Crime Mapping & Analysis News

A POLICE FOUNDATION PUBLICATION

Issue 3: Summer 2015

Police Foundation’s Public Safety Open Data Portal
Policing on Purpose: Revisiting Problem-Oriented Policing
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CrimeStat IV
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*Front cover image art provided by Shefali Tripathi, Gainesville Police Department, FL.

About the Police Foundation

The Police Foundation is the only nationally-known, non-profit, non-partisan, and non-membership-driven organization dedicated to improving America’s most noble profession – policing. The Police Foundation has been on the cutting edge of police innovation for 45 years since it was established by the Ford Foundation as a result of the President’s Commission on the Challenge of Crime in a Free Society.

The Police Foundation, relying on its in-house staff and a team of executive, policing, and research fellows, provides actionable technical assistance and conducts innovative research to accomplish its mission of improving policing through science and innovation.

Our Partners:

The opinions, information, and ideas presented herein are those of the authors and do not necessarily reflect the views of the Police Foundation. This newsletter offers an outlet for scholars, practitioners, and policy makers to learn, share, and collectively address topics of mutual concern.
Greetings everyone! And welcome to the summer issue of the Crime Mapping & Analysis News.

In this issue, you’ll find an interesting mix of articles on practical applications of mapping technology to not only help fight crime but also locate missing children as well as a brief summary of latest software and resources available in the field of crime analysis and crime mapping. The articles included in this issue are:

- Police Foundation’s Public Safety Open Data Portal
- Policing on Purpose: Revisiting Problem-Oriented Policing
- Role of Mapping Technology for Locating Missing Children
- Ripeness and Hot Spots in Time: Possible Futures in Micro Place-Based Policing
- CrimeStat IV - a spatial statistics program for the analysis of crime incident locations

I hope you’ll enjoy reading about what our fellow colleagues are doing. I am always looking for articles on innovations in policing to include in the newsletter. I encourage you to submit articles on the interesting work you are doing that you would like to share with others.

I would like to thank everyone who sent us their articles, and also our editorial team who spent time to publish this issue. We love to hear from you, so please send us your feedback at editors@policefoundation.org

Sincerely,
Shefali Tripathi
*Editor-in-Chief*
Greetings Colleagues –

2015 has been a very busy and exciting year for the International Association of Crime Analysts. We have been working hard at collaborating with our partners to share in the efforts of expanding crime analysis across the country.

The IACA and the Police Foundation’s partnership with the support of the Bureau of Justice Assistance (BJA) funding is moving ahead with the Advancing Policing Through Innovation & Science: A Crime Analysis Symposium for Law Enforcement Leaders project. The project consists of an informative full-day crime analysis symposium for executives. The curriculum was developed by IACA member Professor Dr. Rachel Boba-Santos (Florida Atlantic University, FL), who serves as the subject matter expert on the project. Instructors were all selected through an application process and all are IACA members. Three areas of the curriculum are represented through the use of three different presenters: A Criminologist, an Executive and a Crime Analyst.

In a free one-day symposium, executives will be shown how to focus their use of crime analysis by matching the appropriate type of analysis to the appropriate rank and division in the agency, so that crime reduction at all levels is informed by actionable crime analysis. The expert team of presenters – a police executive, criminologist, and crime analyst - will discuss and explore how agencies of all sizes can integrate approaches such as problem-oriented policing, hot-spots policing, community policing, predictive policing and intelligence-led policing.

April 30, 2015 the symposium was presented to approximately 90 attendees in Oakland (CA). IACA members Police Intelligence Analyst Dawn Clausius, Olathe (KS) Police Department, Deputy Chief Richard Del Toro, Port St. Lucie (FL) Police Department and Dr. Eleazer "Lee" D. Hunt Greensboro (NC) Police Department presented to attendees. The Oakland (CA) Police Department and the California Endowment organization hosted the event at the Oakland Conference Center. The next symposium sites are tentatively planned for the cities of Chicago (IL), Camden (NJ)-Wilmington (DE) and Detroit (MI). The locations coordinate with the U.S. Department of Justice’s Violence Reduction Network partner cities. For additional information on that program please visit: https://www.bja.gov/Programs/vrn.html.

