



CRIME MAPPING IN URBAN AREAS: CASE STUDY CITY OF PATRAS

Sofia Vagiota¹

Abstract

The work describes the development of a Geographical Information System designed to analyze and study the spatial distribution of violent acts and events (property crimes) that took place at the city of Patras (Greece) during the years 2007 – 2010. The final geodatabase is composed of 5400 records (occurrences) categorized in 50 distinct fields (variables) Crimes of violence are an old and rather common category of crime. Property crime is a category of crime including, among other, burglary, robbery, theft, motor vehicle theft etc. (Spinelli, 1985); it includes only the seizure of money or property, and does not involve force or threat against a victim. The main objective of the described GIS is to contribute to the study, research and analysis of criminal incidents parameters in conjunction with the parameters of the urban environment – which is the receptor space of such events – in order to design and identify strategic orientations and create safer urban areas. Generally speaking, people have legitimate and obvious right to be and feel safe in their homes, neighborhoods or the city center, and generally in the broad environment where they live. Cities are places where people meet, where social life is more intense and complex, where culture is produced, where economic development together with technical and scientific changes are more evident. People are increasingly sensitive to the perception of social risks, including risks related to crime and victimization (AGIS, 2006-2007). As it turns out, it is interesting to clarify how theory and practical analysis can help to apply their knowledge to design and prove that although the socioeconomic characteristics of the residents exert a strong influence on crime rate, the physical characteristics of the urban layout can exert a counteracting influence. Particularly the work documents the theoretical background of crime mapping and crime analysis process and presents all steps of logical and physical design of the GIS and its implementation: organization and verification of the crime report data, identification and encoding of variables, design and implementation of the databases structure, normalization as well as the spatial dependence process of data georeference. Finally, it presents the early conclusions of the research, regarding the spatial distribution and inventory of events accompanied by visual examples.

¹ Architect, MSc, MA, doctoral candidate. Laboratory of Urban & Regional Planning, Department of Architecture, University of Patras, Rio-Patras, 26500, Greece. Email: sofia vagiota@gmail.com.

1. Introduction

The focus of strategic urban planning issues in deterring crime events has not been adequately studied. There are not only actions to improve the built space preventing and reducing the likelihood of generation of criminal incidents and antisocial behavior but also the principles and objectives of public and / or private space (Cohen, LE & Felson, M., 1979). The spatial structure of city's infrastructures (roads, open spaces, etc.) requires special attention in order to prevent such types of actions (Nes A. Van, 2005a). According to international literature (Shu, 2000; Keith, 1999) it is indicated that under certain circumstances, urban planning parameters such as building factor, the number of floors in a building, the distance from the city center, the width of the sidewalk, land use, the area of building blocks, the age of buildings, population density, the territoriality etc. are important elements which contribute to the "safe" image of a city. The design process of the Greek cities, and the legislation framework, do not correlate such relationships and parameters. The focus and the only approach are from the point of view of forensics (Deladetsimas, 2009).

The objective is to study the relationship of the spatial distribution of criminal actions with the spatial and planning parameters of the urban environment in which these acts are committed. The main research question is whether it is possible for the urban planning to take into account factors that can prevent the commission of criminal incidents or hostile / antisocial behaviors. The research focuses on the contribution of criminal analysis results in the improvement of urban planning.

Geography has a major influence on crime. Combining geographic data with police report data and then displaying the information on a map is an effective way to analyze where, how and why crime occurs. Computerized crime maps became more common with the introduction of desktop computing and software programs called Geographic Information Systems (GIS). Analysts map where crime occurs, combine the resulting visual display with other geographic data (such as location of schools, parks and industrial complexes), analyze and investigate the causes of crime, and develop responses. Recent advances in statistical analysis make it possible to add more geographic and social dimensions to the analysis (AGIS, 2006-2007).

2. Space and Crime

The creation of urban environments that are defensible against crime has been a focal point of criminological discourse from as far back as the 1960s, when sociologists discovered that certain places, like people, possess a higher risk of being victimized than others. Although much attention in criminology has rested on sociological explanations of the concentration of crime at place – such as social disorganization and control theories – many researchers have subsequently changed focus, looking to the built environment rather than the sociological context for causal explanations of crime (e.g. Jacobs, 1961; Newman, 1972; Jeffrey, 1999). With this principle, the crime–design perception offers an exclusive point of view, because it emphasizes the fact that the built environment is more easily manipulated than the sociological con-

text, making it a potentially more fruitful angle from which to tackle crime prevention at place (Reynald & Elffers, 2009).

