

# Chapter 3

## Community Outreach Using Incident Records and Visual Analytics



Chittayong Surakitbanharn, José F. de Queiroz Neto, Guizhen Wang,  
and David S. Ebert

### Introduction

Poor perception of law enforcement can strain the overall relationship between law enforcement and the community; however, transparency of law enforcement actions can solve these problems and the availability of police data provides new opportunities (Forst 2008; Scheider et al. 2003). Unfortunately, police record databases are often cumbersome to navigate and do not have built-in interactive capabilities. As a result, there lacks a readily available way for law enforcement to explore CAD and RMS data for policing strategy evaluation and community outreach. To address this challenge, we have designed, deployed, and tested the Visual Analytics Law Enforcement Toolkit (VALET) to aid officers in data exploration.

Initially, VALET was designed for internal use within a police department to understand crime trends and aid in resource allocation decision-making. However, Crime Prevention Specialists, who primarily interface with the community, are utilizing VALET as a visual tool in community meetings to address public questions about crime incident trends and statistics. Below, we overview recent community policing techniques, VALET and its features, and report the outcomes and challenges of our efforts to use visual analytic crime data software to shape public perception.

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C. Surakitbanharn · G. Wang · D. S. Ebert (✉)

VACCINE – Visual Analytics for Command, Control and Interoperability Environments, Potter Engineering Center, Purdue University, West Lafayette, IN, USA

e-mail: [csurakit@purdue.edu](mailto:csurakit@purdue.edu); [wang1908@purdue.edu](mailto:wang1908@purdue.edu); [ebertd@ecn.purdue.edu](mailto:ebertd@ecn.purdue.edu)

J. F. de Queiroz Neto

CRAB – Computer Graphics, Virtual Reality and Animation, Computer Science Department, Federal University of Ceará, Fortaleza, Brazil

e-mail: [florencio@lia.ufc.br](mailto:florencio@lia.ufc.br)

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## Perceptions of Community Policing

The standard approach to fighting crime was traditionally based on a large number of police officers, random patrols, and reaction to incidents (Weisburd and Eck 2004). However, these methods are being replaced by more broad sighted and focused strategies, such as Community Policing, Problem Oriented Policing, and Hot Spot Policing. Community policing is a strategy that believes community members and the police, working together, can better resolve problems related to crime as well as physical and social disorder (Trojanowicz and Bucqueroux 1990). However, community policing is not without controversy, as critics cite a lack of causal evidence between community policing and crime reduction (Coquilhat 2008). Furthermore, despite engagement efforts, residents may still not perceive police as effective or active in policing their neighborhood or another region. Our law enforcement partners in Lafayette, IN cited comments during community meetings about “feeling” the rise of crime in a particular area, despite contrary records data. Without real-time analytical tools, officers are unable to empirically support or test such claims about crime trends. The lack of data creates a back-and-forth interaction with the community where both officers and the public believe the other side is making unsubstantiated claims, which can strain the relationship between officers and the public.

### *Problem Oriented Policing*

Problem Oriented Policing (POP) expands police activities and relationships to include communities and other government agencies, collaboratively working to understand and address the underlying conditions of recurring crimes (Braga 2014). In this context, a problem is a social or systemic condition that continuously generates clusters of criminal incidents.

The POP approach first identifies an overarching problem, such as an opioid epidemic that leads to drug arrests, and then examines all factors that might contribute to the problem. In the opioid example, unintended addiction resulting from prescription drugs may lead to opioid related incidents. Together with the community and other agencies, the POP approach defines, implements, and continuously evaluates possible solutions, such as the increased regulation of prescription drugs. A challenge with POP is evaluating the impact of solutions, with few rigorous evaluations available (Weisburd et al. 2010). Data exploration tools can help evaluate and convey the impact of the POP approach on crime incidents, especially for multiple criteria.

## *Hot Spot Policing*

Hot spot policing allocates more officers and resources to areas with higher crime rates. It is based on the idea that certain areas have a higher concentration of incidents and tend to remain consistent over time (Weisburd et al. 2012). Knowledge of these areas can both simplify patrol decision making and contribute to crime reduction (Weisburd and Eck 2004), with minimal displacement of criminal activity to neighboring regions (Braga 2001).

Nevertheless, concentrating officers at hot spots can lead to law-abiding citizens in the vicinity feeling unfairly targeted. Without empirical data and community outreach, the rationale for an increased police presence may be unclear to the community and even misconstrued as racial profiling. Such feelings may reduce goodwill and trust towards the police officers, and create obstacles in community policing. In a similar vein to the community policing problem, there has been a lack of interactive technology to show hot spots and address community questions in real time.