Through our partnership with the Police Foundation and support from BJA, the IACA is proud to be able educate executives on the importance of the implementation of actionable crime analysis strategies into their daily police functions. Through this partnership, with the Police Foundation, the IACA is pleased to be a part of the overall goal of supporting and enhancing crime analysis nationally. To view other BJA supported crime analysis projects, please visit their website at: https://www.bja.gov/ProgramDetails.aspx?Program_ID=113#horizontalTab3.
The IACA is hosting its 25 Year Anniversary Training Conference this year in Denver, CO, September 21-25, 2015. Registration is open and the conference committee is finalizing plans for the event. We are on track to have a class schedule available via the web the week of June 1st. We are extremely excited and honored to have Denise O’Donnell, the Director of the Bureau of Justice Assistance, as our opening session keynote speaker. Our luncheon keynote will be IACA Parliamentarian Nancy Sylvester. She will be discussing recent changes in the IACA’s bylaws.

National Institute of Justice is a large part of our conference again this year. We will have a track of NIJ speakers to present on projects they are working with in conjunction with NIJ. We are finalizing nights out plans and looking forward to a great time in Denver celebrating IACA’s 25th year! Please visit the IACA website for further details.

2015 is also the year for new elections. All positions on the Executive Board are open for new members to get involved. The nominations are in and the campaigning will begin soon for those who are running.

We value all of the support The Police Foundation offers the IACA and we look forward to continuing this wonderful partnership.

Sincerely,

Carolyn Cassidy, President
International Association of Crime Analysts
Police Foundation to Launch the Public Safety Open Data Portal

By Jim Burch, Vice President for Strategic Initiatives

The Police Foundation has been exploring the use of open data as a means to improve transparency and accountability and to encourage and support innovation in policing. To pursue these goals, a Public Safety Open Data Portal will be launched to highlight what local agencies are doing in the area of open data and to offer the public and professional users the ability to see, visualize, and analyze the data in one location.

In light of the Police Foundation’s work, the White House has asked the Police Foundation to participate in its Police Data Initiative (PDI), which aims to encourage local agencies to release data about their operations as a way of improving the relationship between the police and the communities they serve. The Public Safety Open Data Portal will provide access to the open data released by local agencies participating in the PDI (more than 20 are currently signed up to participate) and to open data released by other agencies.

An important objective of the Foundation’s Portal is to provide the context that non-law enforcement users need before delving into public safety data. For example, it is important to explain the differences between calls for service and incident data and to provide visualizations that show how officer-involved shootings often occur in the most dangerous parts of a city, for example. Additionally, the Portal allows users to explore broader contexts supported by open data from other sectors, such as the links between public health and public safety.

Crime mappers and others interested in spatial analysis can benefit from the Portal by accessing data from many different agencies and mapping it online through Esri or Socrata visualization tools, or downloading the datasets for analysis in ArcGIS, for example. To see the beta version of the Portal, visit www.publicsafetydataportal.org

Mr. Burch is the Vice President for Strategic Initiatives at the Police Foundation, overseeing the Foundation’s efforts to advance policing through innovations in practice and technology as well as the Foundation’s strategic programs and management services. Prior to joining the Police Foundation in early 2015, Mr. Burch served for more than 20 years at the U.S. Department of Justice, having been appointed to various senior executive and leadership positions, including Acting Director of the Bureau of Justice Assistance (2009-2011), Deputy Assistant Attorney General (2011-2014) of the Office of Justice Programs (OJP), and Acting Assistant Director at the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) (2014-2015). During his career at the Department of Justice, Mr. Burch developed, supported, and led many key initiatives to advance policing and criminal justice, including major initiatives designed to encourage the use of data, technology and evidence-based crime reduction and policing strategies.
Modern Policing has come a long way baby, or has it? While any police history buff will already know, Sir Robert Peel offered up nine key principles of policing back in 1829.

