PREDICTIVE POLICING: ONE STEP FURTHER TO A SAFE COMMUNITY

Danijela Spasić, PhD[1]

University of Criminal Investigation and Police Studies, Belgrade, Serbia

Ksenija Butorac, PhD

Police College, Zagreb, Croatia

Abstract: The availability of large datasets and the rapid development of sophisticated tools that allow fast processing of vast quantities of information have been the key drivers behind the increasing use of algorithmic technologies in policing since the early 2000s. "Predictive policing" became an umbrella term for a variety of models, software and applications. All location based predictive policing programs however have the same aim: Sending police officers to the right place at the right time. For decades, police action has been rather reactive than proactive, focused on arrest and failing to see incidents as indicators of continuing underlying problems. Predictive policing has been praised as a turnaround of this approach, a "panacea" for the optimization of resources and the creation of a safer society, where the police can stop breaches of law, before they happen. Although lately more critical voices have been raised from civil society and research, questioning the effectiveness of the tools as well as their compatibility with human rights, there is still a lack of objective research on the issue.

Key words: *predictive policing, safe community, GIS, law enforcement agencies*

INTRODUCTION

When in doubt, predict the present trend will continue.

–"Merkin's Maxim"

The availability of large datasets and the rapid development of sophisticated tools that allow fast processing of vast quantities of information have been the key drivers behind the increasing use of algorithmic technologies in policing since the early 2000s (Pearsall, 2010). It is mainly decision-makers in the US and the UK that have identified big data analytics as a tangible solution for their budget strapped law enforcement agencies. Today, "law enforcement agencies are on the frontier of the data revolution" (Bachner, 2013: 6). Predictive policing became an "umbrella" term for a variety of models,

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software and applications. All location based predictive policing programs, however, have the same aim: sending police officers to the right place at the right time. For decades, police action has been rather reactive than proactive, focused on arrest and failing to see incidents as indicators of continuing underlying problems (Moore, 1992). Predictive policing has been praised as a turnaround of this approach, a *panacea* for the optimization of resources and the creation of a safer society, where the police can stop breaches of law, before they happen (Jouvenal, 2016). The topic has been widely discussed in the public discourse, often with a positive rhetoric.

Similarly to other technological reform processes in the public sector predictive policing models are often developed by the private sector, many of the underlying techniques were initially designed to predict consumer behavior for private sector clients (Bachner, 2013). The outsourcing of technology however changes the way public sector agencies work and can create new concerns of practical an ethical nature (Cordella & Willcocks, 2010).

Proactive policing refers to all policing strategies that have as one of their goals the prevention or reduction of crime and disorder and that are not reactive in terms of focusing primarily on uncovering ongoing crime or on investigating or responding to crimes once they have occurred.

According to the National Institute of Justice of the U.S. (2010), there are four categories within proactive policing: person-focused, place-based, problem-oriented, and community-based. Person-focused strategy targets specific criminal behavior by a small number of offenders, who are confronted and informed that continued criminal behavior will not be tolerated.

Smart, effective, and proactive policing is clearly preferable to simply reacting to criminal acts. Although there are many methods aimed at preventing crime, predicting where and when a crime is likely to occur, who is likely responsible for prior crimes, and who is most likely to offend or be victimized in the future has recently gained considerable currency.

In this paper, we explore the importance of predictive policing in the development of a safe community.

WHAT IS A SAFE COMMUNITY?

Safe community is a term that has entered the research field of many institutions in recent years. It is presented as a proactive, coordinated activity of state and social bodies and citizens to improve safety in the community (Aldous & Leishman, 1999). The development of this concept in many democracies has directed attention to those state and social bodies, organizations and institutions that are responsible for security, safety, public order and peace and the general quality of life.

A safe community implies a positive result of prevention activities crime that is proving to be a new quality of human life. In such a positive environment, people, as individuals or collectives, are protected from possible dangers or threats arising from violence or crime, and institutions have the answers and capacity to solve security problems. These are crime prevention activities, and security is seen as a public good. A safe community is a process in which the key organizations of a community come together to work in partnership to achieve a safer environment for all. The World Health Organization defines a safe community as the prevention of all human injuries, including intentional such as violence, criminal activity and suicide, and unintentional injuries - traffic and other accidents, fires and natural disasters (Krug, Dahlberg, & Mercy, 2002).