## *Crime Mapping Technologies*

CrimeStat IV, GeoDa, ESRI Public Safety Incident Maps, and Crime Reports are currently available analytical tools that are limited in their broader use. For example, CrimeStat IV provides hundreds of statistical analysis modules to capture trends (Levine 2013), but lacks a built-in visualization component. As such, the tool does not lend itself to real-time analyses by a larger section of the police department.

GeoDa is a free tool designed for general spatial analyses and it is not specialized for law enforcement data and lacks features designed for exploratory data analysis of crime incidents (Leitner and Brecht 2007). It can, however, display visual analyses as a freestanding software, making it more accessible to the public.

ESRI offers tools on their commercial GIS platform dedicated to law enforcement activities including, Public Safety Incident Maps, Repeat and Near Repeat Analysis, and Manage Community Events. These tools are designed for specialized use rather real-time crime data analysis.

In contrast, CrimeReports is a web-based collection and spatial visualization of crime datasets in the United States. Public users can filter incidents by date, time, and event type in CrimeReports, but limitations hinder more in-depth analysis. First, the public interface only displays the last six months of data, making it impossible to compare trends over several years. Second, incidents are displayed at the block level rather than at the actual location, creating ambiguity about the location of occurrences. Third, CrimeReports does not allow the creation of boundaries around a neighborhood to capture a total amount of crimes for a certain area or the differences in crimes for that area at different periods of time.

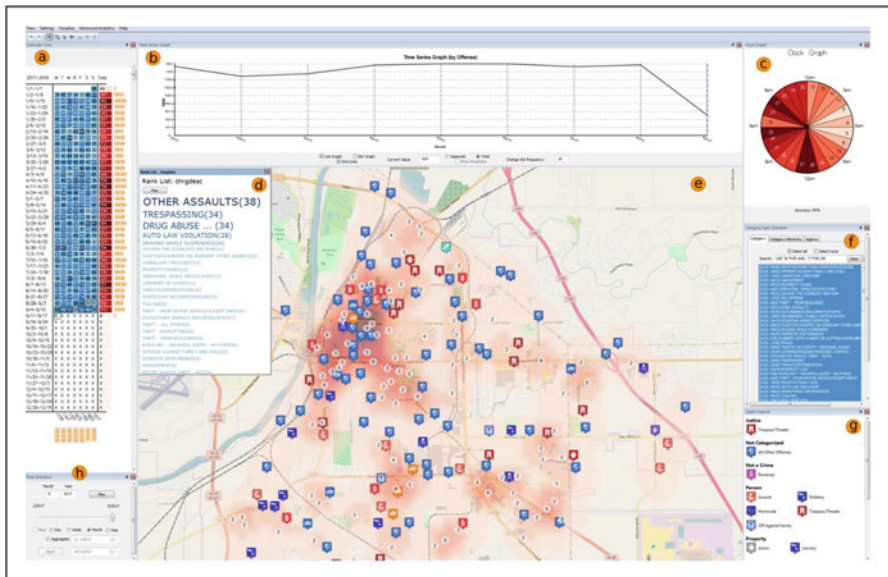
Individual tools may have strengths in analytical capabilities or usability, but prior technologies are not designed to find a balance between the two traits. Moreover, the tools can be difficult for an officer to use in a community meeting to address questions in real time. As a response to these shortcomings, our law enforcement partners and our team brought VALET to community meetings for initial testing of whether it would improve public perception of law enforcement actions.

## Community Outreach with VALET

Officers can encounter challenges in shaping community perception with a lack of empirical evidence to support claims of improved performance or a reduction in crime. Partnering with the Lafayette Police Department (Indiana, USA), we attempted to bridge the perception gap between the community and the police department through real-time use of the VALET.

VALET was originally designed and tested for internal use by a police department to facilitate interactive and visual spatiotemporal exploration of crime, traffic, and civil incident reports (Malik 2014; Wang et al. 2017).

At the center of the VALET display (Fig. 3.1, view e) is a map view that aggregates and displays the spatial crime distribution. Additionally, VALET displays the



**Fig. 3.1** VALET’s main interface is composed of interactive interconnected views: in (a) calendar view, in (b) time series line view, in (c) clock view, in (d) rank view, in (e) main map and incidents view, in (f) incident type selection view, in (g) icon dictionary view and in (h) we have the time slider view

total number of crimes by day of the week for every week of the year (Fig. 3.1, view a), incident trends over time (Fig. 3.1, view b), and a clock view (Fig. 3.1, view c) that shows hourly crime distribution. VALET can display selections of data for a certain period, geography, crime, or a combination of these factors. The function at the center left filters the data by time (Fig. 3.1, view h), drawing a boundary on the displayed map selects a region, and the right window (Fig. 3.1, view f) facilitates crime selection.