The early studies on crime and the urban image of the city were developed in The Chicago School in 1920 (Shu, 2000). As a key question had been claimed, whether crime as a phenomenon, can be identified in areas within the city of Chicago and associated with the 'type' of residents. For that purpose, there was a data collection focused on victims, such as the gender, the residence and age and the type of criminal act. Hence, applying this information in city maps and taking into account the population and the crime rates in each region, the research concludes that higher ratios are located on the outskirts of the city and especially in areas in transition. Terence Morris (1957), Brantingham & Brantingham (1975), Hope (1988), and Gilling (1997) emphasize that in the correlation of space and crime, the place of crime is not connected with the offender's residence (Shu, 2000).

One of the most remarkable theories focused especially on how urban space can affect the kind of criminal acts was in the book 'The Death and Life of Great American Cities' of Jane Jacobs (1962). Jacobs supports the idea that the relationship between space and crime depends on the city's function and all parts of a city are not safe in the same way. However the citizens and the visitors of an area can play a key role in the feeling of safety. In this direction, the author states the following conditions in order a city to be safe: mix of land use, small building blocks, coexistence of old and new buildings and finally should be enough density of residences and visitors. The appearance of Oscar Newman's '*Defensible Space*' in 1972 signaled the establishment of a new criminological subdiscipline that has come to be called by many "Crime Prevention Through Environmental Design" or CPTED. All 'Defensible Space' programs have a common purpose: they restructure the physical layout of communities in order to allow residents to control the areas around their houses. This includes the streets and grounds outside their buildings and the lobbies and corridors within them and it depends on resident involvement to reduce crime and remove the presence of criminals. Also, it has the ability to bring people of different incomes and race together in a mutually beneficial union. The key word in Newman's concept is territoriality.

In what follows in 1989, Hillier and his research team address the controversy about the relationship between crime and spatial design. There are two divergent views: the one which advocates open and permeable environments in which strangers as well as inhabitants pass through spaces and the second based on the model of defensible space in single mix which advocates closed and impermeable environments. Research by Simon, Shu (2000) and other crime-space studies carried out by the Space Syntax Laboratory have some striking results – they found no correlation between crime and density, only a poor correlation between affluence and crime, but a very strong correlation between layout type and all kinds of crime, with traditional street patterns, the best, and the most 'modern' hierarchical layouts, the worst. The approach offers some simple design guidance: join buildings together, avoid any kind of secondary access, make sure that all public spaces are continuously 'constituted'

by dwelling entrances and maximize the intervisibility of these entrances by a linear rather than a broken up layout.

The dual relationship of crime and urban planning keeps an important role in predicting crime in urban areas. Crime prevention through environmental design (CPTED) began as a theoretical effort in order to demonstrate the relationship between the urban environment and crime and also to prevent crime through urban interventions (Crowe, 1991). The theory of CPTED belongs to the criminologist Ray Jeffery, after the publication of his book in 1971. The aim is to prevent crimes through a design which will also influence positively human behavior and will leave no room for committing crimes while it reduces the chances. People living in areas where CPTED strategies are followed should feel a sense of security, and potential criminals consider this area as a particularly dangerous place to commit a crime. The main issue of Crime Analysis is the prevention of criminality. Generally speaking, the design of urban spaces prevents or allows the commission of a crime (Keith 1999).

3. Urban Planning Strategies

A complex range of factors contribute to insecurity in the city. Economic conditions and social problems are generally considered as the main causes, but safety is also affected by the physical environment. It depends also on the way in which cities are planned, designed and built; the way in which people identify them with the environment which they live in, and the way in which urban spaces are looked after and managed. The layout and organization of urban spaces influence their level of security: they can contribute to making them safer, but they can also contribute to making them more dangerous. A good or bad layout can contribute to making a city more or less safe. Urban planning deals with the distribution and physical organization of activities and population in urban spaces; it can contribute to prevent phenomena of insecurity in our cities because there is a link between crime and the structure of urban spaces (AGIS 2006-2007).

