategies used to combat crime. Without theory, points on a map represent where crimes occur but lend no assistance into the development of strategies to combat the crime.

Together, crime mapping and theory represent components of a problem solving process. Crime represents the problem and theory represents the solution. However, as with any problem solving process, proper identification of both the problem and the solution is required. Failure to do so results in a return to the process. While not entirely unexpected, careful consideration of both the problem and the theory employed mitigates the unexpected consequences.

This study examines and identifies the basic prerequisite knowledge to understand and utilize crime mapping as an efficient tool of law enforcement. To build this knowledge and comprehension the following topics will be considered with an overall strategy for implementation to be discussed based on a problem solving model. A review of literature establishes the credibility of mapping as a means of identifying crime. An analysis of theory provides the essential knowledge behind why crimes occur where they do which lends insight into strategies to effectively address crime. The basic underpinnings of the technology and the creation of maps give the reader an understanding of how one creates maps including the data required and the output generated. Case studies involving crime mapping initiatives provides a practical examination of crime mapping, and its management, in the field. Finally, the discussion provides an overview of the efficient implementation and utilization of a crime mapping program.

II. Literature Review

Establishing Crime within A Place

Policing is a dynamic profession experiencing constant change in policy and practice. Transformation is readily apparent in law enforcement responses which evolved from the standard policing tactics of routine preventative patrol and reactive investigations to that of recognizing that crime possesses attributes which allow for analysis beyond a response to calls for service, rather, there exists the ability to intelligently strategize based on accumulated data.

Significant with some offenses is the proximity of related crimes. Bernasco (2008) studied 3624 detected and attempted burglaries in the Hague and found that repeat and near repeat burglaries, ones which occurred either at the same location or nearby, were commonly committed by the same offender. A time element only increased the relationship such that the closer in time and place a crime occurs; the more likely it was the same offender.

Tonkin, Bull, Bond and Palmer (2011) reviewed the criminal histories of offenders who had committed multiple crimes from different offense types and categories to determine if a spatial relationship, the "intercrime" distance, existed. Crime categories broadly describe the offense such as burglary, robbery and theft while type is more descriptive of the offense such as armed residential or commercial burglary. Tonkin et.al. found that regardless of the crime being committed by the offender, the offender tended to commit his crimes at regular times and in certain geographical areas regardless of the crime type or crime category. However, greater consistency in both time and space was found when the offenses committed by a single criminal were of a similar type.

Andresen and Mallesen (2011) studied crime and appropriate units of analysis in Vancouver, British Columbia. The units of analysis considered were, in decreasing order, census

tract, dissemination area, and street segment, or 100 block. Using calls for service data from 1991, 1996 and 2001, Andresen and Mallesen found that concentrations of crime, 50% of crimes, could be attributed to only a small percentage of street segments. Additionally, crime remained stable over time on these blocks.

Given the clear relationships between crime and geography, Rossmo (1997) further delineated geographical typology by metaphorically describing offender focused crime in the context of hunting. Rossmo labels those offenders who seek out victims in their awareness spaces, or those areas frequented on a regular basis, as hunters. Poachers travel outside of the awareness spaces to seek victims. Trollers are opportunistic criminals who commit their crimes when the occasion presents itself. Trappers let the victims come to them. Merely asserting though that crime occurs in place, and behaviors differentiate crimes, is insufficient to establish the relevance of crime to practical law enforcement tactics.

Koper (1995) believed that fear and crime would be reduced by addressing disorderly behavior and police could in turn reduce disorderly conduct by addressing hot spots, or areas of concentrated crime. Koper also thought a deterrent effect would continue after police left. Koper found that with officers merely driving through an area there was a 16% chance of the behavior reoccurring. If officers stopped for 10 to 15 minutes at a location, there was only a 4% chance of the behavior reoccurring. The greatest effect was found when officers stopped for 14 to15 minutes. Recommended then was that police, during the course of their tour, make periodic and sporadic stops in hot spots.

Weisburd and Eck (2004) studied various police tactics used to fight crime. The list of tactics covered many major tactics employed by modern law enforcement agencies including Community Oriented Policing, Problem Oriented Policing, foot patrols, crackdowns, directed

patrol, traffic stops and drug interdiction. Weisburd and Eck found in all cases, the key to successful interventions was focus; focus on the people, the problem and the geography.

Summary

Research has consistently found relationships between crime and geography. This relationship can be further expanded to include criminals and the places that they commit crime. Connections carry significant implications for law enforcement as strategies and tactics derived from this knowledge are employed to combat crime. However, to truly understand, one must explain why there is an association between crime, criminals and place; this explanation is provided through theory.

III. Theoretical Framework

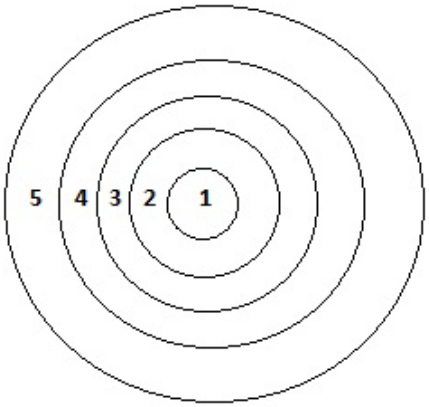
Theory unifies the practical application of mapping and the strategies employed to analyze and address crime. Two sets of theories, including Social Disorganization and Opportunity, are generally applicable for the purposes of a temporal- spatial examination of why crime occurs at a particular place although they may not be explanatory for all crime (Weisburd et. al., 2009). Similarly, theories exist which provide guidance towards addressing crimes of place including Broken Windows and Crime Prevention through Environmental Design.

Social Disorganization

Social Disorganization - The Chicago School

Ernest Burgess theorized that cities grow from the inside out. Burgess pictorially depicted this growth in a series of concentric circles, as displayed in Figure 1, with each circle representing a different social structure.

Figure 1 Concentric Zones/Social Disorganization



The center circle, or Zone I represented the business or industrial area. Zone II was the transitional zone populated by those working in industry typically the impoverished living in inexpensive housing. Zone II is described as transitional as with growth, industry pushes its way

into the zone. Burgess found that as one moves out from these innermost zones, income and home values increased with the outermost reflecting the commuting zone (Tibbets & Hemmens, 2010).

Shaw and Mckay (1942/2006) expanded on Burgess' theory believing that crime and delinquency would be similarly represented with the innermost zones having more crime than the outer zones. Shaw and McKay postulated that conditions present in the inner city areas, including poverty, heterogeneity and transiency, create conditions which foster social disorganization, or a breakdown in the social controls of the community. With a breakdown in social controls, youths learn criminal behaviors from older youths who serve as mentors. Important though is the fact that Shaw and McKay found that crime remained stable, whether high or low, for a given area. Shaw and McKay's finding that crime relates to place is significant in the study of mapping. Mapping is founded on the concept of spatial relationships, in this case the relationship between social disorganization and neighborhoods of a city.

