Interactive Crime Mapping Systems - Opportunities and Risks from the Point of Spatial Planning

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Abstract

The background of this paper is to show the opportunities and risks of Interactive Crime Mapping Systems from the view of spatial and urban planning. Due to the development of web-based mapping platforms for geodata with the possibility to integrate user-generated-content, such platforms will gain importance in the planners practice. The main contribution of this paper is an investigation on the feared and hoped effects of these systems on urban areas, their population, local players, and in particular urban planners. As part of this investigation, applicability of such systems for planners is observed as well as the possible negative effects of the availability of sensitive data for urban areas. As a conclusion the positive effects of crime mapping systems can only be achieved, if various complex factors like data privacy protection or fear of crime are considered.

1. Introduction

Investigations about the correlation of crime and urban areas are as old as traditional urban planning. Already in 1829, Balbi and Guerry mapped different kinds of property and violent crimes in France in correspondence to the educational level of the offenders (Boba Santos 2009) and drew their conclusion of possible connections. Nearly 100 years later, Park from the Chicago School did some research about "Social Ecology" and crime locations (Vogt 2001). Hence, monitoring crime in urban areas was and still is an essential issue for urban planning, because it's an important influencing factor for citizens' well-being. Research was done in this sector, especially from urban sociology. However, during the last 180 years, this was a topic which only experts (planners, city councils, scientists or the police) were able to access. During the last decade, the circumstances have changed. Some research about this was done for example in the context of the combination with mental maps (Matei et al. 2001). First of all, this change was possible because of the wide capabilities of new GI-systems to make very detailed analysis and get very useful data out of it. Even more important is the fact, that this data could be published through the web, which makes all of this data accessible for every citizen and other laypeople. Furthermore, mobile phones are making this data accessible everywhere, allowing users to contribute own crime data by User-Generated-Content (UGC). In the light of these developments, this examination aims to provide a critical analysis for its effects for cities and planners. From an urban planning perspective, some questions about the use of such system are obvious:

1. What is crime, which are the effects for citizens?
2. What are interactive crime mapping systems and how will data be gathered?
3. What are the chances for the use of such platforms from an urban planning perspective?
4. What are the risks for the use of such platforms from an urban planning perspective?
5. Considering chances and risks, under what conditions could such an approach be promising for urban planning?

2. State of research & planning methods

The research focus to crime mapping platforms is intensifying, because there has been an immense growth in numbers of such platforms, especially in Anglo-American countries. This was despite of the uncertain complex interactions with the urban environment. Alone in the USA, there are more than 125 crime mapping systems. Great Britain for example empowers the public platform "police.uk" (Police UK 2011), where various kinds of crime mapping data for the United Kingdom can be accessed. Furthermore, these services are getting more and more available through mobile devices. From a planning perspective, there are plenty of potentials for implementation. These embrace different spatial and urban planning issues as well as the urban sociology perception. These mentioned topics are barely integrated in planning processes or researches yet. Hence, aim of this paper is a comparative analysis of the existing crime mapping systems and approaches and to assess the potential positive and negative effects of these platforms for urban areas as well as for planners.

3. Methodology

The paper examines the theme on the basis of the earlier mentioned research questions. In this regard, it first analyzes theoretical questions, such as the definition of criminality, its connection to the planning field, the challenges of the data collection and finally, the history of crime mapping. Secondly, the technical basis of the interactive crime mapping platforms is studied. Because of the diversity of different systems, three main categories were developed, in order to comprehensively illustrate all functions, types of visualizations and base data.

In the next step the paper discusses the possible positive (hoped) and negative (feared) effects of such systems, based on these theoretical and technical facts. In both cases, effects for urban areas, their inhabitants, stakeholders and city planners will be illustrated. Although the paper was composed from a planner's point of view, especially the hoped positive effects will include and discuss numerous aspects, which derive from the perspective of the police.

Finally the paper summarizes the assets and drawbacks in order to picture the proportion of chances and risks. Considering these results, a few

recommendations will be outlined and possible future developments will be discussed.