To commit a residential burglary the offender must first navigate public space in order to gain access to private space and then negotiate entrance to the proper. The crucial question that must be answered is which particular part of public space gives the easiest access to the private space from the viewpoint of the offender. This question determines which kind of spatial information is relevant and needs to be extracted from the crime records in order to map each burglary case to its exact location and link it to the part of public space responsible (Shu, 2000). In fact, accessibility, density, mix of uses, integration, pedestrian and vehicle network, number of floors and vitality are key issues for crime prevention through urban planning. Crime prevention criteria should therefore be considered from the early stages of decision making, at the scale of planning; strategic plans, master plans, local plans and urban regeneration programs as well as infrastructure projects all affect in their specific way urban safety. The research focus on the following urban parameters:

- **Social and Physical structures:** the city is a living organism, where inter-relationships are the essence of urban life. It has been shaped over time by a self-regulating process. Any intervention affects the existing equilibrium and therefore the insertion of a new part requires careful evaluation in order to avoid rejection. New projects (regenerating an existing urban district or developing a new area) should become part of the whole urban structure. Social inclusion and social cohesion are goals to be strongly pursued for preventing isolation and social exclusion that lead to insecurity or at least are favorable grounds for crime. Indeed, social and economic characteristics of residents are strong predictors of crime (AGIS, 2006-2007).
- **Accessibility:** good accessibility and a capillary road network are essential to foster flows of movement which produce vitality, natural surveillance and therefore increase safety. To guarantee continuity of movements it is thus important to avoid fractures in the road and pedestrian networks. Lack of accessibility can also contribute to social segregation, and can create enclaves or isolated areas concentrating social problems.
- **Vitality:** traditional zoning practice tends to separate land-uses (residential, business, commercial, industrial, institutional). This creates districts with streets and public spaces which are not used some times of the day or days of the week, curtailing natural surveillance. Areas with “mixed use” avoid this drawback and therefore should be preferred to single function zoning, wherever possible. Activities add vitality to streets and public spaces, and provide an efficient “eye on the street”. They are therefore one of the most powerful tools for creating spontaneous surveillance. Moreover, vitality is also important for social inclusion and cohesion, and thus for the potential reduction of crime.
- **Providing mixed status:** a safe city is a mixed and open city, with districts where different social groups live together. Providing diversified housing units on the same site attracts different economic groups and persons of different ages, with different habits, schedules and patterns of movements. This helps to create neighborhoods with good vitality which improves safety. In many cities, offices are concentrated in business districts which – being unpopulated at night – may become dangerous places that have no natural surveillance and are difficult to control even employing private police. Natural surveillance is lacking also in residential areas where housing density is too low to generate vitality and flows.
- **Visibility:** visibility allows people to see their way (and thus avoid dangerous situations) as well as to be seen as they use public spaces, thus making spontaneous surveillance possible. Natural surveillance is defined as the capacity of physical design to provide surveillance opportunities for residents and their agents (Newman, 1972). Indeed, windows and doors that are designed to face each other along a street have a better visibility of the private and public space around residences. The increased sense of security results in a more frequent use of space by residents, which in turn increases surveillance and improves the desire to defend that space (Reynald & Elffers, 2009).
- **Number of floors:** in residential buildings, the height of the ground floor should be such as to allow switching from residential to commercial use or vice versa. This allows replacing activities which close down with dwellings, and avoid the

sense of abandonment and the lack of surveillance generated by empty ground floors.

- **Territoriality:** the degree of safety of a place – public or private – depends considerably on the sense of belonging of the users and their identification with the place, because people respect and protect the places they feel as theirs (Newman, 1972). The appearance of residential space creates an image of the area that symbolizes the lifestyle of inhabitants. When the image of an area is a negative one (isolated, dilapidated and neglected) it becomes negatively differentiated from surrounding areas, making it vulnerable to criminal activity. If, from its outward appearance, an area appears to be well maintained, Newman suggests that a message is communicated to offenders that an area is well cared for and controlled by residents, and this serves as a symbolic deterrent to potential offenders.
- **Attractiveness:** an attractive place, instills respect, enhances the sense of belonging and civil responsibility of the users and inhibits misbehaviors. Besides, the *broken windows theory* which is a criminological theory of the norm setting and signaling effect of urban disorder and vandalism on additional crime and anti-social behavior, states that monitoring and maintaining urban environments in a well-ordered condition may stop further vandalism and escalation into more serious crime.
- **Pedestrian network:** walks shall be provided for safe convenient direct access to each unit and for safe pedestrian circulation throughout a development between facilities and locations where major need for pedestrian access can be anticipated. Walks shall be located so that they are easily surveyed from the interior of units.

Crime and fear of crime can affect the way a city works as well the attractiveness and functioning of some urban areas. When people feel threatened, they alter their lifestyle and consequently the way they use the city on a daily basis. Many do not go out in the evening, do not use public transport in the slack hours, avoid underground car parks, do not use public spaces (parks, squares etc.) and shut themselves in armored flats or gated communities. Local crime problems also make business activities and life in public spaces decline. Therefore, safety affects economic development. A complex range of factors contribute to insecurity in the city. Economic conditions and social problems are generally considered as the main causes, but safety is also affected by the physical environment.