Problematic is the unit of analysis which was used by Shaw and McKay, the census tract. In using census tracts, Shaw and McKay's theory reflects a macro level examination of crime, not necessarily suited for problem solving yet the theory does introduce the concept of concentrated areas of crimes. Weisburd, Groff and Yang (2009) took Shaw and McKay's study one step further and examined social disorder at the street segment level, a micro level of analysis. Street segments are one city block. Weisburd et. al. found that approximately 6% of all street segments account for 50% of crime incidents and all incidents were found to have occurred in only 65% of all street segments, in other words, 35% were for the most part crime free. More importantly though was the variation of crime within neighborhoods and between

street segments. This variation in crime supports the micro level analysis of social disorganization and also presents the idea of concentrated areas of criminal activity, or hot spots.

Broken Windows

Broken Windows, as conceived by James Wilson and George Kelling (1982), is a theory which is responsive to disorder and disorganization crimes. The underlying premise of Broken Windows is that crime, on a larger scale, decreases when disorderly behavior, and other minor offenses, such as littering, vandalism and battery, is addressed in deteriorating neighborhoods as well as deleterious environmental conditions including blight and graffiti (Wilson & Kelling, 1982).

In addressing the social disorder of neighborhoods a secondary effect is observed and that is the growth of collective efficacy and community capacity building in the neighborhoods (Sampson & Raudenbush, 1999). In other words, directing efforts towards disorder also brings organization back to the community. Broken Windows empowers the community to participate in crime prevention.

Opportunity Theories

Opportunity theories represent a school of thought that crime occurs as a result of a criminal being presented with the occasion to commit crime. Within the opportunity also lies the potential to identify the criminal as many times the acts are committed within a physical area and/or a time period significant to the offender. These theories, Routine Activity, Crime Pattern, Journey to Crime and Crime Prevention Through Environmental Design explore the geographical context of crime not only through place, but also through time examining the unique trail a criminal may leave.

Routine Activity

Cohen and Felson (1979) theorized that crime occurs when three factors are present, a motivated offender, suitable targets and the absence of capable guardians. Essentially, crime is committed when a criminal observes something of value that they want, and the likelihood of being caught is minimal. Disrupting any of these three factors reduces the likelihood of crime occurring.

Key to Routine Activity is the assessment of crime and its temporal-spatial relation. Criminals are more apt to commit crimes when there is no suitable guardian. Suitable guardians are anything, or anyone, that would deter a criminal from committing a crime, including vigilant neighbors, police patrols or even environmental factors such as lighting or security. Cohen and Felson found that residential burglars were more apt to commit crime during working hours when residents were less likely to be at home. Additionally, once the burglar commits one burglary, knowledge gained from this burglary may cause them to return and commit more at either the same residence or neighboring residences as they now have knowledge of the neighborhood (Farrell et.al., 2005).

Crime Pattern Theory

Crime Pattern Theory, developed by Paul and Patricia Brantingham (1981) narrows and further defines Routine Activity by focusing on the environment an offender conducts his daily routines in (Reid, et. al., 2014). Targets are identified and influenced by the awareness spaces, the activity spaces and the routes taken by offenders to daily activities. These activities then create the foundation for crime pattern theory in that criminals create patterns through their activities. These patterns are both spatial in nature and temporal, in that many activities people

conduct are done during the same time period daily and use the same routes, such as going to work or school (Reid et. al., 2014).

Activity spaces are those areas of which the offender has intimate knowledge of as they spend their time in these spaces. Activity spaces would include that area around their home, work or where they shop. Activity spaces involve the offender giving a greater amount of attention to the environment. Awareness spaces are those areas of which the offender has some knowledge, knowledge which could be gained due to the areas proximity to activity spaces or as a result of being in the path to the activity space. Created from this interaction with the environment are mental maps, one's subconscious knowledge of their environment (Reid et.al, 2014).

Journey to Crime

Conceptualized by Phillips (1980), Journey to Crime expands upon Routine Activity by focusing on the fact that most crimes occur within a short distance from an offender's home and considers more specifically, the distance violent criminals travel is shorter than the distance traveled by those whom commit property crimes (Reid et. al., 2014). This short distance is reflective of the least effort principle which postulates that most people will not travel any further than necessary to accomplish a task (Ratcliffe, 2004).

With Journey to Crime, three factors are considered: the point of origin, or where the offender began, typically his home, the direction of travel and the distance to the point of the actual crime. Like other opportunity crimes, when multiple crimes are committed, a pattern may emerge. In the case of Journey to Crime, the pattern established is that of the distance to the crime and the direction. With this information, it is possible to determine the origin of the offender, or his location (Reid et. al., 2014). In a most simplistic manner, one might estimate

this location as being in the middle. However, researchers have also created mathematical algorithms which establish, with a greater degree of certainty, a point of origin (Rossmo, 1995)

Crime Prevention Through Environmental Design

The logical response to a crime of opportunity is to reduce the opportunity. Crime Prevention Through Environmental Design (CPTED), as proposed by Jeffery (1971), focuses on the guardianship and suitability of targets within neighborhoods putting a share of the responsibility of crime prevention on the public. CPTED provides for crime prevention through three methods, controlling access, natural surveillance, and defining ownership (Zahm, 2007).

Controlling access is a matter of limiting the ability of an offender to reach a target (Zahm, 2007). On a grander scale, gated communities accomplish this by controlling entrance. At the residential level, controlling access may be accomplished through the use of deadbolts and ensuring windows are locked. Such measures are often called target hardening.

Natural surveillance, or guardianship against crime, may be provided by the police, neighbors or even cameras (Reynald & Elffers, 2009). People notice things in their everyday activities, crime included. Thus neighbors may be one of the better surveillance systems, and they are free. However, in order to assist, there should be unobstructed views of the house to the greatest extent possible.

Finally, CPTED encourages property owners to care for their space under the belief that a well-cared for property is less likely to attract the attention of criminals. Caring for the property defines ownership of the property (Zahm, 2007). Those who are likely to care for their property are also likely to take measures to protect their property (Reynald & Elffers, 2009).

Summary

Crimes in places can generally be described in the context of two sets of theories, social disorganization and opportunity. While the two differ in approach, one focusing on the greater social context of neighborhoods, the other focusing on the opportunities presented to offenders, and offender behavior, both share a commonality in a geographical focus.