- **Peelian Principle 1** - “The basic mission for which the police exist is to prevent crime and disorder.”
- **Peelian Principle 2** - “The ability of the police to perform their duties is dependent upon public approval of police actions.”
- **Peelian Principle 3** - “Police must secure the willing co-operation of the public in voluntary observance of the law to be able to secure and maintain the respect of the public.”
- **Peelian Principle 4** - “The degree of co-operation of the public that can be secured diminishes proportionately to the necessity of the use of physical force.”
- **Peelian Principle 5** - “Police seek and preserve public favour not by catering to the public opinion but by constantly demonstrating absolute impartial service to the law.”
- **Peelian Principle 6** - “Police use physical force to the extent necessary to secure observance of the law or to restore order only when the exercise of persuasion, advice and warning is found to be insufficient.”
- **Peelian Principle 7** - “Police, at all times, should maintain a relationship with the public that gives reality to the historic tradition that the police are the public and the public are the police; the police being only members of the public who are paid to give full-time attention to duties which are incumbent on every citizen in the interests of community welfare and existence.”
- **Peelian Principle 8** - “Police should always direct their action strictly towards their functions and never appear to usurp the powers of the judiciary.”
- **Peelian Principle 9** - “The test of police efficiency (i.e., effectiveness) is the absence of crime and disorder, not the visible evidence of police action in dealing with it.”

It is this author’s humble opinion that these Peelian Principles are universal and timeless, yet we find law enforcement agencies across the globe violating them, and at times violating basic human rights. Don’t assume for a second I am anti-police, nothing is further from the truth. I have dedicated my 25-year career in crime analysis and crime mapping towards the advancement of police services, the very essence of this article. My intent for writing it is to shine some light on sound professional calls for evidence-based practices, and more specifically, the absolute use of assessment—the call for regular evaluations of patrol operations, crime prevention strategies, investigative practices, and a dire recommendation to revisit Herman Goldstein’s Problem Oriented Policing (POP) paradigm.

This call for a paradigm shift was offered by Herman Goldstein, who invented problem-oriented policing after a lifetime career in the profession back in 1979 – nearly 35 years ago. Professor Goldstein offers one of the most profound statements regarding police work ever written:

> The police, by the very nature of their function, are an anomaly in a free society. They are invested with a great deal of authority under a system of government in which authority is reluctantly granted and, when granted, sharply curtailed. The specific form of their authority—to arrest, to search, to detain, and to use force—is awesome in the degree to which it can be disruptive of freedom, invasive of privacy, and sudden and direct in its impact upon the individual. And this awesome authority, of necessity, is delegated to individuals at the lowest level of the bureaucracy to be exercised, in most instances, without prior review or control.
Yet a democracy is heavily dependent upon its police, despite their anomalous position, to maintain the degree of order that makes a free society possible. It looks to its police to prevent people from preying on one another; to provide a sense of security; to facilitate movement; to resolve conflict, and to protect the very processes and rights—such as free elections, freedom of speech, and freedom of assembly—on which continuation of a free society depends. The strength of a democracy and the quality of life enjoyed by its citizens are determined in large measure by the ability of the police to discharge their duties. (Goldstein, 1977)

This statement conceptualizes the profound nature of American policing and the tenets of problem-oriented policing, along with the varying styles and new names of policing paradigms, since all call for the professionalization and accountability of modern law enforcement agencies. Community policing, problem-oriented policing, “broken windows” theory, evidence-based policing, hotspot policing, intelligence-led policing, information-led policing, predictive policing - each and every one shares these elements. For an intelligence- or information-led or evidence-based approach to work, assessments must be embedded into the process, not as a gimmick, but as a fundamental part of the process.

