Geography of Crime and Geographic Information Systems

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Abstract

A link between human geography and criminology has been established as a result of the development of strong parallel that has existed in science for decades, similar to how criminology was predominantly put in the focus of sociology due to the series of paradigm shifts. Cognitive mapping, environmental perception and values and meanings attributed to "place", "space" and "environment" have constructed a framework for interaction between criminology and human geography and for development of geography of crime. Spatial data analysis through geographic information systems is becoming more popular in crime mapping and crime analysis in contemporary police organizations and their usage is limitless. Geographic information system as an analytical instrument is also used for pattern analysis or for analysis of spatial crime distribution model and for researching spatial relations between crime and other demographic and socio-economic factors by using visual representation of spatial data. Along with usual implementation of traditional methods, geographic information systems contribute in directing crime investigations to a certain area of probable locations of residence, other activities and the offender's itinerary. Due to its significant impact on the quality of police work, as well as policy and decision making on operational, tactical and strategic levels, modern police organizations use GIS in their daily work in order to prevent and reduce crime rates.

Keywords: Environmental criminology; Situational Criminalistics; Geographic information systems; Geographic profiling

Introduction

Geographical approach and an interest for crime research have significantly increased over the last few decades due to the fact that crime cannot be separate from the offender's natural habitat. This has resulted in development of human geography, a science describing and analyzing location patterns of static or moving phenomena of human origin on the surface of earth [1]. Crime phenomena are also a part of these phenomena which means that they represent a subject of geographical research. There are no direct geographical theories that provide explanation of spatial crime distribution, but a link between human geography and criminology has been established as a result of the development of strong parallel that has existed in science for decades, similar to how criminology was predominantly put in the focus of sociology due to the series of paradigm shifts.

Since the mid-20th century human geography has been dealing with quantitative methods and constructing models related to spatial analysis, while criminology experienced a surge of interest in the last few decades for environmental criminology. Cognitive mapping, environmental perception and values and meanings attributed to "place", "space" and "environment" have constructed a framework for interaction between criminology and human geography and for development of geography of crime or "crime geography" since the 70ties in the 20th century [2]. Geography of crime has a descriptive and scientifically based analytical function. It is used in geography more and more frequently when evaluating the impact of social control system on existing crime patterns. Second contemporary approach refers to so-called geographic profiling [3-5] that studies the movement of crime offenders and the process of locating their places of residence. Spatial data analysis through geographic information systems (hereafter known as GIS) is becoming more popular in the so-called crime mapping and crime analysis in contemporary police organizations and their usage is limitless.

Short historical overview of criminological theories with a spatial component

Majority of criminological theories are based on researching the offender, the victim or the situation in which a criminal act has been committed and these theories have been developed under the influence of psychological and sociological trends

in criminology. Considering that psychological theories do not necessarily include spatial components [6], this article will present criminological theories relevant for geographic crime analysis and thus the following issues will be considered: where, when and why criminal acts are committed in certain locations and is there a specific pattern or a model in the offender's movement?

Development period for spatial or environmental theories and empirical research of crime can be divided historically into four phases: the cartographic school in the 19th century, the Chicago school in the first half of the 20th century, the factor analysis school from the mid-20th century and criminology of the environment (environmental criminology) and geography of crime that has developed since the 1970ties till today.

The 'Cartographic School': By investigating environmental and spatial sources of crime, criminology as a scientific discipline has contributed to judicial reform and to the development of the classical school of criminal law in the late 18th century and in the beginning of the 19th century. That is how the cartographic school (1830-1880) emerged in England and France as a part of classical reformist school. The majority of the studies referred to the description of differences in attributes and the number of criminal acts between certain cities, regions and smaller regions, for example Guerry [7] and Quetelet [8] discovered that crime was unevenly distributed in different French districts. During the second half of the 19th century, studies focused more on researching crime rates in city centers. The most important results produced by the cartographic school showed that crime changes fundamentally in relation to space, that deviations occur in many different levels of social danger of criminal acts and that there is a mutual connection between crime and certain social characteristics such as population density, for example.