4. Crime Mapping & GIS Analysis

During the past 20 years, many scholars have introduced definitions of Crime Analysis. Although definitions of crime analysis differ in specifics, they share several common components: all agree that crime analysis supports the mission of the police agency, utilizes systematic methods and information, and provides information to a wide range of audiences (Boba, 2009). The following definition of crime analysis could be the best description of its meaning: “*Crime analysis is the systematic study of crime in order to solve problems related with socio-demographic, spatial and temporal factors and focus to the crime and disorder reduction, crime prevention and evaluation*”.

Crime analysis is the systematic examination of crime and disorder problems. It is not haphazard or anecdotal; rather, it involves the application of social science data collection procedures, analytical methods and statistical techniques. More specifically, crime analysis employs both qualitative and quantitative data and methods. The qualitative methods, specific to crime analysis, include field research (such as the observation of characteristics of locations) and content analysis (such as examining police recording reports). Quantitative data and methods deal with statistical analysis of numerical or categorical data. The spatial nature of crime is crucial to understanding the nature of the phenomenon. Crime Mapping is the process of using GIS technology to conduct Spatial Analysis of criminal incidents.

Crime mapping serves three main functions within crime analysis (Boba, 2009):

- It facilitates visual and statistical analyses of the spatial nature of crime and other types of events.
- It allows analysts to link crime data with geographic variables and location.
- It provides maps that support the visualisation process.

Based on the previous, a typical schema for a feasible crime analysis process includes: data collection, data collation, analysis, dissemination of results and feedback from users of the information.

Collection: The crime analysis process begins with observations (data). Data is drafted from various sources including, in most cases, outside crime analysts. Crime analysts examine data observed and collected by others, such as police officers, call-for-service dispatches, community service officers and geographers (Crowe, 1991). The police agencies, officers or civilian employees insert crime reports and other data into a computer system (not always as in our case). These data usually include long-hand reports and have no specific form. However, the manner in which data are stored and the amount of data stored are important in crime analysis. Data must be kept in a digital format and to be collected for a significant amount of time to be useful for crime analysis. In general, the crime analysis data collection process requires the following:

- a. The data must be collected accurately and consistently.
- b. Only data appropriate for crime analysis should be compiled.
- c. The data must be collected in a timely manner
- d. The data must be stored for an adequate amount of time to allow effective analysis.
- e. The data must be accessible in digital raw form to be queried and downloaded.

Collation: The main sources of the crime analysis data are from police sources. These data are not often coded or under any type of quality control. Data collation entails a number of different tasks, but it generally takes three forms:

- a. Cleaning: the process of correcting mistakes and inconsistencies in the data.
- b. Geocoding: the process of locating the crime analysis data and therefore to be enriched with spatial data and characteristics.

- c. Creating new variables: the process of recoding or computing new variables from existing variables for more effective analysis.

Analysis: Analysis takes place after data collection and collation, including the use of many different statistical and visualization techniques. The crime analysis process is not a linear process. Very often the crime analyst is aware of problems related to data until the analysis begins. When this occurs, the analyst must often return to the collection and collation steps in order to improve or change the way data is collected, stored or collated. This practice is called data modification subcycle. Therefore the crime analysis process has to move from collection to collation and to analysis and vice versa. These three steps are the most important and time-consuming and define the quality of the next steps.

Dissemination: Once the data analysis is completed, the crime analyst needs to disseminate the results to various types of audiences. In fact, tables, graphs, diagrams, and thematic maps are easily understood. However, the presentation should be tailored to the knowledge of the particular audience and the presentation of the results should convey only the most necessary information. In more specific terms, much of the work of crime analysis takes place behind the scenes and the presentation of results need not include all the information and all the work has been done.

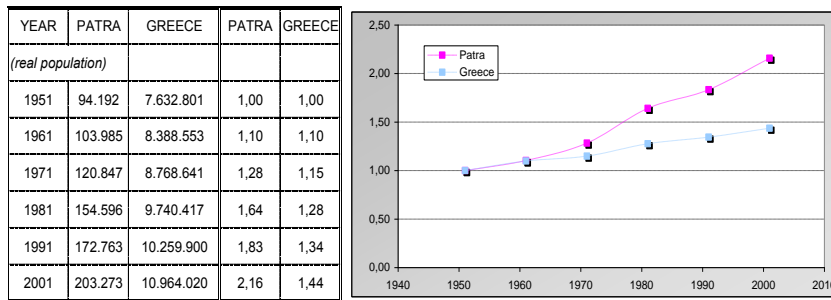
Feedback: The researcher has to benefit from the dissemination process and to enrich the analysis results by receiving feedback and transform it to new information. This step improves the whole process. Analysts must receive feedback about the quality and the nature of the analyzed data in order to reach to a better decision making.