Most agencies, but certainly not all, embraced these paradigms—some for noble purposes, others for the grant funds or the notoriety. The truth be known, many of these paradigms were convoluted or “derailed” in a manner that allowed agencies to hang on to traditional practices. Community policing was seen as too soft, even though it most closely adheres to Peelian points. Problem-oriented policing was relegated to quick and reactive responses to community issues that have simplistic solutions—albeit with a number of innovative POP projects documented over the years. “Broken windows” turns into racial profiling and intelligence-led policing—post 911—provides agencies with the license to target prolific offenders. What continues to be offered up as part of these paradigms is the need, even the necessity, for program evaluations and strategic assessments. What I am suggesting here is that while we continue to “talk the talk” about evidence-based practices, we continue to fail to perform sound pre— and post—tests regarding what works and what doesn’t in police work. My primary premise is to point out the obvious: We need to police with a purpose—police on purpose; and then we need to measure our effectiveness. Did we reach our goal?

Policing on purpose requires that we articulate systematic objectives about what we want to accomplish, how we go about it, and when and where we implement it; so we can assess its efficacy. Policing on purpose is simple, it is really just good policing. It is honest about what we hope to achieve and then goes about measuring the effectiveness of those efforts. It is about police accountability (i.e., e.g., COMSTAT). It is about systemic problem solving and being certain to include the in-depth analysis and the follow-up review through SARA – scanning, analysis, response and assessment. Every healthy organization conducts research and development, and clearly understands the environment in which it operates. What follows is a recommendation to revisit problem-oriented policing with an emphasis on assessment. Without creating a new name or shifting to a new paradigm, let’s just call it good policing—police work to which every law enforcement agency should aspire. In doing so, a synthesis of existing ideas is offered.

Why is this so critical today? The shooting death of an unarmed black youth in Ferguson, MO and the aftermath of protests and civil unrest, that’s why. This is not to say that the officer was wrong nor to convict the youth, without their day in
court. Good policing is critical today for the same reason that community policing and problem-oriented policing were introduced and supported by the U.S. Department of Justice back in the 1990s; and why the 1960s Presidential Commissions called for a major re-construction of the criminal justice system over 50 years ago. The justice system and policing is not as good as it should be. There is plenty of room for improvement. And the only way to get systematic continuous improvement is through assessment. It’s that simple. Every police paradigm since the 1960s has called for action research, evidence-based practices and continuous improvement. The statistics on racial disparity cry out for better explanations, even if disparate enforcement is justified. Public outcry over the Trayvon Martin and Michael Brown incidents continues to remind us that racial profiling, real or perceived, has a significant effect on police-public relations.

Sir Robert Peel and Herman Goldstein have nailed it when it comes to the essence of good policing. Yet, there is still something amiss in America on racial grounds and we have an obligation to address it. The reports of sexual assaults on college campuses across the United States related to binge drinking, the lack of ability to give consent as a result of intoxication, and the predators who victimize a reported one-in-five of college female freshmen and sophomores begs for evaluation. Current practices and social interactions continue to result in crime and violence, and yet we continue to fail to incorporate sound research into what works and what doesn’t. It is time to embrace programmatic assessments of patrol operations, investigative practices, and situational crime prevention strategies to improve the safety and welfare of our citizens.

Unfortunately, we continue to fall prey to reactive police methods and case-by-case investigations. What did Herman Goldstein actually suggest?

**Problem-oriented policing is an approach to policing in which discrete pieces of police business (each consisting of a cluster of similar incidents, whether crime or acts of disorder, that the police are expected to handle) are subject to microscopic examination (drawing on the especially honed skills of crime analysts and the accumulated experience of operating field personnel) in hopes that what is freshly learned about each problem will lead to discovering a new and more effective strategy for dealing with it. Problem-oriented policing places a high value on new responses that are preventative in nature, that are not dependent on the use of the criminal justice system, and that engage other public agencies, the community and the private sector when their involvement has the potential for significantly contributing to the reduction of the problem. Problem-oriented policing carries a commitment to implementing the new strategy, rigorously evaluating its effectiveness, and, subsequently, reporting the results in ways that will benefit other police agencies and that will ultimately contribute to building a body of knowledge that supports the further professionalization of the police (Goldstein, 2001).**

The mastermind behind Compstat, Jack Maples (1999:32)—a NYPD Deputy Commissioner, proclaimed four principles that “any police department needs in order to operate as an undeterrible force against crime.” These guideposts, as he called them, were: (1) Accurate, timely intelligence, (2) Rapid deployment, (3) Effective tactics, and (4) Relentless follow-up and assessment.