Social disorganization describes the social conditions that exist within a given neighborhood. Typified by an environment which consists of an impoverished population living in blighted areas, disorganization is observed in anti-social behaviors which include littering, battery, vandalism or other disorderly acts. While originally identified at the census tract level by researchers, later findings were able to establish that disorganization could be measured at the block level. Researchers postulated that if the disorderly behavior, and blight, is addressed, disorganization would be reduced and citizens would feel safer.

Opportunity theories have two components, an opportunity which presents itself, and an offender that is motivated to commit a crime. From a geographical focus, it is known that offenders are likely to commit offenses within areas with which they are familiar. As such, often a geographic pattern will emerge as well as a behavioral pattern. From these findings, probable locations of offenders may be identified, including homes or other places the offender frequents, and crime prevention techniques are also suggested. Knowledge of these theories though must be put into practice which will be accomplished through an applied evaluation of crime mapping and its role in contemporary law enforcement.

IV. Practical Application

Mapping is a data driven approach to policing which is representative of a process, one which includes the identification and filtering of relevant records, the selection of a map model, and the interpretation and analysis of the results. As previously discussed, theory provides the fundamental underpinnings in the examination of crime, how it occurs and logical law enforcement responses. These concepts aid in identifying and defining data sources, the appropriate map type to utilize for analysis the strategies for problem resolution.

Information Gathering

Information gathering is a significant part of a police officer's job. Given any crime, police reports describe people, places, activities and things. It is within this volume of information that variation between criminals and crimes may emerge forming patterns (Rossmo, 1995). Essentially, with all of the data, a profile is created of the criminal based on the acts and how they were committed (Canter et.al., 2000). Databases from which to draw this information include offense, arrest, suspect, and property files. Common to the coding of the information within these files is the National Crime Information Center (NCIC), Uniform Crime Reports (UCR) or National Incident Based Reporting Service (NIBRS) code tables.

Offense files contain information regarding the crime itself. The offense described may be so broad as to use a NCIC, UCR, or NIBRS code, or an agency specific descriptor. Additional information such as locations and weapon use may also be coded within these files. An example of this would include the offense of burglary which is classified in the Uniform Crime Reports as follows:

Burglary Residential	Burglary Commercial
Force Residential	Force Non-residential
Unlawful Entry Residential	Unlawful Entry Non-residential
Attempt Residential	Attempt Non-residential

Using this table as a means of filtering information, the user has the ability to look at specific types of burglary and to determine if any geographical, or temporal, relationship exists.

Suspect files provide descriptions of suspects. Minimally this information should include sex and race to differentiate. Further description though could include height, weight, glasses, hair color and scars, marks or tattoos. A caution comes with suspect information as it is provided by witnesses of crimes who can differ in accounts and descriptions. Included within suspect files though is the modus operandi, which lends significant insight into any patterning of behavior.

Arrest files provide known information about individuals and their crimes. While these files may be similar to suspect files, as both provide descriptive features of the offender, differentiating the two is the knowledge of the offender's name and the reliability of the information as the offender is known.

Property files detail the type of property taken and in some cases damaged. Property files tend to be coded broadly in order to simplify classification. Property files serve to further differentiate crimes and the offenders that commit them however this differentiation is limited based on broad categories. Much like criminals commit similar crimes, often the property taken is similar, or representative of the crimes they commit. For example, a garage burglar may take tools and equipment while a residential burglar may take electronics and jewelry.

Much like any other analysis though, the end product is dependent on the reliability of the information gathered (Canter et.al., 2000). For example, Journey to Crime suggests that a suspect's residence may be found based on a mathematical algorithm related to where crimes occur. Should the criminal move, the data loses some explanatory value. Data entry methods and the interpretation of reports when coding data may affect reliability. If dispatchers code a crime

based on a citizen's description, the coding may not be as accurate as that of the records management personnel who code crimes based on officers' reports. A citizen may not know the difference between a robbery and burglary whereas the coding officer is cognizant of the elements of a crime. Another difference which may distinguish dispatch from records information is the availability. Dispatch information is likely to be entered and available immediately while records information may not be entered until reports are received (Eck et. al., 2005). In other words, while dispatch information is timely, it may not be as accurate, while records information is likely to be more accurate but not as timely. Thus the data source and its reliability is an important consideration when conducting analysis and this, along with the details of the crime, drives the investigation.

Software

GIS software platforms perform mapping functions however data must also be filtered and analyzed for patterning through the use of other programs. Within most records management systems, data is filtered through queries. Provided the addresses associated with the query are geocoded, the data may be imported directly into the GIS software. Geocoding is the process by which the data, as described previously, is related to "x" and "y" coordinates. Similar to latitude and longitude, x and y coordinates represent places to be plotted on the map. This geocoding may occur within the records management system or through other special software.

CrimeStat, a free statistical programming package download, developed by Ned Levine (2007) through a grant, and distributed through the National Institute of Justice, conducts statistical analyses of data with the output exported and plotted through GIS software. CrimeStat

has many key features which includes the ability to create hot spots and calculate distance to crimes. The software only requires that imported data be geocoded.

Integrated systems combining filtering and GIS functions also exist to streamline the process. Such systems allow the user to create the query through a data selection process then map the data. Simple analytics may be included such as hot spot mapping.

Mapping Formats

The foundation of a crime map is the "base" map. The base map depicts streets and other features which are consistently present such as parks or schools. Examples include the common street map and the satellite imagery map (Eck et. al, 2005). Crime data is displayed in layers which are superimposed over the base maps. There are also several types of map models, each using a base map, each having its own unique attributes. Some of the more recognizable maps include the point, choropleth, and continuous surface which will be discussed further. In order to better demonstrate the integration of data with GIS software, and the resulting output, Omega Crimeview® Dashboard is used to sort data provided by the Kenosha Police Department while ESRI ArcGIS Server is used to execute mapping functions.

Point Map

The point, or pin, map is the most simple of maps to construct and understand. Each pin represents an address point, and the corresponding filtered records, which is beneficial as incidents are correlated to a specific address. Problematic with the pin map is if too many points are plotted, due to insufficient analysis and filtering, the map becomes cluttered and meaningless (Eck et. al., 2005). Figure 2 displays a citywide map of robberies over a year's time. One might surmise that there are a large number of robberies in a general portion of the city; the map itself lends little insight into potential remedies. By narrowing the scope of data, by dates and

location, the map is easier to comprehend. Figure 3 shows the same data narrowed down to a single patrol area.