To sum up, the crime analysis process is not linear. It is cyclical since in every step there are improvements and feedback. Analysts spend a lot of time in the modification of their data. However, the process is constantly evolving by improved policies such as technologies, databases, training and examples of effective analysis. The research of space and crime can be achieved by creating a complete, appropriate and flexible methodological framework. This would define the main axis that will make easier the problem's solution by providing a logical interpretation, a prioritization of targets and a development of new data and information.

5. The Database for the city of Patras

The present chapter refers to the development of GIS and the relevant thematic database. The case study is the city of Patras (Greece), third urban complex in Greece and one of the oldest, having a continuous history of 4.000 years. The modern history of city is characterized by a rapid and continuous development and transformation, concerning its structure, function and physiognomy. It presents all the characteristics of a developing urban center as it concerns to the organization of its urban structure and socio-economic activities. Patras has a population of approx. 203,000 inhabitants (2001), and the evolution of its population, is shown in the following table and graph compared to the population of the country (Table 1).

Table 1. Population evolution in Patras and Greece



At the beginning of 2008, the Central Police Department of Patras, offered to the university Laboratory all census forms of criminality acts (1614 reports) - for year 2007 – however, not including those who do not safeguard the privacy of the individual (data referred especially the so-called "Crime of the road"). These data have a great volume and do not exhibit any standardization in coding.

Therefore there was an obvious and time-consuming appropriate treatment in relation to their standardization and more specific the focus was to identify variables' encoding and credible digital conversion into a database. Along the way, the database was tested with respect to data reliability and normalization rules. After the final database tests, all the records were georeferenced using the digital cartographic structure (digital map) of Patras – which includes building blocks, buildings, roads, etc - by the Greek Statistical Authority (2001) as it is the only reliable digital map with such information. We have to mention that more updated maps are not yet available as there are only preliminary results from 2011 population and building national census. The final database contains 50 distinct fields describing the inventory data sheets. That georeferenced data was the source material for a pilot approach which used to control the process efficiency. Then the police passed to the laboratory the inventory records of violent acts for the years 2008, 2009 and 2010. These records- more than 5.400- are on hard copy and currently they are being rendered in an electronic database. In this sense, the initial results presented below (Figure 1), refer to the pilot data of 2007 (1624 cases). The characteristics of a crime are distinguished into three categories: a) modus operandi, b) persons involved in the crime and c) vehicles involved in the crime.

Modus operandi (MO): a Latin term meaning literally “method of procedure” refers to the method of crime, which is the key elements of the crime incident itself (Boba, 2009).

What: the nature of crime (e.g. burglary, robbery etc.).

How: the way the crime was carried out (varies by type of crime). Characteristics include but are not limited to the following: a) point of entrance, b) method of entrance, c) suspect's actions, d) method of escape etc.

Where: Where the crime was committed. Characteristics include but are not limited to the following: a) address, b) location, c) area, etc.

When: when the crime was committed. Characteristics include the following: a) exact time, b) first date and time, c) last date and time.

Persons involved in crime: the information about a person involved in a crime typically includes a description of the victim and the criminal. These data refer to the name/address/date of birth and gender.

Vehicle involved in crime: this category of information concerns the involved vehicles. This kind of data is important because vehicles often serve key roles in the commission of crimes. Some of the characteristics include the color and the type of vehicle (car, truck, motorcycle, etc).