4. Crime in urban areas

One of the key factors for the quality of life in urban areas is the subjective well-being of its inhabitants. Many circumstances influence this subjective impression (social and ecological issues for instance), but feelings about their sense of security are often considered as very dominant (Floeting and Seidel Schulze 2012). Due to the fact, that crime is mostly taking place in public areas, and the fear of crime is an important factor for the quality of life, there has to be a scientific debate for urban planners about crime mapping platforms in order to improve the urban environment.

As mentioned in the introduction, crime or especially the impression of urban crime is strongly connected with subjective impressions, which is part of urban research (Vogt 2001). From a terminological point of view, the explanation of crime is considered to be very complicated. Simplified, it is described as "something, which deviates from legal regulations" (Belina 2011). The definition of deviance depends on the current political and social circumstances of a respective region. This means, that an action (e.g. drinking alcohol in public) could be considered as crime in one specific place at a specific time, whereas the same act isn't necessarily seen as a crime in other countries under other circumstances. Besides the fact, that due to the mentioned problems, the statistical crime data gathering by the police is not able to entirely illustrate crime in urban areas realistically, many other problems have to be revealed (BMI and BMJ 2006): Unreported number of unknown cases, discriminating and disparate reporting behavior, suspects- and offender statistics, and contradictory interpretations of crime statistics. These issues make a complex analysis of crime mapping systems for urban planning necessary.

5. Empirical study cases

The various forms of crime mapping platforms offer various functionalities because of the complexity of the phenomenon of crime itself. Therefore the technical basis was analyzed detailed in three separated categories in order to ensure an essential comprehensibility and will be illustrated in the following on the basis of exemplary study cases:

- Type of data set (A)
- Type of visualization (B)
- Functionality (C)

Example A

The first category, respectively the first group of study cases, is defined by the type of the underlying data set. It can be illustrated, that most of the platforms are based on police data, whereas only a few platforms use user generated content (UGC) for their visualizations. This general segmentation of base data in two groups is quite oversimplified. In fact, the data set relies profoundly on platform operators and their aims. In this context four types of data sets can be revealed, that are substantially affecting the platforms. As pointed out in the illustration below, these four groups are: Systems operated by the police, Systems operated on behalf of the police, independent systems using police data and independent systems generating own datasets.

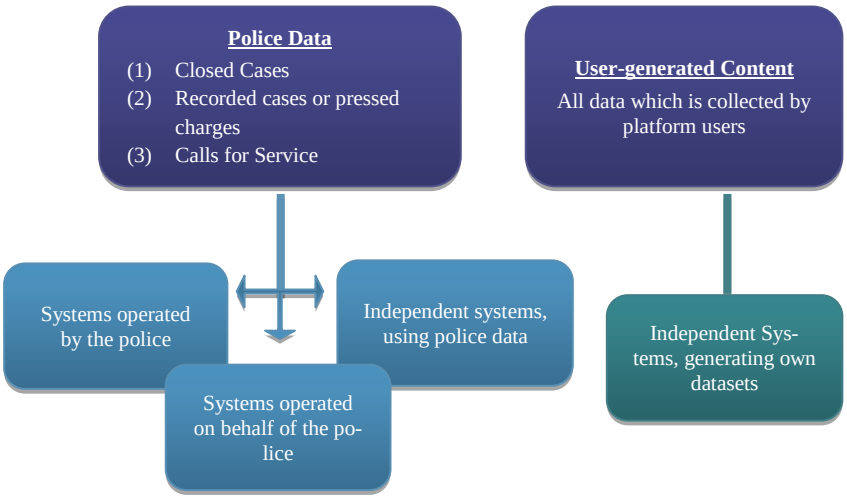

Fig. 1. Types of base data; (Own figure)

Example B

The second case group examines the different types of visualizations of crime mapping systems. There are various kinds of visualizations, but here the focus is put on the three most common groups. Generally the visualiza-

tion of the platforms can be divided into 3 classes, which implicate different assets and drawbacks:

- Symbol Maps illustrate all crimes with an own symbol. Accordingly, these maps are easy to understand, but in the case of big map extracts they can get overloaded. This can be seen especially, when various kinds of different crimes have to be visualized.