The 'Chicago School': Scientists from the University of Chicago have studied and tried to provide an explanation about the distribution of crime in Chicago in the late 19th century and early 20th century by introducing a concept of social ecology that consisted of two elements. The first one was based on social competition or social conflict due to scarce spatial resources of expanding cities created due to industrialization and urbanization. The second one referred to nature and quality of social organization within various areas. The most significant Chicago School researchers who applied the concentric zone theory were Shaw and McKay [9]. They established a link between delinquency in different neighborhoods and other socio-economic factors. Their results, which pointed to the existence of delinquency areas, had a major influence on future research in American criminology.

The 'Factor Analysis School': Empirical research conducted in the mid-20th century had many things in common with the Chicago School. They highlighted a link between the geographical distribution of offenders and criminal acts and characteristics of certain areas inhabited by delinquents [10], i.e. places where offences are committed. The studies done by Morris [11] and especially Lander [5] in relation to Shaw and McKay research results did not show substantial differences in crime analysis of large city agglomerations.

Contemporary findings in environmental criminology and situational criminalistics

During the 19th century and in the early 20th century crime was considered a socially derogated, deviant form of behavior that is different from the usual, frequent behavior patterns, and the studies were focused on the origin of crime motivation. However, crime perspective has changed radically during the last few decades. The works of Ray Jeffrey ("Crime Prevention through Environmental Design") [12] and Oscar Newman ("Defensible Space") [13] have strongly influenced the research of physical space and environment within which criminal acts occur, especially for police officers and criminologists. Environmental criminologists such as Brantingham and Brantingham [14,15] and Carter and Hill [16] have studied a mutual connection of characteristics of criminal acts, target locations and criminal act locations in a physical or spatial environment, choice of movement or travel itinerary of the offender and usage of the offender's space which is specified according to specific characteristics, and used for various activities. Namely, crime motivated individuals analyze a location from the very beginning as well as space in which they are planning to commit a criminal act and they choose their target.

One group of theories and empirical research within social ecology focuses on places (territory) where individuals commit their crimes. The offenders do not choose their targets by chance, but on the basis of "awareness space" and a series of rational choices they make, given the fact that a criminal commits a criminal act when highest gain is likely to occur and the risk of getting caught is at its lowest [17,18]. Other group of theories based on studying offenders are the ones that study territory, i.e. space in which offenders of criminal acts live or reside by taking into account that the behavior of an individual is conditioned by his/hers social environment and that delinquents, through their affiliation, form social subcultures in certain areas. These theories recently became current again due to the usage of new techniques that investigate probable offender residences by using geographic information system and geographic profiling. These are relatively new techniques that analyze the movement of potential offenders in order to narrow down the search to areas in which the offender is most likely living or residing. This technique was created and successfully applied by Kim Rossmo [3,4]. The position and role of the victim in criminogenesis were mostly ignored until the first half of the 20th century.

Only in the early 1960ties have scientists shown an interest in victimology - a science which studies position of the victim in a criminal act. Second type of research which includes a spatial component refers to geographic distance between the offender

and the victim. From a spatial perspective, victimology studies the distance between the offender and the victim as well as distribution of victims, i.e. potential targets of different criminal acts. Theories dealing with criminal act offenders, the victim and situations cannot be studied independently because an overall picture of the criminal act and of characteristic models of committing those crimes is necessary. According to the crime pattern theory, typically, criminal acts do not occur randomly and in a uniformed manner within a physical and social space, but mostly occur during everyday activities or as a sequence in an individual's way of life. Therefore, every criminal act has its offender, its victim and it occurs in a certain time and in a certain place or space that encompasses also decision-making and implementation processes, creating a certain pattern or a sample as a recognizable mutual connection of subjects, objects, processes and ideas. This interconnectivity can be physical or conceptual, and its recognition implies a cognitive process of noticing similarities with other distinctive examples of interconnectivity that may differ somewhat due to local specificities [19]. Besides the dynamic of a certain social or interpersonal situation, specific circumstances and characteristics of an offender, victim, time and place create a possibility for committing a criminal act.

Therefore the routine activity theory [15,19,20] is a good example of integration of these three approaches. The offender does not choose a place for committing a crime randomly, but chooses a location within his/hers awareness space. This is a space that is familiar or known to him/her because s/he is informed about it and feels safe in it. Generally, awareness space encompasses a neighborhood where a person lives, place and surroundings in which that person works or acts in any way, roads that connect all this and a workflow of activities that this person performs in this space. Very often the offender is not capable of recognizing and accepting every detail (object) in a given surrounding because every space has its specific attributes and conditions. Perception of objects within a complex environment represents a type of a pattern (a draft) of an overall perception which needs to be analyzed. These patterns create a virtual mental map of an offender connected to various criminal acts, offenders and they represent a general context within which these acts occur. The already mentioned syntagm closely connected to awareness space is the so-called mental or cognitive map that represents a virtual map of somebody's awareness space and as such is defined by Behavioral Geography [19].