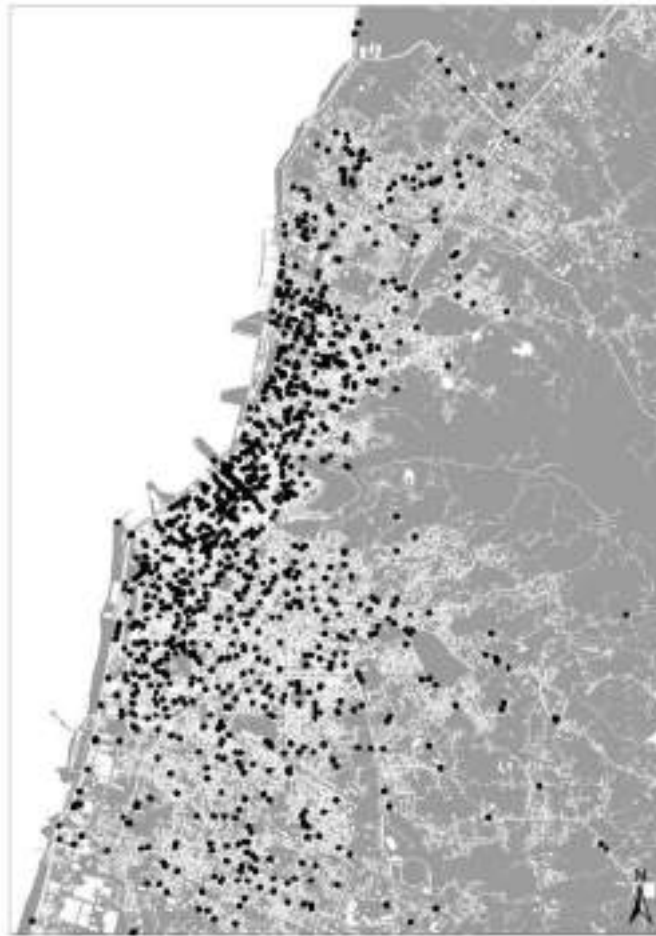


Figure 1. Spatial distribution of crime events

Based on the available information, the implementation of the previous modus operandi renders the database structure for the city of Patras, as presented in Table 2 below.

Table 2. Database variables

<i>modus operandi (MO)</i>	NAME	TYPE	DESCRIPTION
	XID	Integer	The serial number of every criminal record
	YEAR	numeric	The year of the committed crime (2007, 2008, 2009, 2010)
WHAT	XTHEME	text	The theme of the committed crime (α = attempt, δ = burglary, κ = theft, λ = robbery)
	XTYPE	text	The type of the committed crime (building, citizen, state property, vehicle)
HOW	XENTRANCE	text	Point of entrance (door, window, unknown, balcony, etc)
	XLEVEL	text	Level of entrance (1 st floor, 2 nd floor, etc)
	XATTACKED	text	Object of offence (against person, against property)
	PRESEN	text	Situation of victim (presence, absence)
WHERE	PLACE	text	The name of the city (Patras)
	ADRESS	text	The exact address (example Ag.Nikolaou Street)
	XNUMBER	text	The precise number of the address (1, 56 ,102, etc)
	LUSE	text	The type of location (commercial, public space, residential, street)
WHEN	STARTDATE	date	Precise start date xx/xx/2007 etc
	ENDDATE	date	Precise end date xx/xx/2007 etc
	MONTH	text	Month of the incident (February, March etc)
	EPOXH	text	The incident's season (α = spring, κ = summer, ϕ =autumn, χ = winter)
	STARTTIME	date	Precise start time (example 11:45, 12:50)
	ENDTIME	date	Precise end time (example 13:45, 17:50)
	FOUND	text	Criminal's arrest outcome: arrested or

CRIMINAL			not (yes, no)
	CGENDER	text	Criminal's gender (α = male, θ = female)
	CYEAR	numeric	Criminal's year of birth (example 1965 etc)
	CAGE	numeric	Criminal's age (example 18, 20, 52 etc)
VICTIM	VGENDER	text	Victim's gender (α = male, θ = female)
	VYEAR	numeric	Victim's year of birth (example 1975 etc)
	VAGE	numeric	Victim's age (example 22, 30, 42 etc)
VEHICLE	COLOR	text	The color of the vehicle (black, red, blue etc)
	VTYPE	text	The type of the vehicle (car, motorcycle, truck, bus)
PROPERTY	AOBJECT1	text	The type of the stolen object (passport, documents, clothes etc)
	VALUE1	numeric	The value of the stolen object (100, 20, 1000 etc –in euro)

As it was mentioned earlier, the database records are georeferenced based on their address with visual confirmation on a map. Therefore, an independent digital cartographic structure with point topology was created, compatible with the digital base map in accordance with the current Greek reference geodetic system (EGSA '87). The GIS software used is ArcGIS of ESRI. As the research is in progress, there is a growing literature research simultaneously ongoing with the collection and input of new data. In this framework, the paper presents initial results and, obviously, there is a potential of changes or rejections in the future. The results in the following tables and figures present a first statistical description of selected variables from the database and the spatial distribution of positions of the violent acts in the city of Patras (pilot data of 2007) in cooperation to initial experimental applications for calculating density distribution (Kernel density) for different instants of time. As these are some initial results, there are no comments so that they cannot be considered as main positions of the research. The main aim is to give an indicative impression of the spatial database's potentials with regard to the upcoming data of the years 2008, 2009 and 2010.