Even in the midst of Dr. Jerry Ratcliffe’s strong argument for intelligence-led policing (Ratcliffe, Intelligence-Led Policing (2008)) (ILP) and the 3-i Model, Dr. Ratcliffe calls for us to “Reimage policing” – and suggests that “…this movement has
produced problem-oriented policing, Compstat, and now intelligence-led policing.” Problem-oriented policing and Compstat remain extremely relevant to crime analysis today, and in-depth analysis and recurring crime accountability meetings are critical to 21st Century policing. We owe tremendous gratitude to the COPS Office for providing invaluable resources, which allowed the Center for Problem Oriented Policing to produce many useful POP guides and other support services. Those guides and other resources are still available at www.popocenter.org. Professionally, I embrace ILP and the key components (See note 1) which I extract from Ratcliffe’s proposal (see insert above). Most notably, he likewise offers up the need to evaluate the concepts and practices of ILP. He tells us “Evaluation is essential to the development of any crime reduction strategy” and quotes Don Weatherburn (2004:36-38), who identified five features of a rational approach to crime control:

- Adequate investment in measuring and monitoring;
- Open access to crime and justice information;
- Reliance on evidence in the development of policy;
- Commitment to rigorous evaluation; and
- A flexible and eclectic approach to control.

Ratcliffe (2008: 186-87) admits that it might seem strange to dedicate an entire chapter to the idea...
of evaluation. But he reiterates the claims of Gloria Laycock (2001) that change is under way within policing, a change that focuses on crime reduction as an outcome, greater professionalism, a developing body of knowledge, which moves us towards a data-driven, evidence-based problem-solving approach. Assessment is at the core of each and every policing paradigm that has appeared on the landscape over the past 25 years. Now is not the time to turn away from problem-oriented policing or a commitment to assessment. The struggle for good policing—for policing on purpose—is still upon us.

It is time to stop naming and renaming the essence of policing and simply call it what it is, good policing—effective policing, results-oriented policing. Most of all, it is time to require—that police tactics, patrol operations, investigative practices, crime prevention strategies be tried and tested. When we don’t embrace evidence-based practices, we often use innovative ideas to disguise our desire to maintain the status quo and cling to police inertia. It is time to revisit problem-oriented policing, not the watered down version of the late 1990s and early 2000s. We need fundamental change regarding the approach to assessment.

Goldstein (1990:37-38) described how crime analysis was applied to policing in the past and what changes need to occur for problem-oriented policing to take hold.

Crime analysis, which has been an important part of the professional model of policing, is a base on which police can build in meeting the much wider and deeper demands for inquiry associated with problem-oriented policing. In a police agency in which individual officers may not know what has occurred outside the areas in which they work or during periods when they are not on duty, crime analysis has been the primary means for pooling information that may help solve crimes. Initially, it consisted of a review of reports on similar crimes to identify those that may have been committed by the same individual or group, with the hope that the sum of information from a number of reports might better enable the police to identify and apprehend the offender(s). If an offender was apprehended, similar analysis might enable the police to solve other crimes for which the offender was responsible and to increase the strength of the case against him or her. As crime analysis developed, attention focused on discovering patterns of criminal activity, enabling analysts to alert patrolling police officers to individuals suspected of committing a particular type of crime and to the area in which they might commit it. Anticipating where the offender was likely to strike also enabled the police to set up surveillance and undercover operations [much of today’s focus on ILP’s Prolific Offender].

At its best, crime analysis has been used to identify offenders and interrupt crime patterns rather than to gain the kind of knowledge and insights that might be used to affect the conditions that accounted for the criminal conduct...