In relation to property crimes, there is less subject distance between criminal acts of rape and homicide. Danish researcher Sorensen [21] has studied the distance between places of residence and locations of burglaries of 3,238 convicts and he determined that the distances were relatively short (average value is 4,7 km). The number of criminal acts decreases with an increase of observed distance. The phenomenon of distance decay is usual, not only for delinquents, but also in general for movement of people in space (going shopping, recreation, socializing etc.). But it should be noted that delinquents typically avoid criminal activity within the so-called buffer zone - immediate surroundings of place of residence in order to avoid being detected and discovered. Subsequently, criminals most often search for and choose potential targets within a space that is familiar and known (learned) to them where they can conduct their own activities in order to reduce the risk of detection and apprehension, so it can be called an active space that provides good opportunities or available possibilities for committing a criminal act. Rational choice theory [15,19] discusses rational calculation on cost effectiveness (price and gain) of committing a potential criminal act. It contains a geographic component: by increasing distance from a potential target of assault, price is also increased, i.e. the risk for the offender. Other representatives of the rational choice theory [22] consider that perception and evaluation, as well as risk avoidance are important factors that influence the decision on whether to commit a criminal act.

As mentioned before, risk calculation is the basic principle of utilitarian theories on punishment and the doctrine of deterrence from committing a criminal act. However, rationality is a subjective and relative category. Some individuals are deterred by a certain behavior, and others are attracted by it which depends on the attitude of a potential offender, on the situation, and sometimes also on the mood (including a possible influence of psychoactive substances) of the offender [23]. By representing the theory of possibilities or favorable opportunities for committing criminal acts, Mayhew [24] points out the importance of environmental and situational variables in criminogenesis. The criterion which distinguishes professional from situational offenders of criminal acts is precisely the attitude towards the existence of favorable opportunities for committing a criminal act. On the other hand, the higher the number of available potential targets of assault, the higher the crime rate is. Considering that this theory does not highlight personal characteristics of the offender, it contains situational attributes because it directly connects the behavior of the offender and the victim. Behavior of the victim is observed as an incentive from the environment that triggers "criminal" reaction. Therefore this theory represents the basis for the development of the interactive crime model "incentive-reaction" including behavior of both sides into an integrative scheme.

Geographic information systems and geographic profiling of crime offenders

Geographic maps as a descriptive and analytical instrument: Spatial data is a very useful tool for visualization and identification of modality of perpetrating criminal acts, which means that geographic maps very often reveal key information on certain crime events affected by areas not identified and represented by statistical textual reports and tables. For example, when dealing with a series of committed criminal acts at the same location, but one that lies on the

border of two counties or sectors, the data from the table does not show that these criminal acts occurred at the same location. Physical approach to crime mapping has been replaced by computer mapping with the introduction of first computers and automatized data processing in the early 60ties in the last century in St. Louis Police. With the help of program support, computer geographic maps are not used only for locating, but also crime analysis. By introducing computer technology, crime analysis also became available. Therefore geographic information system as an analytical instrument is used for pattern analysis or for analysis of spatial crime distribution model and for researching spatial relations between crime and other demographic and socio-economic factors by using visual representation of spatial data.

An example of spatial analysis' usage of maps is neuralgic points, i.e. active crime locations or hotspots. Sherman [25] describes them as "small places in which the occurrence of crime is so frequent that it is highly predictable, at least over a one year period". According to this author, the crime rate within these active hotspots is six times higher than the average crime rate of an area. In general, in order to extract geography from the data used on a daily basis, the most intuitive way is to view it on a map. Moreover, not just any maps but intelligent digital maps made possible by geographic information system (GIS) technology. Consequently, it is possible to create a map that can identify where the crimes are occurring and clarify what crimes are or are not related based on research done by police officers. This can allow investigators to target their efforts and line officers to patrol and respond to locations while being more fully aware. A recent GIS software product that is most commonly used is ArcGis, a complete system for authoring, serving, and using geographic information. It is an integrated collection of GIS software products for building and deploying a complete GIS wherever it is needed [26].