- Graduated- Symbol- Maps add up all crimes of a certain area, generating a symbol for that area according to the registered amount of events. These types of maps are much easier to read, but in case of missing knowledge harder to understand.

- In contrast to the maps described above, the heat map does not visualize crime scenes punctual and rather it illustrates the density of committed crimes. This approach leads to maps, which are easily to read, but also harder to understand. In programs to generate heat maps there are possibilities to modify the visualizations, which is good for customized solutions, but vulnerable for manipulation. This manipulation does not necessarily imply falsification. It can simply mean the specific configuration in terms of colors or radiuses. The following illustration displays all three kinds of visualization types.

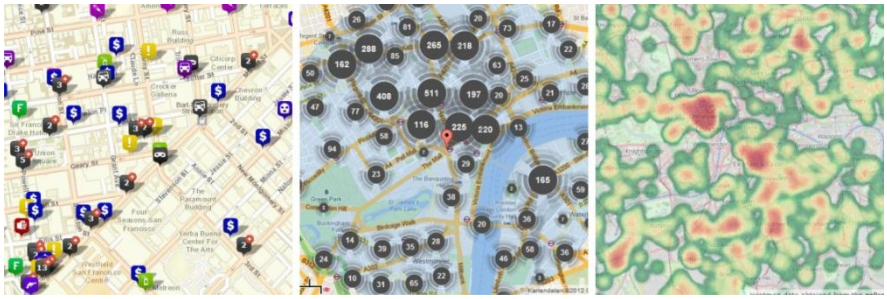

Fig. 2. Visualization Types of interactive Crime Mapping Systems Symbol Map (OMEGA Group 2011) – Graduated Symbol (POLICE UK 2011) – and Heat Map (O'Brien 2011)

Furthermore, there is also the possibility to combine geospatial analysis and 3D-mapping (Wolf and Asche 2009). However, it has to be stated, that visualizing 3D-content is very "eye-catching", but it can be very complicated for laypeople to understand and not to misinterpret the given data. Though there is no common use of 3D Heat Maps through crime mapping

systems worldwide, which is the reason why there is no deeper analysis in this paper.

Very occasional approaches try to combine the described visualization types, switching between symbol maps and heat maps for instance. This maps struggle though with the same problems as before until they are not combining the types of visualization in one and the same map. Nowadays, the only platform offering such combined maps is raidsonline.com, putting heat-maps under symbol-maps (compare Figure 3).

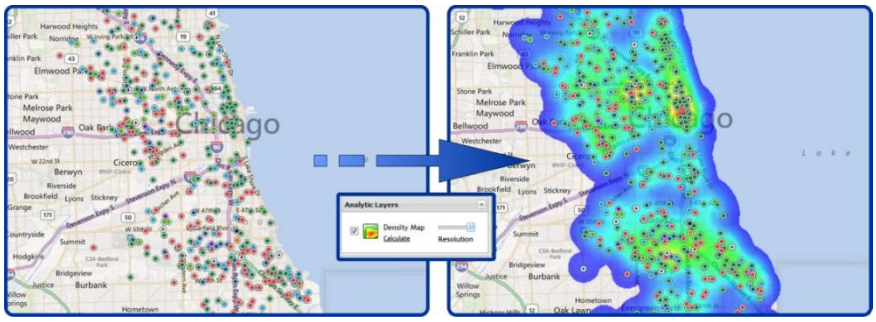

Fig. 3. Combination of two visualization types in one map (BAIR Analytics 2012)

Example C

The last category examines the functionalities of crime mapping systems. Superficially, all platforms can be described as interactive, allowing users to investigate all designated areas in a freely scalable map - interface like Google Maps or Microsoft Bing. Furthermore all platforms offer a few tools to analyze the visualized crimes. In nearly all cases this includes the sampling of different kinds of crime, times of offences or areas of crime scenes.