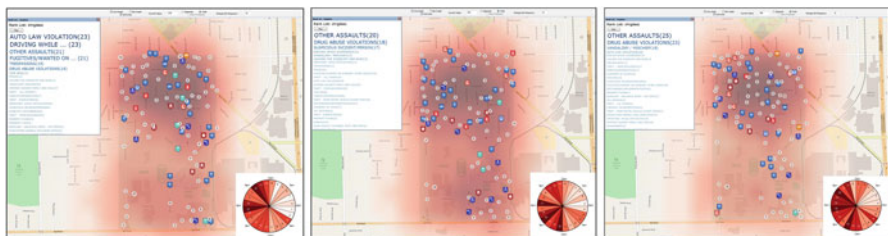
### *Real Time Data Analysis*

In June 2017, VALET’s developers accompanied the Lafayette Police Department (LPD) to three community meetings to use the VALET to answer community questions.

To conduct the crime comparison with VALET, the operator first drew a boundary around a neighborhood and surrounding areas, and selected three different periods: the first half of 2016, the second half of 2016, and the first half of 2017. VALET extracted a copy of the crime incidents from the RMS database and returned the query to the audience in real time, as shown in Fig. 3.2.

Figure 3.2 indicates rising crime trends for the selected region, as seen in the total at the top of the map view. In the selected boundary, the first half of 2016 reported a total of 270 crimes, the second half of 2016 reported a total of 293 crimes, and the first half of 2017 reported a total of 306 crimes. The map and clock views showed insignificant spatiotemporal changes in overall incidents.

The rank view indicated that ‘Auto Law Violation’ was the most prevalent incident in the first half of 2016 with 23 incidents, but decreased to ten incidents in the second half of 2016, and 18 incidents in the first half of 2017. Additionally, ‘Other Assaults’ increased by 25% to be the leading crime incident in the first half of 2017. A closer evaluation of the ‘Other Assault’ trends between the second half of 2016 and the first half of 2017 indicated that incidents became more concentrated at one particular apartment complex. The increase in incidents is visually displayed



**Fig. 3.2** VALET example: The image represents all crime incidents for a neighborhood in Lafayette, Indiana, the USA for the first half of 2016 (left), second half of 2016 (middle), and first half of 2017 (right). Each map has three views: rank view, map view and clock view



**Fig. 3.3** VALET example: ‘Other Assaults’ incidents at two different date ranges for a neighborhood in Lafayette, Indiana, USA. The date range is the second half of 2016 (left) and the first half of 2017 (right)

as a darkened hot spot in the right image in Fig. 3.3, relative to the left image. A numeric label at this address indicated that the number of ‘Other Assault’ increased from five to ten incidents between the two periods at the apartment complex in the lower left of each image.

## Discussion

### *Insight into Crime Trends*

The examples demonstrate how VALET can provide both officers and the public insight into surrounding crime trends only a laptop and an internet connection. In the community meetings, the initial query results guided the conversation between the officers and the attendees. For example, the instantaneous display of crime uptick led to the discussion about whether the attendees felt that the data accurately assessed changes in their neighborhood. Additionally, the reduction of ‘Auto Law Violation’ from 23 for the first half of 2016 to ten for the second half of 2016 could prompt the discussion of contributing factors to the downward trend, such as changes in police behavior, new street signs or traffic signals, or environmental factors like weather.

The change in the data itself does not explain causality, but identifying change can help determine the contributing factors. ‘Other Assaults’ rising to the most predominantly reported incident in the rank view led us to identify additional trends related to this incident type. The hot spots in Fig. 3.3 not only map the change in the distribution of ‘Other Assaults,’ but they pinpoint an address where twice as many incidents have been reported in the most recent 6-months span. The police and

community members could use such information to evaluate and jointly determine factors at the location that have led to this increase. In doing so, the joint effort could take on a POP approach to address the core issue, such as a new tenant or change in management at the apartment, rather than focusing on reducing incidents.

### ***Community Perception***

Interactions from the three community meetings support that VALET can aid in community policing. The ability to answer community members questions with data in real time helped facilitate discussion. The observed conversations between the community and police was not a back and forth argument over perceived risks and actions, but rather a dialogue on ways to address problematic hot spots.