Figure 2 Point Map

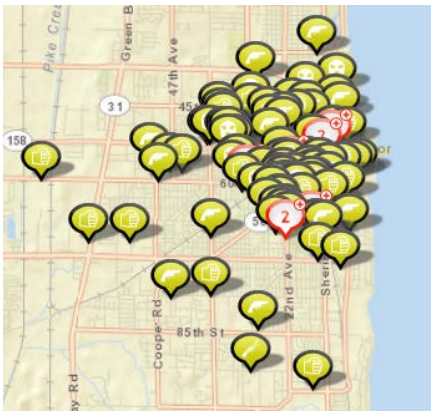
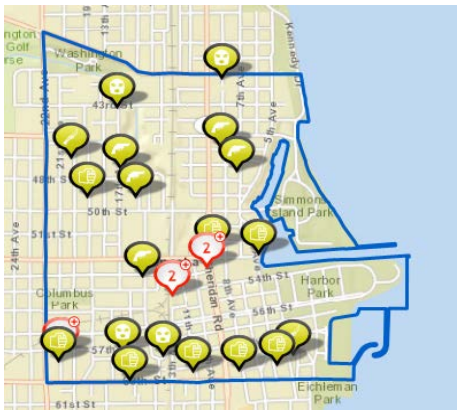


Figure 3 Point Map Filtered



However, these maps are still only reflecting one dataset, robbery. A comparison of offenses or the integration of other data sources can be further accomplished through the layering of data.

Layering is a means incorporating multiple datasets into a map format for comparison (Eck et.al., 2005). For example, in Figure 4 burglaries have been mapped. A tenuous proximal relationship between two burglaries is established as the two are close, however, when a "false alarm" layer is added, in Figure 5, a circle of offenses and attempted offenses, reflective of an opportunistic criminal with a local tie, is created.

Figure 4 Point map

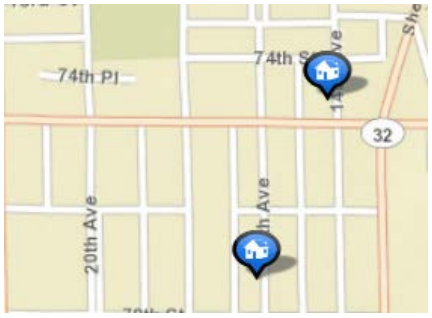
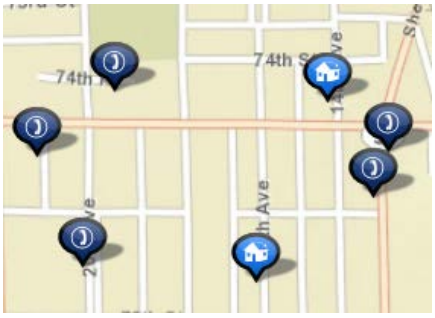


Figure 5 Point Map with Multiple Layers

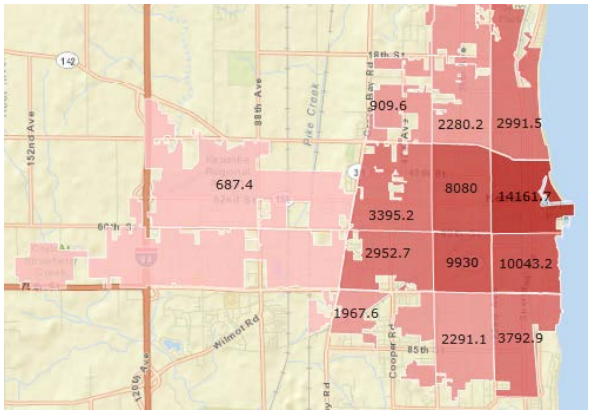


Filtering information brings greater meaning to the map and lends some insight into areas which deserve greater attention. The point map is better at displaying limited information where greater detail is required, however, with masses of information, mapping solely with points is not necessarily the optimal use of mapping software, for technology exists to more readily analyze and display complex crime relationships. Such maps include choropleth and continuous surface maps, also termed hot spot maps as they represent areas of concentrated crime.

Choropleth

A choropleth map is one which displays areas with distinct boundaries, such as police beats, then differentiates the levels of offenses occurring between the boundaries by varying shading. The benefit of displaying data in this manner is that the viewer may compare crime between the areas (Eck et.al., 2005). Figure 6 is a choropleth map representing crime within police beats.

Figure 6 Choropleth Map



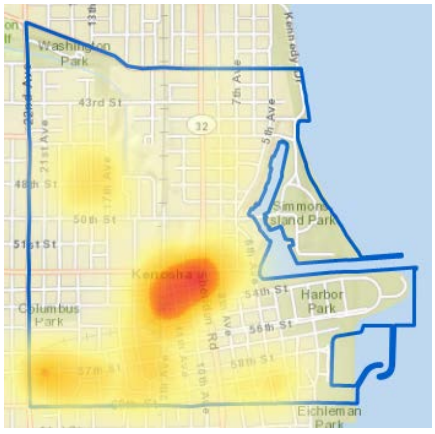
In a general sense, this map serves to assist in operational analysis, which will be discussed further (Levine, 2007). With the broad geographical boundaries, the map lacks the specificity to directly address crime through problem solving. However, one may also note the

appearance of social disorganization as crime is densest, displayed as deep red, in a centrally located sector and progressively decreases, to pink, with distance. The emphasis lacking then in a choropleth map is found in Continuous Surface maps.

Continuous Surface

A continuous surface map measures the density of crime within a boundary. This is accomplished by the analytic program which divides an area into many small grids and then calculates the density of crime based on the proximity and number of occurrences (Eck et.al. 2005). Figure 7 is a continuous surface hot spot map which displays the same robberies from the point map in Figure 3. The figure represents all of the robberies through density though with the most dense levels of robberies depicted in red, drawing the reader's attention specifically to that area. The less dense areas of robberies are depicted in yellow.

Figure 7 Continuous Surface Map



The continuous surface model provides for the analysis of crime at the block level. This level of analysis allows for a more specific intervention when larger numbers of, and more diverse, offenses are examined.

Crime Analysts

In many departments, crime analysts serve as the medium through which information flows, including the crime maps. Problematic is the acceptance of analysts in the law enforcement field. Frequently they are civilian employees who often are relied upon frequently for administrative crime counts rather than actionable analysis. With a long standing history of responding to calls as a tactic, officers do not necessarily accept the proactive opportunities that the analysts provide by way of information nor do they have the opportunities with administrations that advocate standard police responses. Thus, it is questionable whether the value of crime analysts is appreciated and their work integrated (Taylor, Kowalyk, & Boba, 2007). However, analysis is a specialized skillset as many factors are involved in the mapping and analysis of crime.