However, some platforms provide much deeper analysis tools. The following example of the platform raidsonline.com, allows users to put further socio-demographic data layers such as population density or underemployment rate underneath the crime incidents. This gives the user to chance, to make multi-level analysis with results, which can be very valuable from an urban planning point of perspective.

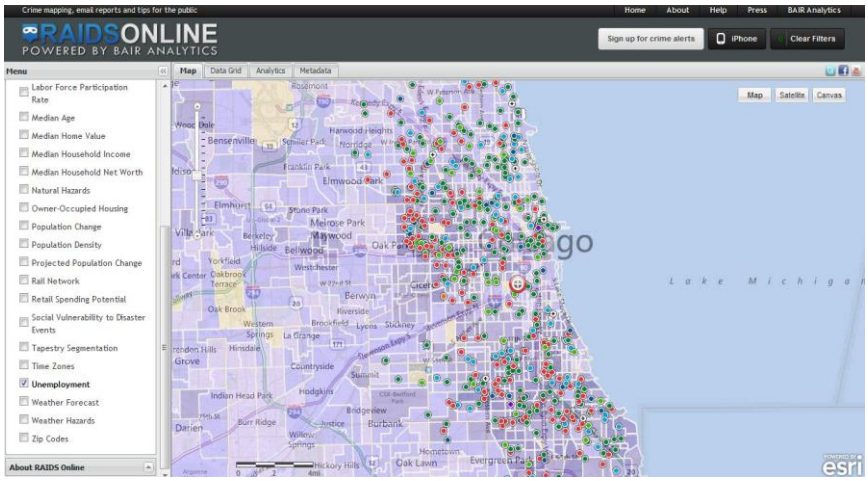

Fig. 4. Combination of registered Crimes and further data layers (BAIR Analytics 2012)

Other platforms also offer solutions for mobile phones. It has to be mentioned, that these solutions are not as detailed as the platforms for real computers, but usually they provide maps and functions that include the actual position of the user, allowing him to search for possible threats in the surrounding area.

Very often the solutions for mobile devices are quite specific, which is on the one hand a limitation, but can be seen as a chance on the other hand. The example aside shows an application (FindAPad for Windows Mobile) that displays vacant houses nearby the location of the user and offers him information about crime incidents in the neighborhood.

Fig. 5. Example of the mobile phone app FindAPad (FB Solutions Ltd. 2012)

These two examples clarify the range of functions interactive crime mapping platforms are offering. However, there is an advancing number of mobile applications available for mobile devices. For the United States, there are already lots of iPhone applications like "Crimemapping.com Mobile for iPhone" (OMEGA GROUP 2011), "Crime Reports for iPhone"(Public Engines Inc. 2010), or "RAIDS Online for iPhone" (BAIR Analytics 2012). Some of them use data by public au-

thorities like the police, but there are more and more applications, which enable the user to contribute data with their mobile devices.

6. Chances for urban planning

Indisputable, the described platforms will generate positive as well as negative effects for urban areas, their inhabitants, local stakeholders and also planners. In this context, the paper examines in two steps first the hoped positive effects and secondly the feared negative effects for cities and the named groups. The positive effects can be seen from two different angles, first of all from the view of the police, secondly from the view of a planner. On the one hand, the aims of police departments should be considered, because they were the primary reason for the implementation of the platforms. Nevertheless, these hoped effects concern particularly urban areas and their inhabitants (Chainey and Tompson 2012, Wartell and McEwen 2001):

(1) Better information for citizens, reducing the fear of crime and the workload of the police
(2) Increased transparency of police work and more confidence of citizens
(3) The bond between citizens and local police departments will be strengthened, enhancing their cooperation
(4) Inhabitants will be empowered to independently prevent avoidance and prevention measures

On the other hand, further effects can be identified from a planner's point of view. Besides the urban areas and inhabitants, these effects additionally concern local actors and of course planners. However, they have to be reconsidered in their relation to the earlier mentioned aims of the police:

(5) Assistance in processes of urban and regional planning, e.g. in the preparation of development plans
(6) Benefits for other urban actors like youth welfare officers, neighborhood management workers or public housing coordinators, indicating trends and emerging problems
(7) The public could use the platforms as pressurizing medium towards city administrations, claiming for the realization of security measures