Furthermore, at the community meeting on June 20th, a majority of the attendees commended both LPD and VALET developers for jointly developing software for direct use at the community meetings. Such comments seemed to support a positive perception of the law enforcement agency. Additionally, a City Council Member in attendance at another community meeting asked for a follow-up to determine broader uses of VALET, further supporting the notion of multi-agency collaboration in POP.

Finally, the concept of hot spot policing may have been less controversial among the attendees because citizens had input in the decision-making process of patrol areas. Furthermore, community members now knew to be on the lookout for illicit activity at hot spot locations and that it was also their duty to inform the police of suspicious activity.

### ***Limitations***

First, the sample of attendees at the community meetings primarily represented an older and singular racial demographic. Although the group in attendance may have more positive views of the police, it may not extend to other segments of society. Second, we surveyed the use of VALET but did not conduct a controlled study to determine statistically significant changes in public perception. In future work, quantifying the impacts of real-time interactive and visual crime analytic software on perception may require a controlled study to compare groups with and without exposure to VALET. Third, although we captured temporal changes in crime incident data, we do not know whether these trends are fluctuations within the normal limits of the data. Additionally, we drew comparisons from data at only one period of one-half a year. Longer and shorter time bins may produce different results into crime trends and may provide additional insight.

## Conclusion

We piloted VALET, an interactive spatiotemporal crime incident mapping software, as community outreach tool. Initial findings support that VALET can help Community Policing, Problem Oriented Policing, and increase understanding of the rationale behind Hot Spot Policing among community members that directly interact with officers and the software. The primary mechanism for the success of a crime incident visual analytic tool was real-time data exploration to address the questions and concerns of community members. Secondary mechanisms for success stemmed from community meeting attendees perceiving that they were working with the police, they had input in neighborhood policing, and the police were taking extra efforts of technology development for community policing.

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## References

- Braga, A. A. (2001, 11). The effects of hot spots policing on crime. *The Annals of the American Academy of Political and Social Science*, 578, 104–125.
- Braga, A. A. (2014). Problem-oriented policing. In *Encyclopedia of criminology and criminal justice* (pp. 3989–4000). New York: Springer New York. [https://doi.org/10.1007/978-1-4614-5690-2\\_266](https://doi.org/10.1007/978-1-4614-5690-2_266).
- Coquilhat, J. (2008). *Community policing: An international literature review*. Wellington: New Zealand Police Association Incorporated.
- Forst, B. (2008). *Improving police effectiveness and transparency: National information needs on law enforcement* (Tech. Rep.). Washington, DC: Bureau of Justice Statistics.
- Leitner, M., & Brecht, H. (2007, 5). Software review: Crime analysis and mapping with GeoDa 0.9.5-i. *Social Science Computer Review*, 25(2), 265–271. Retrieved from <https://doi.org/10.1177/0894439307298921>.
- Levine, N. (2013). *CrimeStat IV – A spatial statistics program for the analysis of crime incident locations*. Washington, DC: National Institute of Justice.
- Malik, A., Maciejewski, R., McCullough, S., Ebert, D. S., & Towers, S. (2014, 12). Proactive spatiotemporal resource allocation and predictive visual analytics for community policing and law enforcement. *IEEE Transactions on Visualization and Computer Graphics*, 20(12), 1863–1872.
- Scheider, M. C., Rowell, T., & Bezdikian, V. (2003, 12). The impact of citizen perceptions of community policing on fear of crime: Findings from twelve cities. *Police Quarterly*, 6(4), 363–386. Retrieved from <http://journals.sagepub.com/doi/10.1177/1098611102250697>.
- Trojanowicz, R. C., & Bucqueroux, B. (1990). *Community policing: A contemporary perspective*. Cincinnati: Anderson Pub.
- Wang, G., Akers, A., de Queiroz Neto, J. F., Surakitbanharn, C., & Ebert, D. S. (2017). Spatiotemporal driven analysis of law enforcement data. In *The IEEE Visualization Workshop on Visualization in Practice*, IEEE Computer Society, 2017



- Weisburd, D., & Eck, J. E. (2004). What can police do to reduce crime, disorder, and fear? *The Annals of the American Academy of Political and Social Science*, 593, 42–65. <https://doi.org/10.2307/4127666>.
- Weisburd, D., Telep, C. W., Hinkle, J. C., & Eck, J. E. (2010, 2). Is problem-oriented policing effective in reducing crime and disorder? *Criminology & Public Policy*, 9(1), 139–172. Retrieved from <http://doi.wiley.com/10.1111/j.1745-9133.2010.00617.x>.
- Weisburd, D. L., Groff, E. R., & Yang, S. M. (2012). *The criminology of place: Street segments and our understanding of the crime problem*. Oxford: Oxford University Press.

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