Problem-oriented policing actually provides an incentive to make much more effective use of the data typically collected as part of crime analysis and to expand beyond the current limited objectives of the most advanced crime analysis models. This would first require focusing more broadly on all of the problems police handle rather than on just traditional categories of crime. It would require trying to understand the nature of these problems as a basis for critical review of the agency’s response, rather than limiting inquiries to narrower operational goals. It would use more sources of information than just the reports filed by police officers. To understand all aspects of a problem, police would have to become adept at conducting literature searches, using telephone and door-to-door surveys, interviewing those having the most direct knowledge about a problem (including citizens, officers, representatives of various government agencies and private services, and ex-offenders), and making use of data.
collected by other government agencies and in the private sector. Finally, the type of systematic inquiry contemplated as part of problem-oriented policing would place a much higher value on the accuracy and preciseness of the data used and the conclusions reached than has been characteristic of studies conducted within police agencies.

Otherwise, we can continue to rely on misinformation and erroneous false claims like the Crime Clock, which distorts the facts and uses fear to make decisions.

It is this in-depth analysis and “relentless and rigorous” assessment consistently articulated across all contemporary policing paradigms that is compulsory to accomplish ILP’s and POP’s strategic aim of informed decision-making regarding resource allocation and priorities; and that makes for good policing.

Notes

(1) These components represent a short list of key elements of ILP, as interpreted by this author but directly drawn from Ratcliffe’s (2008) book by this very name: Intelligence-Led Policing, and several other articles of his writing.
crime analysis has been the primary means for policing. In a police agency in which individual officers demands for inquiry associated with problem-oriented policing, is a base on which the professional model of policing, is a base on which it is time to require— to revisit problem-oriented policing, not the innovative ideas to disguise our desire to maintain investigative practices, crime prevention mandate— that police tactics, patrol operations, strategies be tried and tested. When we don't appear on the landscape over the past 25 years. We need fundamental change regarding what changes need to occur for problem-oriented analysis was applied to policing in the past and what Goldstein (1990:37-38) described how crime core of each and every policing paradigm that has appeared on the landscape over the past 25 years. Laycock, Gloria (2001). “Research for police: who needs it?”, Trends and Issues in Crime and Criminal Justice, 211:1-6

References


*The opinions offered in this article are the sole views of the author and do not in any way reflect the views of the Tempe Police Department and its members, or the Police Foundation and Crime Mapping and Analysis News. Please send any comments or questions to Noah Fritz at njfritz@gmail.com

Dr. Noah Fritz is the SPARC—Strategic Planning, Analysis and Research Center— Supervisor at the Tempe Police Department and the past Crime Analysis Manager at the San Diego County Sheriff’s Department. Noah got back into the “field” of crime analysis after spending five years as an Assistant Professor in the Criminal Justice & Criminology Department at Metropolitan State University of Denver. His primary area of research is Crime Mapping, Crime Analysis and Geographic Information Systems. He was the previous Director and Founder of the Crime Mapping and Analysis Program (CMAP)—a U.S. Department of Justice sponsored training and technical assistance program; and served as the Deputy Director of NLECTC; and a previous two term President of the IACA.

Most notable accomplishments include a Doctorate in Justice and Social Inquiry from Arizona State University, a Master’s from same and undergraduate degrees in Sociology and Criminal Justice from Illinois State University. He has authored articles in the Sociological Quarterly, the Encyclopedia of Criminology and Deviant Behavior, is a co-author of Exploring Crime Analysis (2004); and appeared nationally on ABC’s Weekend News Edition featuring crime mapping and has been featured on public radio in Australia where he provided consulting services to the Victoria Police Department. Noah enjoys camping, hiking and golf; and spending time outdoors with his family and friends.
Role of Mapping Technology for Locating Missing Children

By Marisa Cowdry

The Florida woman was frantic: her 8-year-old grandson was missing again. Like nearly half of children with autism, her grandson was prone to wandering and could be in danger. Her local sheriff’s office responded quickly, calling on 11 agencies to help search for the child using bloodhounds, ATVs, and helicopters. A call was made to the National Center for Missing & Exploited Children (NCMEC), the leading nonprofit organization working with law enforcement on issues of missing and exploited children, at its Alexandria, Virginia headquarters requesting immediate assistance.