(8) Image promotion for slightly affected areas
(9) Crime Monitoring with the help of crime mapping platform serves for all stakeholders as an early trend detection tool and it can be used to test the effects of measures for crime reduction

A possible realization of such a tool for visualizing crime can be seen in the subsequent figure. The following map of the stamen design group illustrates the desired results exemplarily for the city of San Francisco (City of San Francisco 2011). The example map visualizes crimes, which took place during the nightlife in a specific part of the city. This map can be used by several of the defined groups, fulfilling different of the hoped effects. In particular, citizens could avoid the highlighted crime hot spots during the nighttime as hoped in number (4). Further this could lead into an improved cooperation between citizens and police as it is described in point (3). City planners should include this information in their work as well, using the data for more precise geo-localization of urban problems as seen in point (6). This could lead for example to the reconsideration of the concepts of illumination and visibility during nighttime in order to make these areas safer and improve the subjective well-being of the citizens.

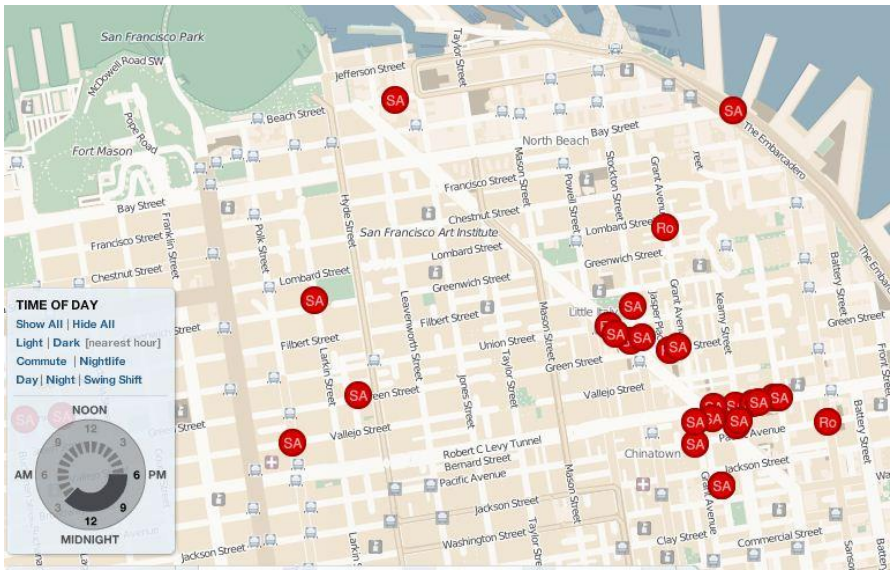

Fig. 6. Registered crimes during nightlife Francisco (City of San Francisco 2011).

7. Risks

In addition to the discussed hoped effects, possible negative effects have to be considered, which are also strongly correlated. In this context misinterpretations are particularly relevant for the other outcomes, causing or intensifying many of them. This embraces the problem of stoking of fear (d) in the affected areas or the possibility to manipulate the user perception (b). The following problems could occur caused by the crime mapping web applications:

(a) Misinterpretations by users, due to a lack of expertise, a lack of information about the published data and visualizations that provoke misinterpretations
(b) Manipulations of the platforms by outsiders and operators, especially in the case of user-generated content. This will be even more relevant through the massive use of mobile communication devices, which enables their users to tag crimes in urban areas at every time at every place. Furthermore, due to the easy use of geo-mash-ups, it is very easy to develop own crime mapping applications, which aren't under any kind of public or scientific surveillance
(c) Commercial use of the platforms, including severe consequences for the population (Example: Redlining of insurance companies or credit institutes)
(d) Research shows that the general fear of crime bears no relationship to actual experiences in victimization. Rather, it is shaped by the mass media image, which concentrates on particularly cruel cases. As a result the population fears not existing dangers (BMI and BMJ 2006). Since Crime- Mapping- Systems must be considered as a part of the mass media and are quite often operated by mass media companies often (e.g. LA Times Crime Mapping), they fan the fear of crime most likely too
(e) Crime- Mapping- Systems are supporting the stigmatization of areas and their inhabitants (Farwick 2011)
(f) Criminals can use the platforms like all other people. They could use the published information to find possible victims and identify less controlled areas
(g) The platforms are not able to reduce crime, its just a displacement of the crime locations (Boba Santos 2009)
(h) The platforms violate the individual right to decide which personal information should be published and which not, because of the effort to ensure absolute public safety