Geographic information systems in police practice: As a data management system, geographic information system has become especially important during the last two decades due to availability of modern information technology to general public and also to numerous police systems worldwide [27]. Although there are several GIS definitions depending on its usage, this work shall use descriptive explanations of GIS produced by several authors. According to Clarke [28] it is a system for the capture, storage, retrieval, analysis, and display of spatial data. According to Huxold and Levinshon [29], GIS consists of three unavoidable functioning elements: data, applications and technology. In police work GIS represents a data management system which stores, processes, analyses and displays spatial data on crime, offenders and victims of criminal acts by providing support in decision-making and usage of police forces, in order to increase the level of safety and police efficiency in the community. Data is collected and inputted from various sources, not only police databases or registers, and is stored in the system. In order for the data to be processed, analyzed and cartographically represented, the data must be structured, meaning that before inputting, storing and further using the data it needs to be "cleaned", sorted and coded in order to be used as labels on a geographic map.

The function of spatial analysis is to recognize trends and patterns of committed criminal acts on one hand, and digital cartographic representation via visualization of raw data from the database (main map) as well as results obtained through more complex analyses of this data on the other hand [30]. For this purpose, GIS as a computer software links geographic information with descriptive information, presenting many layers of different information. All this information; where the point is located, how long the road is and so on, is stored as layers in digital format as a pattern of ones and zeroes in a computer, each layer representing a particular theme or feature of the map. This also allows for both operative and strategic crime analysis and for development of an interactive system or a so-called Internet mapping system and crime data exchange. From the point of view of an operative and strategic crime analysis, crime patterns and trends of certain type of crimes are easily recognized, analyzed and manifested because there are several methods for identifying active crime hotspots, unlike present conventional methods which cannot uncover these problems. As the basis for developing the Internet mapping system, GIS provides insight into crime and crime hazardous areas that can be used also by citizens for the purpose of their contribution in detecting and solving crime, participating in community police prevention programs, data exchange and other. These interactive applications present a direct assistance to police patrols [31]. By using GIS it is possible to understand events and dynamics in a neighborhood including persons, events, and crime hazards, identify risk factors including businesses, buildings, or other locations that draw crime, rapidly reconfigure beats and reallocate resources after analyzing crime trends over time etc. Law enforcement often suffers from limited resources.

Hence, owing to the flexibility of GIS, data can be handled and combined with other data types; they are readily available and can be forwarded in urgent situations. By allowing a clear overview via visual representation of crime activities within a designated area, decisions on engaging available police forces and resources can be made far more efficiently and the security of police officers in implementing their authority regarding criminal offenders and their activity in cooperation with citizens in the community can be increased, and all this with the purpose of reducing crime rate. GIS is very interesting to police operation-communication centers, police officers, investigators, crime analysts and other officers [27] due to the fact that GIS presents data on criminal acts and offenders in a simple and understandable manner, which contributes to a better police cooperation, a more favorable ratio of detecting and apprehending offenders and other [31]. By knowing where the problems are GIS also provides a visual means to proactively combat crime and communicate with citizens to build support.

Geographic profiling of crime offenders: A sequence of linked criminal acts committed by an unknown offender usually requires coverage of a larger number of suspects such as previously registered sex offenders, known burglars etc. This usually results in significant burden for investigators. Therefore modern police organizations are using knowledge from research in behavioral sciences more and more, and geographic profiling is a part of it. Geographic profiling is a research methodology which analyses the spatial sequence of criminal act locations (spatial pattern) in order to determine the most probable area where the offender lives or resides and works, as well as his itinerary [32]. This method represents a tool for managing spatial data in investigations of mutually connected, serial criminal acts such as homicide, burglary, rape, kidnapping etc. by using geometry of connected locations of series of criminal acts [3,33-35]. In this way probable jeopardy surfaces are identified which are integrated into virtual maps that represent crime areas - geoprofile. Geographic profiles are generated by using an algorithm that describes and connects spatial sequence of criminal acts or the criminal hunting process by focusing crime investigation on probable offender behavior within space.