As it does in most critically missing children cases, NCMEC rapidly deployed a member of Team Adam to Florida and had another consultant on standby. A third consultant, Henry Schmidt, who is a search and rescue expert, began working on the case remotely from his home in Utah using a new software mapping tool on his iPad. Developed by one of NCMEC’s partners, ESRI, the software enables law enforcement to visually illuminate patterns on a map from scores of leads, and to plot search areas.

Schmidt plotted the location where the child went missing on a map and noted the various bodies of water that should be checked first. Many children with autism are attracted to water, and NCMEC has seen a spike in the number of children with special needs drowning. In case the child had been abducted, Schmidt was able to add more layers to the map: the locations of registered sex offenders and attempted abductions in the area.

The innovative software called Collector Application, developed by ESRI, eliminates the problem of having information scattered over a variety of locations and establishes a framework of analysis derived from the data. By overlaying data sets – even things such as areas already searched by dogs, which can be located through GPS devices on their collars – law enforcement can see how they correlate to one another and draw analytical conclusions faster and more efficiently.

Fifty hours after he was reported missing, the child was found in the woods, hiding under a bush, about a half-mile from his grandmother’s house. He was dehydrated, but safe.

Schmidt, retired from law enforcement after 33 years, said the new mapping software enabled him to advise those searching for the child in Florida from his home in Utah. “We’re able to take our experience and view the maps and segment them into searchable areas, so they’re not wasting valuable time and resources searching places they don’t need to,” Schmidt said.

Schmidt is one of NCMEC’s 85 Team Adam consultants (TACs), located throughout the United States. Team Adam, named after the abducted and murdered 6-year-old son of NCMEC cofounders John and Reve Walsh, is comprised of retired or former law enforcement officials who have been selected in a competitive process for their experience in the field of child abduction and sexual exploitation. Since the team was created 12 years ago, TACs have been deployed 890 times in every state but one, to help find more than 1,000 missing children.

Team Adam’s mission is supported by the annual federal grant NCMEC receives to serve as the nation’s clearinghouse on issues related to
missing and exploited children. Team Adam consultants rapidly deploy anywhere in the United States where critically missing children cases are unfolding, provide technical assistance, and connect local law enforcement and victim families with a network of free NCMEC resources.

The program was established as a vehicle to get the best investigative tools and latest technology to the nation’s 16,000 local law enforcement agencies, more than half of which have fewer than 15 officers. Critically missing children cases can be complex and costly and can generate national media attention, putting a strain on already strapped agencies. Team Adam consultants are truly dedicated because they must remain on-call and respond at a moment’s notice.

The Collector Application mapping software they are using can provide law enforcement with more reference points as a case develops regarding people and places of interest, underscoring the importance of being able to relate new information in real time back to existing data already placed on the map.

Team Adam has been using the software for about six months, most recently in the case of missing University of Virginia student Hannah Graham. Investigators used the mapping system to plot the areas of high probability where
Hannah might be, in relation to the movements of the suspect law enforcement identified.

In addition, NCMEC offers a wide variety of training and other free services to aid law enforcement in missing children and child sexual exploitation cases, including: case analysis and technical support; forensic support, including age progression; missing children photo distribution; unsolved case analysis; Child Victim Identification Program, which helps law enforcement identify victims portrayed in sexually explicit images; and the CyberTipline, which serves as the national reporting mechanism for suspected child sexual exploitation. For more information, visit missingkids.org.