Especially the last point should be reflected in detail. It is impossible to publish geographically referenced crime data and to protect the victims of crimes at the same time. If a crime is referred to a specific location and published in a crime mapping system, the general public can see it. Although there are some regulations about data privacy, the marking of a specific place as a crime scene (or even more as area with a general high rate of criminality), can be directly referred to a specific location and the people who are living there. This could lead to false allegations against individuals or negative images in terms of criminality and all its corresponding consequences for whole regions, even though the inhabitants of this areas are in the first instance victims and no offenders. This stigmatization would have consequences for the whole neighborhood and could lead into affecting real estate prices. Whereas there is some legal regulation from services offered by public authorities, this won't be the case for data distributed by private companies and especially for UGC-crime data. How strongly privacy rights of single persons could be affected can be seen on the subsequent figure, that shows a particularly explicit example. The so called "Homicide watch D.C." publishes personal data of murder victims like home addresses, personal photographs and the exact crime spot in order to "remember" them. According to this, the platform doesn't even have the aim to prevent any possible future crimes, but it violates the privacy of family members.

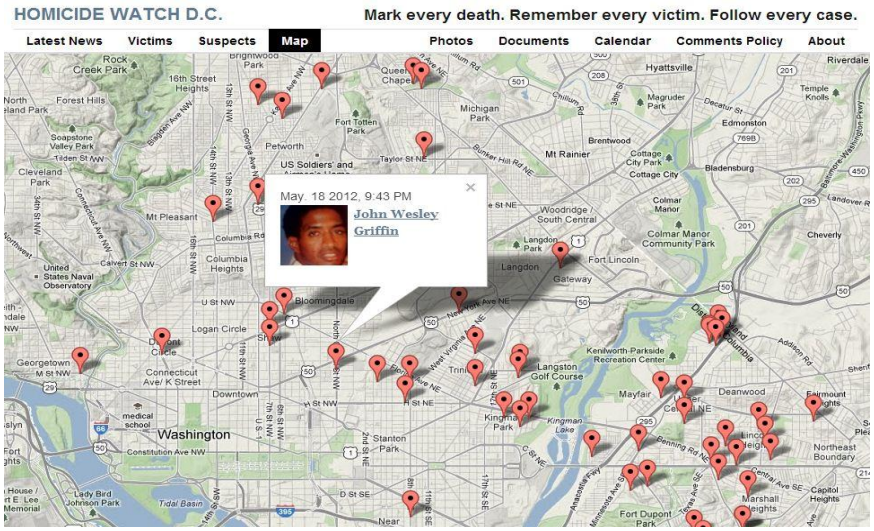

Fig. 7. Visualization of homicide victims (Homicide Watch DC 2012)

Another example for the potential danger of misinterpretation by users (a) is given in figure 8. All four maps visualize crimes for the same area in the city of London. Each of the two upper and lower show the same amount crime incidents for the same time period in the same area. It is just because of the configuration (different symbols and a heatmap-slider) for the visualization because the graphics seem so different. This example demonstrates how easy the offered maps can be misinterpreted or manipulated.