A safe community should also be a healthy, functional community. Taking into consideration the needs of its citizens, it is expected that the local community creates the conditions in which they will

be satisfied with the quality of life, i.e. in which the local community will strive to meet their needs. That, however, does not mean that each local community should strive for an "ideal" model, state and manner of functioning. The "ideal" model of the local community does not exist, nor is it possible to develop it, therefore, the communities in which the quality of life is estimated as good, and in which the conditions for meeting the most of the citizens' needs were created, are called, in theory and in practice, *functional or healthy* communities (Boehm & Cnaan, 2012).

Systems (services, institutions, agencies) for providing services to the citizens in the functional communities base their activities on defined priorities of the local community, they reduce the potential risks for the citizens, put a focus of their work to outcomes (changes with the citizens) and not to the processes themselves, maintain the existing and establish new social networks of assistance and support to the individuals, they include citizens (service users) into the agencies for decision making, etc. (Checkoway, 1995). At that, always when realizing different forms of the activities and social work in the local community, the specificities of the target groups and characteristics of the population in the local community, whose needs and deficiencies have to be meet, have to be taken into consideration (Ife & Fiske, 2006). The police organization within the concept of the local community work bases its activities on these principles, too.

WHAT IS PREDICTIVE POLICING?

The *Predictive Policing* should be a step forward in the development of technological applications in the context of a safe community. *Predictive policing* is the application of analytical techniques – particularly quantitative techniques – to identify likely targets for police intervention and prevent crime or solve past crimes by making statistical predictions. The use of statistical and geospatial analyses to forecast crime levels has been around for decades. In recent years, however, there has been a surge of interest in analytical tools that draw on very large data sets to make predictions in support of crime prevention. These tools greatly increase police departments' reliance on information technology (IT) to collect, maintain, and analyze those data sets, however (Perry, McInnis, Price, Smith, & Hollywood, 2013).

Predictive policing can be defined as: "any policing strategy or tactic that develops and uses information and advanced analysis to inform forward-thinking crime prevention" (Uchida, 2014: 3871). The fundamental principle underlying the theory and practice of predictive policing is that it is possible to make probabilistic inferences about future criminal activity on the basis of existing data (Bachner, 2013).

For example, on the 14th of March 2014 a serial robber was detected and arrested thanks to the "Key-Crime" software program, developed by the police in Milan, Italy. The software had analyzed his criminal behavior using an algorithm able to cross hypothesize about human criminal intentions and predicting he would have perpetrated that specific crime (*Corriere della Sera* online ed., 27 March 2014). According to his criminal background, the thief was responsible for eleven robberies in different pharmacies since December 2013. The algorithm used to catch the criminal could represent something of revolutionary, however, this is nothing new under the sky for experts in criminal risk-assessment (Mendola, 2016). Also research from the Memphis Department of Pre-crime shows how factors leading to crime are multiple and complex and tracking crime rates back to primary causes remains notoriously difficult (Vlahos, 2012). Predictive strategies such as Memphis's Blue Crush system have helped to stem crime. Since 2006, when Blue Crush was instituted, crimes against property and violence decreased significantly about 26% (IBM Source).

With a specific focus on individuals, Richard Berk and his colleagues from the University of Pennsylvania have centered his studies on the individual-related algorithm. His research is able to estimate the probability with which a person on probation could commit homicide based on a statistical review of thousands of cases and account variables such as age, sex, type of crime as well as the date of the first infraction (Berk, Sherman, Barnes, Kurtz & Ahlman, 2009).

As we can see, predictive policing can be applied to different activities. Some scholars have divided them into four broad categories creating one dedicated taxonomy. According to Perry et al. (2013), there are four broad categories of predictive methods. These methods can be focused on predicting: 1) *crimes* (used to forecast places and times with an increased risk of crime); 2) offenders (identifying individuals at risk of offending in the immediate future); 3) victims *of crimes* (used to identify groups or individuals as potential target of criminal offence), and 4) perpetrator identities (creating profiles that match likely offenders with particular past crimes). The innovative aspect of predictive policing is that its most common use focuses on the prevention of *future crimes* rather than on combating *previous crimes*.