Table 4. Theme of crime

Attempt	89	5,5%
Burglary	642	39,8%
Theft	847	52,5%
Robbery	36	2,2%
Total	1614	100,0%

Table 3. Type of crime

Deceit	232	14,4%
Armed Robbery	24	1,5%
Break/Force	1324	82,0%
Physical violence	34	2,1%
Total	1614	100,0%

Table 6. Main land of venue

Commerce	205	12,7%
Private House	243	15,1%
Private Office	35	2,2%
Recreation	36	2,2%
Public Installations	60	3,7%
Public Space	917	56,8%
Other	118	7,3%
Total	1614	100,0%

Table 5. Presence of victim

Presence	310	19,2%
Absent	1304	80,8%
Total	1614	100,0%

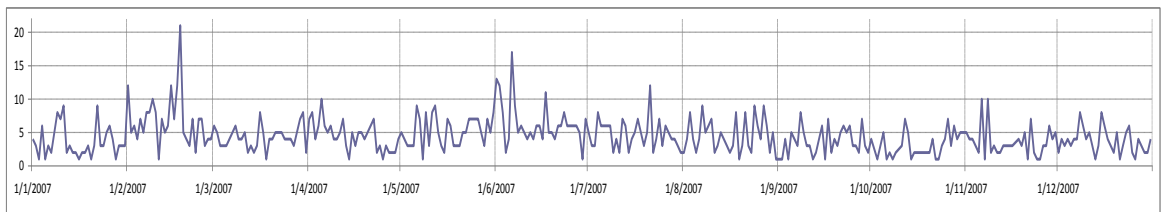


Figure 2. Daily distribution of crime events

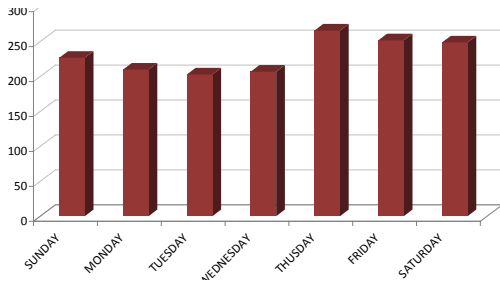


Figure 3. Crime events per day

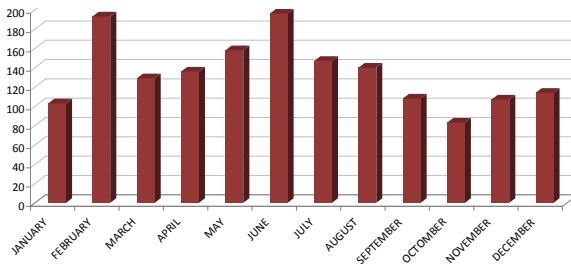


Figure 4. Monthly distribution of crime

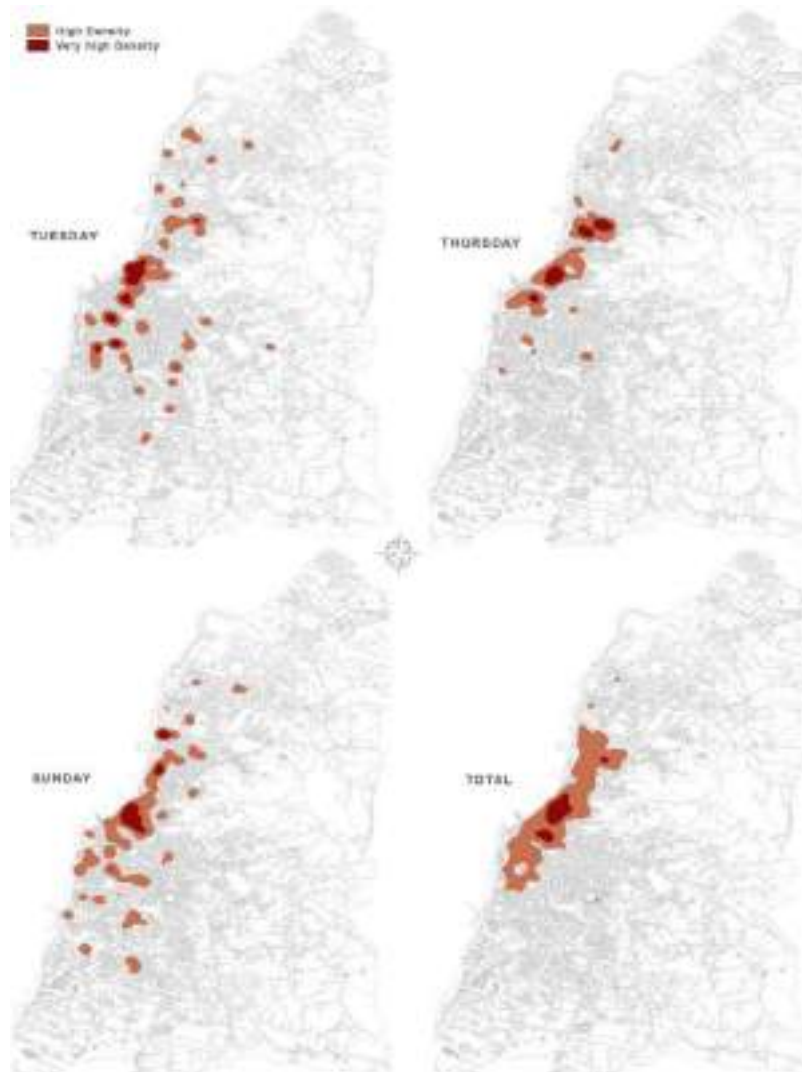


Figure 5. Spatial densities

On Tuesdays the minimum of average events is occurring and on Thursdays the maximum. They are only the top two classes from Kernel densities.

6. Future research

The future research will focus in the effort to integrate and incorporate the results of the study of space and crime in the process of urban planning. On a broader level, it seems that violent acts are the product of social and environmental factors (Nes van A., 2005b).

Unfortunately, there are still hidden analytic dangers lurking just below the surface, especially at the larger scales of analysis. First and most obviously, there is always an extremely uneven distribution of crime opportunity in cities because cities have uneven distributions of people and activity with more people, cars, activities in some areas than others, and, above all, far more people and activity, and therefore crime

opportunities, in the central areas than elsewhere (Shu, 2000). So if we do a simplistic analysis, we will always find the highest rates of crime in the city centers, because this is where there is by far the highest concentrations of crime opportunity are, and this might be taken – mistakenly, as we will see - to reinforce the idea that people are a source of danger. However, nearly all of this is property crime against commercial premises, and this can -by definition- only happen where commercial premises are located, and commercial property crime rates are often well above those for dwellings (land use).