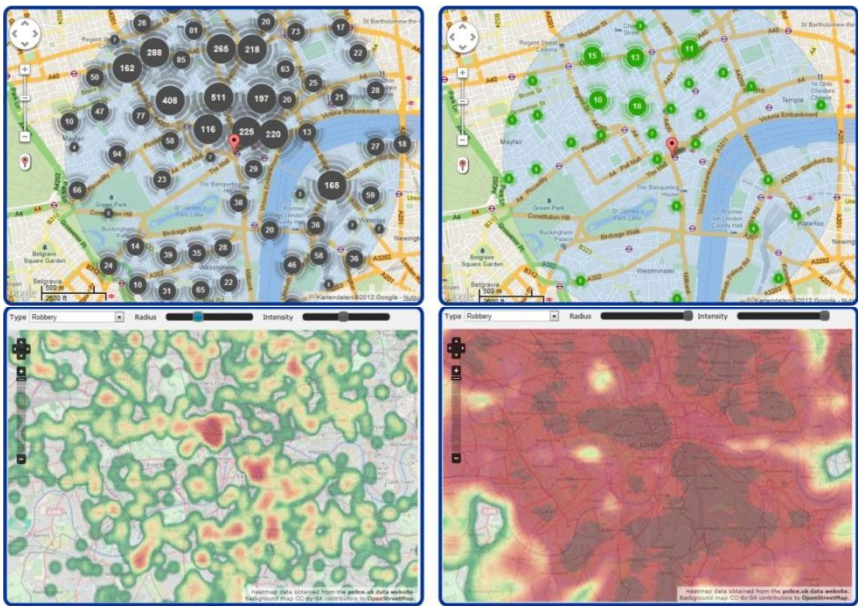

Fig. 8. Examples for data misinterpretation and manipulation (Police UK 2011) and (O'Brien 2011)

8. Conclusion, recommendations & future research

In view of the dynamic developments in the crime mapping sector in the last years, the increasing prevalence of these tools and methods will continue. This is mostly due to the fact of the technological development for data processing and the possibility for accessing this data via mobile phones. Furthermore, this will be especially relevant in developing countries, were such technologies meet urban areas with relatively high crime rates and societies that could rely on the big promises of crime mapping systems.

It has to be stated, that after evaluating the potentials and risks of crime mapping systems, it is very problematic to find a compromise in use of such systems by free availability for the public society. As mentioned, monitoring urban crime is very complex and there has to be some contextual knowledge to deal with it. This is not often the case for all the citizens. This problem is even more relevant due to the fact, that through data publishing via Internet, all of this data is theoretically accessible for all citizens – at every time and in every place. Furthermore, it is also possible for them to create their own "crime geodata" with mobile phones, which could be seen by other citizens. If there is an open and unrestricted access to crime mapping data and systems, negative impacts like misunderstanding of visualizations, exaggerated fear of crime as well as data manipulation could occur. This is mainly because of the lack of knowledge in terms of crime research or geodata visualization for example.

Nevertheless, there is a potential of crime mapping methods for urban planning, urban actors or for citizens with the necessary contextual knowledge. For this purpose Crime- Mapping- Systems with restricted access could be implemented, offering the information for the designated audience and forestalling misinterpretations and other negative consequences such as the data protection issues, which have to be expected in the case of freely available services. In this case a multitude of contradictory negative effects will be prevented, increasing the benefit of the positive effects. If there is a political will to embed these systems in the public services of a city, the dependence on legal (data privacy regulations), social-cultural, political regulations has to be discussed. The use of such systems has to be considered wisely and also from an ethical point, in order to achieve a benefit for the society.

Besides these official approaches, crime relevant data created by User-Generated-Content with mobile phones will also be more important in the future and there has to be a broad scientific debate how to deal with it in an urban context. Furthermore, crime mapping platforms driven by private companies should be seen very critically. Unrestricted publications of crime data through crime mapping platforms could raise negative effects for the urban environment. Through stigmatization or other effects, self-amplifying effects could occur and lead for example to misled development in these quarters. There is also the possibility for planned manipulation of real estate prices for example. Such negative effects could be avoided by an approach like the earlier mentioned system with restricted access.

Therefore, urban planners have to be aware of these topics and have to consider potentials and risks of crime mapping systems for public authorities, police and especially the citizens before an implementation of crime-

mapping tools in the daily working routine. Although there is a potential for future planning approaches in order to prevent crime in urban areas, there will be also an ethical question to discuss, what kind of data is suitable for the public society and which should be better handled by experts.

9. Acknowledgement

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