Key considerations in making the decision regarding which map to use includes: the unit of analysis, the individual(s) that will be using the map, and the purpose of the map. As differentiated as maps may be, so are their purposes. Function in maps may be described then from an analytical perspective which includes the tactical, operational and strategy level (Eck & Clark, 2013).

Tactical analysis includes mapping for the front line officers which could include a daily area briefing. In that briefing, specific actions, and geography could be discussed. This type of mapping is reflective of micro level enforcement. These are short term maps intended to focus on making specific arrests or interventions.

Operational analysis is an intermediate level of analysis as it focuses on the organizational level. Maps at this level serve to assist in the allocation of resources including the staffing of beats and teams. Operational analysis assists an agency in prioritizing its demands

and provides support for area commanders in planning crime reduction. The output in some cases from an operational analysis is tactical in nature.

Strategic analysis is a global perspective which looks towards long term planning to affect change. This change is not only affected by tactical interventions and resource allocation, but also through policy and statutory change designed to prevent crime. A strategic analysis looks at crime patterns and trends and seeks ways to prevent future occurrences.

Strategies

A number of proactive strategies and tactics exist for law enforcement officers to take against identified problem targets. Broader reaching strategies include that of saturation patrols, order maintenance policing, directed patrols and foot patrols. More focused efforts include targeting known offenders, surveillance, decoy operations, and fixed police presence.

Koper (2014) surveyed 350 municipal police departments regarding perceived success of the varied law enforcement approaches to personnel allocation and responses to crime and found the circumstances surrounding the crime often dictated the response. What is clear from his findings is that the more information that is known about the offender, the offense, and the location, the more focused the response. Offender based responses, such as buy-busts, were frequently used against those offenses where committed by certain people or groups such as drug or gang violence. High visibility police actions, such as directed patrol and saturation patrols, were more effective against hot spots of robberies or shootings. However, there was little consensus amongst departments regarding the most effective strategy. This is understandable though as, again; the circumstances of the problem dictate the response, so there may not be one single response that is appropriate. Rather, important is an understanding of the situational significance of the intervention.

Problem Solving

Joining all of the accumulated data, analysis, strategies and tactics is a problem solving method. The S.A.R.A. model of problem solving, developed by Eck and Spelman (1987), is promoted by various law enforcement organizations including the Center for Problem Oriented Policing (2013). Consisting of four stages, Scanning, Analysis, Response and Assessment, S.A.R.A., provides a structured format for law enforcement professionals to follow when responding to community issues, one in which the mapping process may be incorporated at each stage as part of the process.

Scanning is the initial stage of problem solving. Scanning involves identifying the problem. The problem as defined is not only difficulties which pose concern for the police but also for the public. In this process many problems may be identified in which case the utilization of prioritization assists in a greater focus. Consideration of the consequences of the problem assists in establishing these priorities. With scanning, maps assist in the identification of issues through a geographical examination. For example, mapping hot spots shows officers where concentrated numbers of offenses occurs (Eck & Clarke, 2013). Once the selection of a problem occurs initial analysis begins.

The Analysis stage evaluates the problem and the circumstances surrounding the problem. Data is gathered and research is conducted into the problem and its causal factors. The gathering of data and further research assists in narrowing the focus of the problem allowing officers to create a hypothesis as to the relationship between the causal factors and the problem. Mapping serves to assist in the analysis as the illustrative nature of mapping provides visual cues as to why offenses occur where they do.

The Response stage involves the brainstorming of ideas and strategies to address the problem. Maps may assist in the identifying of targets. The conceptualization of multiple alternatives allows for the implementation of the best idea. Once selected, the roles of responsible parties are defined and the plan is carried out.

The Assessment stage involves a review of the results in regards to the established goals and expected outcomes. Goal attainment does not necessarily occur in which case a return to the beginning stages may be necessary to determine if the problem was properly identified, if sufficient data was obtained or if a proper response was generated. Maps may illustrate the before and after effects of any interventions.

Problem solving provides a structured format to follow when addressing concerns. However, S.A.R.A. is limited in that a problem solving model is directed at identifying specific issues, a micro level approach to problem solving. When one takes into consideration the many crimes and crime locations police departments deal with, and greater division by way of precincts or patrol districts, a mechanism must be in place to manage the problem solving. One such mechanism is Compstat.

Compstat

Compstat is a management process conceived by William Bratton, Commissioner of the New York Police Department. Defined, Compstat is a "goal oriented, strategic management process that uses information technology, operational strategy, and managerial accountability to guide police operations." (Walsh & Vito, 2004, p. 57). As designed, Compstat represents the exchange of information between the administrative and operational divisions. Command staff meets on a weekly basis to ensure the timely flow of information between divisions.

Significant to Compstat is geography. Staff sets specific objectives for command areas. Within command areas, specific problems are identified which are to be followed up on. Crime mapping and innovative problem solving are central to a four step process employed to strategize, however, more importantly, accountability exists such that commanders are responsible for their areas, and crime, based on intelligence. Essentially reliance upon analysts is created.

The four step process used within the Compstat program includes the gathering and analysis of intelligence, rapid deployment, effective tactics and assessment. The intelligence gathered must be both accurate and timely in order to be effective. Four questions are answered which include what type of crime is being examined, where the crime is occurring, both location and type of location, when is the crime happening, time of day and day of week and why is the crime happening. Resources are then rapidly deployed to the areas of need to quickly address problems. Effective tactics reflects a focus on identifying issue specific resources directed at specific problems. Assessment then is conducted to ensure that the remediation is working.

The success of mapping within Compstat, as a single feature, is difficult to measure as mapping is not exclusive to the process, rather any change could be attributed to any method employed by the NYPD or changes in social conditions. However, since the employment of Compstat as a management method crime in New York City fell from a high of 9,780 offenses per 100,000 people in 1988, to 2,362 offenses per 100,000 people in 2012, a 77% decrease. Nationally, in the same time frame, crime decreased 45%, from 5,898 offenses per 100,000 people to 3,246 offenses per 100,000 people (USDOJ, 2013).

Summary

The practical application of mapping is contingent upon many things however a review of its parts may best be accomplished through a problem solving format as mapping is actually merely a series of choices. Identifying, defining and describing the problem are accomplished through the filtering and mapping of data. Databases to consider could include calls for service, offense, suspect, arrest, or property. Base maps and layers assist describing the problem. Depending on the nature and circumstances of the offense, or problem, to be considered, one might contemplate the point map for more specificity, a continuous surface map which takes into account crime density, or a choropleth map if one wants to compare offenses between geographical areas. Solutions are reflected in the law enforcement tactics employed. Problems may be limited to specific individuals where buy-busts are an appropriate tactic, or neighborhood disorder where crackdowns and directed patrol are employed.