Crime rates must clearly then always be correlated to opportunity, and comparison shall be made with variables of same spatial nature – for example city centers to city centers, not city centers to residential areas. This applies not only to the number of premises offering crime opportunity. This inherent difficulty in spatial analysis is exacerbated by the spatial distribution of social and economic factors. A third difficulty is the correlation between the crime and spatial mechanisms: pickpockets are helped by crowded streets; muggers need victims one at a time, burglars need secluded access to dwellings and so on. Again Alford's work shows that different crimes have different distributions, and also different distributions by night and day, but all are powerfully related to space. An overly aggregated analysis might well have missed the genuinely spatial influences on crime distributions that articulates so good.

Finally, a fourth difficulty arises from the familiar search for 'crime hot spots'. The identification of these can of course be very useful for the police in deciding where to deploy their resources, but from the point of view of identifying spatial influences on crime, they tend to be misleading because most hot spots turn out to have social explanations. So, even if it is shown that the crime rate in an area is higher than in another, or even that more criminals come from one area than another, it still isn't known whether the high rate has been produced by the area itself or by the social process that put its population there. In principle, it ought to be possible to resolve this statistically by using multivariate analysis to isolate the influence of different factors (Scott, Ken & McLaren, 2000). In technical terms, more effort to control the layout variables needs to be made.

Eventually, the applied part of the research is in progress and in the near future, according to the methodological design of the research, it will focus on the methodological integration of investigation's findings of literature and how these are specified in accordance with the requirements of the collected and organized in a GIS spatial database. Moreover, there is a growing literature research simultaneously ongoing with the collection and input of new data. Hence, the theoretical phase will identify the models of spatial analysis to determine the contribution of urban parameters in the process of spatial distribution of crime incidents. The objective of crime mapping is to offer some directions about how to deal with such kind of urban transformations. A crime map sets out to show us something we cannot otherwise see. Its goal is predictive, to identify patterns and anticipate future criminal acts by collating information about the time, place, and frequency of past crimes, not only to see, but to foresee (Aurora, 2009).

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