GIS (GEOGRAPHIC INFORMATION SYSTEM) APPLICATION IN THE PREDICTIVE POLICING

Catalogue of scientific knowledge in criminology, criminalistics and behavioral geography has enabled development of new police technologies such as GIS, crime mapping and geographic profiling that are used nowadays on operative, tactical and strategic level in crime investigation. The importance of geographic data in finding and analyzing patterns or models of criminal behavior has been recognized by modern police organizations in proactive policing in order to prevent and reduce crime rates, benefiting the citizens.

a) GIS as a partner to police officers on the field

Some police work and corrective actions have distinctly field character that requires the use of GIS technologies. Police officers must be able to access key data in emergencies on the field or during tactical operations. Although almost every service has mobile terminals in their vehicles, geospatial solutions and mobile technologies move the source of the information from vehicles to the street, using only smart phones. Mobile GIS gives police officers the ability to access and share important information about their location, suspicious person or illegal activity. In some countries, it is common to use GPS movement tracking against the persons in house arrest, who can be easily tracked using real-time GIS. A study conducted using GIS in one Ohio district confirmed that as many as 45% of sex offenders lived within 300 m of the school (Grubesic, Mack & Murray, 2007). Since each action provokes a certain reaction, the problems in assessing the effectiveness of crime control are two spatial and external influences. One of them is the spatial shift that occurs when police measures of crime control cause crimes to move further in space even though the overall crime rate has been reduced in the target area. Another spatial and external impact is spatial diffusion, where the benefits of crime reduction are transferred to neighboring areas, which is a desirable phenomenon. Both effects are random and lead to linking crime rates in neighboring areas by spatial correlation. Most perpetrators follow a declining rule with a greater distance from their place of residence or domicile and they are more likely to commit a crime in areas closer to the perpetrator's home. Therefore, in spatial terms, a decrease in the crime rate in one area is associated with an increase in crime in other areas, and vice versa. Often, researchers use data on serious crimes (e.g. murders) more than on other crimes because

there is greater confidence in the accuracy and quality of such data. On the other hand, there is an apparent increase in some types of crime because they are reported more often. This uncertainty in data can significantly affect the validity of scientific research in criminal investigation. For spatially based research and police work, the accuracy of geocoding is very important for collecting crime data. Traditionally, geocoding is address-based. Sources of errors in geocoding by address include typographical errors, abbreviations, duplication of addresses, lack of standardization, etc. The error can also be caused by the lack of concentration of the police officer while writing down the address, which is a very common mistake according to some research (McCarthy & Ratcliffe, 2005). Installing a GPS device on police cars or using a handheld GPS device at a crime scene could eliminate these sources of error.

b) GIS in criminal investigation and prevention

Many murder cases have been resolved by tracking a signal from victims' mobile phones, tracking a suspect using GPS, or using phone call records. In order to perform the analysis, the analyst must have geographical data on the position of the mobile device at the time of the call (either SMS or internet traffic). This data can be used to determine the geographical distribution of calls, the most likely location of mobile device users, other common locations, travel information. GIS can display all this data as maps, which would allow visualization of the locations where most calls were made (either incoming or outgoing calls). Also, a map can be created in order to find out where the mobile device user is most likely to live. However, such data collection may represent a violation of the right to privacy. All of this information displayed geographically can reveal patterns of behaviour, which in turn can reveal the profile of the perpetrator. In order to analyze cell phone records using GIS, the data must contain coordinates that can be translated to a point on the map. Typically, mobile phone records contain the coordinates of base stations that receive/transmit data from mobile devices in their area. After that, the analysis of the type and size of the base station cell is approached, which enables the most probable geographical location of the perpetrator.

Cluster analysis is a more complex method of analyzing communication data in a geographical sense because it starts the analysis based on the geographical location of the scene and without a possible perpetrator. This method is not focused on one phone number, but on several of them (cluster) and their mutual communication. The purpose of this technique is to identify the perpetrator based on a known pattern of criminal activity and to apply it to communication data within the area of interest. The analysis of the criminal pattern examines the nature and extent of current and impending crimes, trends, related crimes, hotspots of activity, and common characteristics of perpetrators and their behavior. The main source of data for this analysis are police reports and crime reporting data.

Geographical profiling has attracted much foreign media attention after it assisted in solving much-reported crimes in the media. This technique predicts the area in which the perpetrator is most likely to live, by analyzing the geographical locations of interrelated cases. The key to geographic profiling is in studying what lies behind the points on the map in order to understand the significance of the places the perpetrator chooses as well as the routes of his journey. The theoretical basis of this technique is to find a pattern of behavior of the perpetrator on the way to the crime scene from the place of residence (i.e. the J2C function, Van Koppen & De Keijser, 1997). In other words, the perpetrators commit most crimes relatively close to their homes, and the proportion of crimes committed decreases with distance from home (O'Leary, 2011) because it makes them feel safer. Based on the function of distance reduction, a probability area is generated for each point in the study area - representing each point as a possible perpetrator base (usually home or workplace). This fact shows the complexity of the perpetrator's behavior and argues that in fact the "mental map of the perpetrator" is his/her perception of the