All of these activities occur though with the recognition of the importance of the human resource. Crime analysts provide the tactical information which assists in defining and describing the problem. Police officers are the means by which the solution is implemented. Management serves to guide the response to completion and evaluate the process. A functional appraisal of the process exists by way of case study, three of which follow.

V. Case Studies

Introduction

The maps as outlined suggest different approaches to describing and addressing problems. The pin map is specific to an address. The continuous surface hot spot map emphasizes block level examinations. The choropleth map is a means of comparing established geographical areas. Practical application though of mapping concepts, the related theory, and even the responsible parties is more readily understood through the examination of case studies. The following case studies illustrate how law enforcement agencies employed, and took advantage of, the unique characteristics of map styles to identify problems and to formulate strategies to address them.

Weld County, Colorado

In 2002 the Weld County Sheriff's Office noticed an increase in crime. The most common offenses reported were that of property crimes including burglary, auto prowl, theft and vandalism. The perceived basis for the increase in crime was the spread of methamphetamine use and sales. Much of the crime was centered in a mobile home community named Hill N' Park, a densely populated community consisting of 253 lots (Ainsworth, 2008).

In response to the high crime rates, the Sheriff's Department began analyzing the problems within the community. Analysts studied offenses to determine when they were occurring, where they were occurring and which known offenders were living in the area. With this information, manpower was added during peak times and investigations focused on the known offenders and problem residences (Ainsworth, 2008).

Ultimately the Sheriff's Department strategy resulted in reduced crime. Burglaries decreased by 55%, auto prowls by 87% and overall crime fell 65%. Analysts attributed the

resulting success to an emphasis on the identification of crime types, the modus operandi of the offender, problem addresses and peak offense times (Ainsworth, 2008).

Boston, Massachusetts

In 2007 the Boston Police Department (BPD), under Commissioner Edward Davis, launched a program called the Smart Policing Initiative aimed at reducing elevated violent crime rates. Safe Street teams were assigned high crime areas where they were to utilize problem oriented policing techniques to identify problems and come up with solutions (Braga & Schell, 2013).

The BPD used Mapping technology and violent crime data to identify violent crime hot spots. Because of staffing demands limiting the number of teams which could be formed, with one team assigned to each location, 13 locations were identified to receive the program. However these 13 hot spots represented only 6.1% of the cities geography yet 23.1% of violent crimes were committed at these places. Also found was that robberies and gun violence was very concentrated with 50% of commercial robberies and 66% of street robberies occurring at only 1 % of the street segments and 8% of intersections. 74% of gun violence, between 1980 and 2008 was found to have occurred at only 5% of street segments or intersections (Braga & Schell, 2013).

Teams analyzed problems which occurred within their assigned areas. While each area had similar crimes being committed, the underlying causes often differed. For example, one area had a problem with homeless people robbing commuters and shoppers while another area had youths preying on other youths robbing them of their cell phones and other electronics. While the crimes were the same the population, and the unique characteristics, was different. As such the response to each problem was tailored to the situation. These responses generally fell into three

categories: situational/environmental intervention, enforcement, and community outreach (Braga & Schell, 2013) .

In 2009 the BPD received a grant from the Bureau of Justice Assistance under the Smart Policing Initiative to conduct a program evaluation of the Safe Street Teams and their effectiveness. Researchers found that all violent crime in the identified hot spots fell 17%, with a 19% reduction in robbery and a 15% reduction in aggravated assault. Also, violent crime was found to have fallen at a greater rate than in areas which did not receive the benefit of a Safe Street Team and there was no indications of crime being displaced (Braga & Schell, 2013).

Fort Worth, Texas

In early 2002 Fort Worth, Texas implemented a Compstat type strategy which was called "All Staff Meeting" (ASM). Meetings were held on a biweekly basis between department administration and commanders. The purpose of the meetings was to discuss area crime trends, departmental responses, and to exchange information. Commanders were held accountable for offenses, and the subsequent law enforcement response, in their sectors. Commanders utilized mapping data to identify hot spots. From these hot spots, and other crime analysis, involved personnel, including officers, developed crime prevention strategies. Broken Windows policing was employed with the major goals of reducing crime and improving the quality of life for residents. Part of the program included the creation of four specialized "Zero Tolerance Units" consisting of twelve officers per unit. These units focused on targeted enforcement instead of taking calls for service (Jang, Hoover & Joo, 2010).

A Compstat type strategy has several components including commander accountability, crime analysis and aggressive enforcement. To single out any one component as being the lynch pin of success would be difficult. However, commanders noted that the method employed was

one of focus with 90% of law enforcement activities addressing specific offenses at specific times and locations, all factors associated with the mapping of crime. Index crime statistics were examined from 2000 to 2006. Fort Worth, in that time period, experienced reductions in property crimes and overall index crimes while violent crimes stayed at similar levels (Jang, et.al, 2010).

Summary

The positive attributes of the utilization of mapping within a process are evident in the case studies however; also resulting from the examination is a common element, focus. Filtering, mapping and analyzing brought focus to the problems each agency experienced. Implicit in the consideration of the issues was the knowledge of data and the means to construct instruments with which the data could be viewed. These tasks, filtering, mapping and analyzing, then are evocative of a model means of approaching, and including, crime mapping in a law enforcement intervention.

VI. Discussion

The purpose of this paper was to generally consider the efficacy of crime mapping as a law enforcement tool. Describing crime mapping as a tool implies that, in some manner, mapping eases or assists law enforcement in accomplishing a task. What emerged was a consistent finding of success when mapping was utilized in operations. Often focus was cited as the reason for the success of a geographic examination of crime. However success was also predicated upon common elements being present. Ultimately what emerged is the foundation for the model practice of crime mapping based upon four components being present: theory, mapping and the associated technologies, problem solving, and personnel.

Theory

Theory serves to assist in explaining why things occur, and in the geographical examination of crime, where they occur. An understanding of theory is important as in the problem solving process, theory serves to assist in identifying where crime occurs, why it occurs where it does and is suggestive of methods in addressing crime. As theory pertains to crime mapping, there are two general sets, social disorganization and opportunity theories.

Social disorganization theories, including Broken Windows, assert that crime and disorderly behavior tends to occur in impoverished and deteriorating neighborhoods. When these disorderly behaviors are addressed, citizens feel safer. Studies also support the concept of the micro place, meaning that social disorganization can be identified down to the block level providing a greater focus for law enforcement efforts.