By connecting these locations and crime events, offender's modus operandi and offender's signature are being investigated, and a parallel analysis of crime investigation includes data collection on personal characteristics of offenders on the basis of material and personal data sources. Geographic profiling consists of its objective (quantitative) and subjective (qualitative) components. The later component is based primarily on reconstruction and interpretation of the offender's mental map. Knowledge about probable motive, behavior and way of life of an unknown offender that is directly linked to his/hers activity in space (so-called offender psychological profiling) can be of great use in this case. Objective components refer to the application of series of scientific (computer) geographic techniques and quantitative measurements for analysis and interpretation of obtained primary samples. Geographic profiling focuses the search for suspects using a combination of environmental criminology theory, research on offender's spatial behavior, and mathematics, which has been incorporated into geographic profiling software called Rigel by Environmental Criminology Research Inc. [36]. Rigel [37] uses an algorithm called criminal geographic targeting (CGT) to create a geo-profile, a two-dimensional probability surface that overlay on a street map and shows the most probable areas for the offender's base [37]. Suspects are investigated in the order of prioritization. In some serial crime cases, the number of known suspects can be in the hundreds or thousands, and a geographic profile can help police manage this information [38].

There is a variety of investigative strategies that can be employed once a geographic profile has been prepared. CGT (criminal geographic targeting) also offers a three-dimensional distribution of probabilities (jeopardy surface) represented in a visual form of "peaks" as probable locations of the offender's

residence projected on a geographic map [39]. A probability analysis of repeated performances of criminal acts is performed by using the equal opportunity method and the weighting method so that by performing a midpoint analysis, a probable sequence of criminal act locations will be determined. In comparison with areas in which effort is made to predict certain security threatening events, a statistical concept of standard deviation is used and the percentage of future criminal or some other asocial activity in certain locations or objects is obtained, as well as presumed time (month, day, hour). Prognostic validity of this model is proportionally connected with a number of locations where criminal acts occurred - the more locations there are, the higher reliability of the model. This clearly shows how the geographic information system, along with usual implementation of traditional methods, contributes in directing crime investigations to a certain area of probable locations of residence, other activities and the offender's itinerary. The same methodology is used for spatial distribution of suitable objects of attack or victims of criminal acts.

Conclusion

In crime investigation of a particular offence and crime as a mass phenomenon that encompasses victimization as well, both theoretical and empirical research in areas of environmental criminology and situational criminalistics also investigate external factors, such as space and time geography, that influence criminal behavior of an individual. These are variables that represent a framework for systematic measurement of behavioral characteristics of an individual and of environmental characteristics in which that individual lives and works, i.e. for contextual analysis and general understanding of a criminal pattern or a security issue. Formation of various spatial patterns and activities within it (spatial heterogeneity) and human dependence on space (autocorrelation) can be changeable, but as a rule they follow systematic models. 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 everyday work in order to prevent and reduce crime rates, benefitting the citizens. Besides visual representation of criminal activities, GIS and geographic profiling methods allow for chronological analysis and prediction of future events in relation to time and place as well as important for community safety and tactical planning of efficient and immediate reactions to these events. These methods also contribute to the identification and uncovering of causality in persistent and recurring criminal offences (criminal perseverance) and public order disturbances and with finding appropriate solutions for these issues. GIS crime analysis and

community policing concept is especially well linked in the sense of enhancement of security due to the fact that data on community issues is available and understandable to citizens [36,40,41]. This allows for improvement and exchange of useful data between local institutions, police officers and citizens.

References

1. Crime Analysis (2017) GIS Solutions for Intelligence-Led Policing. USA.

2. Shaw CR, Zorbough FM, McKay HD, Cottrell LS (1929) Delinquency areas. University of Chicago Press, USA.

3. Rossmo DK (1997) Geographic profiling. In: Jackson JJ & Bekerian DA (Eds.), Offender profiling: theory, research and practice, Wiley, England, pp.159-175.

4. D Kim Rossmo (2012) Recent developments in geographic profiling. Policing: A Journal of Policy and Practice 6(2): 144-150.

5. Laverty I, MacLaren P (2002) Geographic profiling: a new tool for crime analysts. Crime mapping news 4(3): 5-6.

6. Hesseling RBP (1992) Dadermobiliteit, een eerste verkenning. In: Tijdschrift voor criminology 34: 2.

7. Guerry AM (1833) Essai sur la statistique morale de la France. Crochard, France.

8. Rossmo DK (1995) Place, space and police investigations: hunting serial violent criminals. In: Eck JE, I Weisburd D (Eds.), Crime and place, Crime prevention studies, USA, p. 4.