environment. Geographic profiling is most often used in the analysis of a number of crimes (serial and most often more serious crimes) due to the larger amount of data that are crucial for the success of this technique. In addition to criminal investigation, GIS is also important in predicting crime. By identifying environmental factors in past events, the analyst can predict an area that is statistically similar to previous crime scene locations. Unlike "hotspots" that focus on areas of high crime intensity in the past, this technique anticipates such areas and enables proactive police action and crime prevention.

Event analysis is a technique used to extract meaning from a series of interrelated events, with GIS providing a timeline of events by creating lines between event points in chronological order. It measures distances for consideration of possible modes of transportation as well as the route of the perpetrator. It also approximately determines the speed of the perpetrator, as well as the perpetrator's stationary points using the focal points of the activity. It is also possible to analyze the overlap of data from several different data sources (for example, field information and information from traffic surveillance cameras).

c) GIS as a tool for planning and action of police forces on the field

The primary function of police work remains patrolling and touring the terrain. For a long time, the police patrols were placed randomly in the field and activated in the moment they are needed and sent on a mission. There are two common police practices that rely on geospatial data analysis: police actions at "hotspots" and spatial police work (Stoffel, Post, Stewen & Keim, 2018). Police work at the focal points is the deployment of police forces according to geographical variations in crime with the greatest focus on places where the number of offenses is greater than the average number of offenses or causing riots (hotspots). Some focal points can occur quite randomly and a rigorous statistical analysis is required to detect clusters (focal points) which are statistically significant. Free software (CrimeStat, SaTScan, GeoDa) contain tools for recognizing focal points within regular geometric shapes (circles, ellipses) (Anselin, 2004). ArcGIS popular GIS software contains statistical tools which recognize statistically significant focal and cold spots. The main goals in the spatial action of the police include the minimum time of arrival at the scene, cost reduction and harmonization of the workload of police officers. ArcGIS allows testing of different scenarios and assesses the workload of police officers accordingly (Curtin, Qui, Hayslett-McCall & Bray, 2005).

d) GIS as a tool for testing theories in criminology

There is a very extensive literature on the application of GIS in theoretical forensic research. A part of the research uses the so-called factor-based modeling to simulate and test the theory of routine activities. The model deals with perpetrators, targets and crime scenes as individual factors and predicts crimes based on the three said factors. A calibrated model simulation generates crimes similar to real crimes both numerically and spatially. The research combined ArcGIS and ABM's RepastPy software whereby the individuals were modeled in a real environment and based on which different scenarios were observed (Groff, 2007). This fact helped to create a virtual laboratory in which it is possible to investigate the impact of police decisions.

CONCLUSION

Many similar relationships in law enforcement can be explored with predictive policing. Police agencies use computer analysis of information about past crimes, the local environment, and other pertinent intelligence to "predict" and prevent crime. The idea is to improve situational awareness at the

tactical and strategic levels and to develop strategies that foster more efficient and effective policing. With situational awareness and anticipation of human behavior, police can identify and develop strategies to prevent criminal activity by repeat offenders against repeat victims. These methods also allow police departments to work more proactively with limited resources. However, it must be understood at all levels that applying these methods is not equivalent to finding a crystal ball. For a policing strategy to be considered effective, it must produce tangible results. For example, crime rates should be lower, arrest rates for serious offenses should increase, and there should be an observable positive impact on social and justice outcomes.

Predictive methods, themselves, may not expose sufficient probable cause to apprehend a suspected offender. "Predictions" are generated through statistical calculations that produce estimates, at best; like all techniques that extrapolate the future based on the past, they assume that the past is prologue. Consequently, the results are probabilistic, not certain.

The limitation of predictive policing might be that the data quality of the police data limits the predictions, since much information on current acts is not yet available in the system at the time of the prediction and therefore cannot be used. Police organisations must be aware that even high data quality does not always create a true representation of reality, which means that forecasts are always subject to uncertainties. The models of predictive policing might result in possibly skewed depictions of society and criminal behavior as they tend to remove context (Innes, Fielding, & Cope, 2005). The risk here is that predictive policing could result in less effective and maybe even discriminatory police interventions. The aspect of legal limitations must also be kept in mind and always be subject to a strict evaluation.

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