Opportunity theories, including Routine Activities and Crime Pattern, explain that crimes tend to occur within the daily activities of an individual and also within geographical areas that they typically have some connection to. With this knowledge, law enforcement is able to

develop tactical plans to address crimes based on geographical patterns and citizens are able to assist in preventing crimes.

Opportunity theories provide two means of addressing crimes. Journey to crime, building on the concept that crime occurs within an offender's daily activities, provides a statistical means of identifying the probable location of the home or a place significant to an offender. Crime Prevention Through Environmental Design promotes crime prevention through reducing criminal opportunities. For example, to reduce burglaries, homeowners are encouraged to keep entrances visible to neighbors, leave lights on and lock doors.

Theory then becomes the foundation for the examination of crime as it relates to place. Insight is gained into the motivations of offenders and the reasons as to why crime occurs where it does. This knowledge and insight then further develops the potential for the practical use of crime mapping and its related technology.

Mapping and Technology

Efficient and effective mapping is contingent upon many factors related to the databases utilized and the knowledge and practice of mapping. While there are many databases to draw from, each has its own positive and negative attributes. Calls for service may enter the system quicker but not be as accurate while records management data may be slower to access but be more accurate. Knowledge of the information available within the database is also important as crimes may be differentiated by many factors including the modus operandi, the description of the suspect or even the property taken.

With the knowledge of data and data sources, one may then create the map. Maps have advantages and disadvantages given each set of circumstances. Point maps are specific and lend themselves to being used where greater information is known about an offense or a behavioral

pattern is recognized. Continuous surface maps' strengths lie in the ability to display the density of crime. This provides a visual representation which allows the user to identify the hotspots of crime. Finally, choropleth maps display density measures within boundaries which provide a use for operational or strategic planning.

Problem Solving

Problem solving is present in the many stages of mapping and should not be viewed only as a means to resolve a problem; rather, problem solving provides a decision making platform by which multiple alternatives can be examined. Mapping itself, and information derived from the geographic examination of crime, is useful in all parts of the problem solving process. Maps serve to identify problems. For example, the hot spot map alerts analysts that there is a concentration of crime in a particular place. Maps then can be further utilized to analyze the problem that exists, including the structure of the community and any environmental cues that may be present. Maps may also lend insight into law enforcement responses. If the concentration of crimes appears to be emanating from a single apartment complex, officers may work with the complex management in addressing issues. Finally, mapping may then be used to evaluate the effectiveness of the treatment applied.

Personnel

Personnel and personnel management may be one of the most significant features of crime mapping. Competent people are required to manipulate the data required for the mapping practice. Crime mapping is an involved process, which requires knowledge of databases and the information contained within as well as knowledge of theory, mapping function, and output. With all of this requisite specialized knowledge, an argument is made for the use of a crime analyst. However, support from management and the officers themselves is also required.

Management directs the activities of officers and also the analysts. As such, management must buy in to the utility of crime mapping. Management also directs the tactical operations of officers so again, knowledge of theory becomes important. Finally officers play an important role in the field. Officers respond to the burglaries, robberies and other calls of service. In addition to making arrests and writing traffic tickets, officers serve as a conduit of crime prevention tips and techniques. Of course, knowledge of why crime occurs where it does can only assist the officer in educating the public.

Limitations

Many assumptions are made within this paper as to the efficiency of mapping. While mapping is available to all, truly efficient and effective mapping requires many things including modern technological infrastructure which provides for the interfacing of databases and GIS programs, the associated manpower to analyze and implement mapping solutions, and also the support of management. However, the three are not required for an agency to examine the utility of mapping within their jurisdiction, and challenge the standard policing model, for sufficient tools are available, freely, to create maps.

The success of mapping was cited as such within the text, however, given the multi-dimensionality of crime mapping and all of the features involved in its practical application, including management of personnel, education, enforcement tactics and the problem solving methods, more questions may be asked than answered as to the ideals within the process. That being said, law enforcement is a dynamic profession which is often driven by circumstance and as such any matrix reflecting the ideals is unlikely.

Recommendations for Future Research

Currently, the Center for Evidence Based Crime Policy (2014) advocates for the furtherance of evidentiary founded policing as policy, yet little research exists on the topic of assimilating evidence based practices into agencies operations and long term strategies. Much of the research to date has focused on the tactical aspects of crime mapping with some acknowledgement of the utility of mapping in the context of operational analysis, however little is known about the effect of a strategic application of mapping.

A strategic application of mapping would challenge the standard model of policing, including the concept of beat assignments and responding to calls for service, with a philosophy of place based assignments including hot spot patrol. A rudimentary examination in the context of this paper clearly identified the significance of the micro place as a unit of measure versus larger units, however, to change a decades, if not century, long practice of boundary policing would require a far more robust analysis of law enforcement responsibilities to the community.

References

Ainsworth, S. (2008). Reducing Crime in a Mobile Home Community. In G. Jones & M. Malina (Eds.), *Crime Analysis Studies*Washington D.C.: Police Foundation.

Andresen, M., & Malleson, N. (2011). Testing the Stability of Crime Patterns: Implications for Theory and Policy. *Journal of Research in Crime and Delinquency* , 58-82.

Braga, A., & Schell, C. (2013). Evaluating Place Based Policing Strategies: Lessons Learned from the Smart Policing Initiative in Boston. *Police Quarterly,* 339 - 357. doi: 10.1177/109811113497046

Bernasco, W. (2008). Them Again?: Same-Offender Involvement in Repeat and Near Repeat Burglaries. *European Journal of Criminology,* 411-431.

Brantingham, P., & Brantingham, P. (1981). Crime and Mobility: An Empirical Study. In W. Rhodes & C. Conly (Eds.), *Environmental Criminology* (pp. 167 - 168). Thousand Oaks, CA: Sage Publications.

Brereton, D. (1999). Zero Tolerance and the NYPD. *Mapping the Boundaries of Australia's Criminal Justice System* (p. 15). Canberra: Queensland Criminal Justice Commission.

Canter, D., Coffey, T., Huntley, M., & Missen, C. (2000). Predicting Serial Killers Home Base Using a Decision Support System. *Journal of Quantitative Criminology,* 457-478.

Center for Evidence Based Crime Policy (2013). *Evidence Based Policing*. Retrieved from www.cebcp.or/evidence-based-policing/.

Cohen, L. & Felson, M. (1979). Social Change and Crime Rate Trends: A Routine Activity Approach. *American Sociological Review*, 588-608.

Eck, J., Chainey, S., Cameron, J., Leitner, M., & Wilson, R. National Institute of Justice, (2005). *Mapping crime: understanding hot spots*. Washington D.C.: U.S. Department of Justice Office of Justice Programs.