9. Sherman LW (1995) Hot spots of crime and criminal careers of places. In: Eck JE & D Weisburd (Eds.), Crime and Place, Criminal Justice Press, USA, p.35-52.

10. Lander B (1954) Toward an understanding of juvenile delinquency. Columbia University Press, USA.

11. Newman O (1972) Defensible space: Crime prevention through urban design. Macmillan, USA.

12. Jeffery CR (1971) Crime prevention through environmental design. Sage Publications, USA.

13. Quetelet MA (1831) Research on the propensity form crime at different ages. Chincinnati Anderson, USA.

14. Brantingham PJ, PL Brantingham (1991) Environmental criminology. Waveland Press, USA.

15. Patricia L Brantingham, Paul J Brantingham (1993) Nodes, paths and edges: considerations on the complexity of crime and the physical environment. Journal of Environmental Psychology 13(1): 3-28.

16. Lawrence E Cohen, Marcus Felson (1979) Social change and crime rate trends: a routine activity approach. American Sociological Review 44(4): 588-608.

17. Kleemans ER (1996) Strategische misdaadanalyse en stedelijke criminaliteit. Dissertatie Universiteit Twente Enschede, Netherlands.

18. Vann IB, Garson GD (2003) Crime mapping: new tools for law enforcement. Peter Lang Publishing, USA.

19. John Chapman (2004) DE-CRIME: Enhancing partnerships working through the internet. Crime mapping news 6(1): 3-4.

20. Cornish DB, Clarke RV (1986) The reasoning criminal: Rational choice perspectives on offending. Springer Verlag, USA.

21. Van Dijk JJM, Sagel-Grande HI, Toornvliet LG (1996) Actuele criminologie. Netherlands.

22. Kevin R Cox (1972) Man, location and behavior: An introduction to human geography. USA.

23. P Mayhew, RVG Clarke, A Sturman, JM Hough (1976) Crime as opportunity. Home Office Research Study No. 34, UK.

24. Morris T (1957) Some ecological studies of the 19th century. In: Voss HL & Petersen DM (Eds.), Ecology, crime and delinquency, USA.

25. David WM Sorensen (2005) The journey to Danish residential burglary: distributions and correlates of crime trips made by convicted Danish offenders. Ministry of Justice, Denmark.

26. Sarah Elwood, Helga Leitner (2013) GIS and Community-based Planning: Exploring the Diversity of Neighborhood Perspectives and Needs 25(2): 77-88.

27. Jasper J van der Kemp, Peter J van Koppen (2007) Fine-tuning geographical profiling. American Journal of Criminal Justice 17(2): 347-364.

28. Carter RL, Hill KQ (1980) Area-images and behavior: An alternative perspective for understanding crime. In: Georges-Abeyie DE & KD Harries (Eds.), Crime: A spatial perspective, USA.

29. Huxhold WE, Levinsohn AG (1995) Managing geographic information system projects. Oxford, England.

30. Johnson MR (2004) Using prison gang intelligence from the inside-out. Crime mapping news, 6(3): 4-7.

31. Clarke KC (1997) Getting started with Geographic Information Systems. Upper Saddle River: Prentice Hall, USA.

32. Weisburd D, McEwen JT (1997) Crime mapping and crime prevention. Criminal Justice Press, USA.

33. Maguire M, Bennett T (1982) Burglary in a dwelling. Heineman Educational Books Ltd, USA.

34. Brantingham PJ, Brantingham PL (1981) Notes on the geometry of crime. Environmental Criminology, Sage, USA.

35. Ned Levine (2009) Introduction to the special issues on Bayesian Journey-to-crime modeling. Journal of investigative psychology & offender profiling 6(3): 167-185.

36. Fridell L, Wycoff M (2004) Community policing: past, present and future. USA.

37. Schwind H, Ahlborn W, Weiss R (1978) Empirische Kriminalgeographie. Germany.

38. Rossmo DK (2013) Geographic profiling. In: G Bruinsma & DL Weisburd (Eds.), Encyclopedia of criminology and criminal justice. Springer, USA, pp.1934-1942.

39. Rossmo DK (2000) Geographic profiling. CRC Press, USA.

40. Jack R Greene (2000) Community Policing in America: Changing the nature, structure and function of the police. National Institute of Justice, USA.

41. Environmental Criminology Research Inc. Canada.

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