Eck, J. & Clarke, R. (2013). *Intelligence Analysis for Problem Solvers.* Washington, D.C.: Office of Community Oriented Policing Services, United States Department of Justice.

Eck, J., & Spelman, W. (1987). *Problem-solving: Problem-oriented Policing in Newport News*. Washington, D.C.: U.S. Dept. of Justice, National Institute of Justice.

Ehrenberg, R. (2006). *Mapping the World: An Illustrated History of Cartography*. Washington D.C.: National Geographic Society.

Farrell, G., Clark, K., Ellingsworth, D., & Pease, K. (2005). Of Targets and Supertargets: A Routine Activity Theory of High Crime Rates. *Internet Journal of Criminology* , 1-25.

Haining, Robert & Law, Jane. (2007). Combining Police Perception with Police Records of Serious Crime Areas. *Journal of the Royal Statistical society*, 1019-1034.

Harries, K. (1997). Mapping Crime: Principle and Practice. United States Department of Justice, Office of Justice Programs. Washington D.C.

Jang, J., Hoover, L., & Joo, H. (2010). An Evaluation of Compstat's Effect on Crime: The Fort Worth Experience. *Police Quarterly*, 388-412.

Jeffery, C.R. (1971). *Crime Prevention Through Environmental Design*. Thousand Oaks, CA.: Sage Publications.

Koper, C. (1995). Just Enough Police Presence: Reducing Crime and Disorderly Behavior by Optimizing Patrol Time in Crime Hot Spots. *Justice Quarterly*, 649 – 672.

Koper, C. (2014). Assessing the Practice of Hot Spots Policing: Survey Results from a National Convenience Sample of Local Police Agencies. *Journal of Contemporary Criminal Justice*, 1 – 24. DOI: 10.1177/1043986214525079.

Levine, N. (2007). *CrimeStat. A Spatial Analytics Program for the Analysis of Crime Incident Locations.* Ned Levine & Associates, Houston, TX and the National Institute of Justice, Washington, D.C.

Manning, P. (2001). Technology's Ways: Information Technology, Crime Analysis and the Rationalizing of Police. *Criminology and Criminal Justice* , 83-103.

Martin, D. (2002). Spatial Patterns in Residential Burglary: Assessing the Effect of Neighborhood Social Capital. *Journal of Contemporary Criminal Justice* , 132-146.

Paulsen, D. (2004). To Map or not to Map: Assessing the Impact of Crime Maps on Police Officer Perceptions of Crime. *International Journal of Police Science*, 234 - 243. Retrieved from www.ebscohost.com

Phillips, P. (1980). Characteristics and Typology of the Journey to Crime. In D. Georges-Abeyie & K. Harries (Eds.), *Crime* (pp. 167 – 180). New York: Columbia University.

Ratcliffe, J. (2004). Crime Mapping and the Training Needs of Law Enforcement. *European Journal on Criminal Policy and Research*, 65- 83.

Reid, A., Frank, R., Iwanski, N., Dabbaghian, V., & Brantingham, P. (2014). Uncovering the Spatial Patterns of Crimes: A Criminal Movement Model. *Journal of Research in Crime and Delinquency*, 231-253.

Reinhartz, D. (2012). *The Art of the Map: An Illustrated History of Map Elements and Embellishments*. New York: Sterling.

Reynald, D. & Elffers, H. (2009). The Future of Newman's Defensible Space Theory: Linking Defensible Space and the Routine Activities of Place. *European Journal of Criminology.* 25 – 46. DOI: 10.1177/1477370808098103.

Rinehart-Kochel, T. (2011). Constructing Hot Spots Policing: Unexamined Consequences for Disadvantaged Populations and for Police Legitimacy. *Criminal Justice Policy Review* , 1-26.

Rossmo, D. (1995). Place, Space and Police Investigations: Hunting Serial Violent Criminals. In J. Eck & D. Weisburd (Eds.), *Crime and Place* (pp. 217-235). Monsey, N.Y.: Criminal Justice Press.

Rossmo, D. (1997). Geographic Profiling. In J. Jackson & D. Bekerian (Eds.) *Offender Profiling: Theory, Research and Practice.* (pp. 159 – 175). Chichester, U.K.: Wiley.

Sampson, R. & Raudenbush, S. (1999). Systematic Social Observation of Public Spaces: A New Look at Disorder in Urban Neighborhoods. *American Journal of Sociology*, 603 – 651.

Shaw, C. & McKay, H. (2006). Juvenile Delinquency and Urban Areas. In F. Cullen & R. Agnew (Eds.) *Criminological Theory Past to Present – Essential Readings.* (pp. 95 – 101). New York, NY: Oxford University Press. (Reprinted from *Juvenile Delinquency and Urban Areas*, by C. Shaw and H. McKay, 1942. University of Chicago Press)

Taylor, B., Kowalyk, A. & Boba, R. (2007). The Integration of Crime Analysis into the Perceptions of Analysts. *Police Quarterly*, 154 – 169,

Tibbetts, S., & Hemmens, C. (2010). *Criminological Theory: A Text Reader*. Thousand Oaks: Sage Publications.

Tonkin, M., Woodhams, J., Bull, R., Bond, J., & Palmer, E. (2011). Linking Different Types of Crimes Using Geographical and Temporal Proximity. *Criminal Justice Behavior*, 1069 - 1088.

United States Department of Justice. (2013). *UCR Data Tool*. Retrieved from Federal Bureau of Investigation: www.fbi.gov

Walsh, W. & Vito, G. (2004). The Meaning of Compstat: Analysis and Response. *Journal of Contemporary Criminal Justice*, 51-69.

Weisburd, D. & Eck, J. (2004). What Can Police Do To Reduce Crime, Disorder, And Fear?. *The Annals of the American Academy of Political and Social Science*, 42-65.

Weisburd, D., & Green-Mazerolle, L. (2000). Crime and Disorder in Drug Hot Spots: Implications for Theory and Practice in Policing. *Police Quarterly* , 331-349.

Wilson, J. and Kelling, G. (1982) Broken Windows - The Police and Neighborhood Safety. In G. Cole, M. Gertz, and A. Bunger (Eds.), *The Criminal Justice System, Politics and Policies 9th Edition* (pp. 96 -108). (Reprinted from *Atlantic Monthly*, 1982, pp. 29-38).

Yang, S.M. (2010). Assessing the Spatial-Temporal Relationship Between Disorder and Violence. *Journal of Quantitative Criminology* , 139-163.

Zahm, D. (2007). *Using Crime Prevention Through Environmental Design in Problem Solving.* United States Department of Justices, Office of Cops. Washington D.C.