Marisa Cowdry is the Data Analytics Integration Specialist at the National Center for Missing and Exploited Children. The National Center for Missing & Exploited Children is the leading 501(c)(3) nonprofit organization working with law enforcement, families and the professionals who serve them on issues relating to missing and sexually exploited children. Authorized by Congress to serve as the nation’s clearinghouse on these issues, NCMEC operates a hotline, 1-800-THE-LOST® (1-800-843-5678), and has assisted law enforcement in the recovery of more than 205,000 children. NCMEC also operates the CyberTipline, a mechanism for reporting child pornography, child sex trafficking and other forms of child sexual exploitation. Since it was created in 1998, more than 4.9 million reports of suspected child sexual exploitation have been received, and more than 146 million suspected child pornography images have been reviewed. NCMEC works in partnership with the U.S. Department of Justice’s Office of Juvenile Justice and Delinquency Prevention. To learn more about NCMEC, visit www.missingkids.com. Follow NCMEC on Twitter and like NCMEC on Facebook.
By Barry Fosberg

Introduction:
Hot Spots to Micro Hot Spots

Place-based policing is known to help decrease crimes. The theory is that specific areas have properties that make them more attractive for specific types of crimes. Areas of a city with a high concentration of apartment complexes are where large numbers of cars can be found, many without sufficient management or guardians. These complexes can be hot spots for auto-related crime.

In policing, predictive analytics uses micro-level analysis, which allows crime analysts to make more mathematically sophisticated analyses of place and crime. Using predictive analytics, one can identify areas where increased police patrol is required to deter criminal activity.

At the September 2014 Training Conference of the International Association of Crime Analysts (IACA), I demonstrated a prototype technique to identify small grid squares, wherein specific crime types were occurring at unusual levels. At the end of that demonstration, I proposed several phenomena for future study. The purpose of this paper is to further explain and to identify methods to isolate these phenomena.

Ripeness, Unusually Low Levels

Threshold analysis is a method to identify areas that are reporting activity at unusual rates. The analysis will rate areas as being at, above or below historic levels. Accompanying documents identify
Threshold report, Red means recent counts over 1.5 Z scores above average.

areas with abnormally high rates as areas where an aggressive police presence may prevent the formation of a permanent hot spot. Rarely emphasized is the possibility that areas reporting unusually low activity may indicate that an area is “ripe” or due to experience an increase in crimes.

The notion of a “cold spot“ as a predictor of future increase in activity has been tested and included in a Charlotte-Mecklenburg Crime Analysis program.

A cold spot represents an area that normally reports some level of activity. Large parts of a jurisdiction may be isolated, empty or otherwise present no opportunity for the crimes under study. Ripeness is intended to identify areas with a level of activity below some expected amount. That is: an area that usually reports some level of targeted crime, but is currently reporting less that its usual amount', may be “ripe” for an increase in activity.

Another method of analysis is Near-Repea Offender Analysis. The theory is that, once a location has been hit, then the same location and the locations nearby are more vulnerable to additional hits.
Threshold analysis is a method to identify areas that are reporting activity at unusual rates. The analysis will rate areas as being at, above or below historic levels. Accompanying documents identify near-repeat calculation: Red means high probability of new hit at this time/distance from a known previous hit.

Near-repeat calculations can report vulnerability as a function of time and space such as how much time has occurred between crimes, measured in bands of time; as well as how proximate to the original incident can victimization be expected, measured in bands of space. Near-repeat calculations create virtual grids centered on events. Each crime becomes the center of a grid that extends as far in time and space as the operator cares to analyze. An analyst might be able to make copies of several virtual grids, overlay them by centering on different occurrences of crimes and produce a potential target list based on overlapping areas of elevated vulnerabilities. Using a near-repeat pattern that points to an increased vulnerability 300 feet away and a peak vulnerability 36 hours later, several maps could be overlaid, each centered on different specific events. Should there be any properties 300 feet from several datum points; the overlays might point to a specific place and time for a future crime. This possibility may be worth testing, but it may be difficult to support it as an extension of the Near-Repeat process.

The questions being asked are: Is a specific area cycling though periods of greater and lesser activity in a predictable manner? Are neighboring areas cycling though similar hot and cold periods in a manner that suggest changes in one predict changes in others? Analysis can identify cycles of activity in an area then in co-related areas and thereby help to design predictive analytics based on detected cycles.
Hot Spots in Time

A temporal function to measure crime is not a new concept. Crime analysts routinely note that crimes are reported more frequently during a certain shift or that a specific crime series has a specified time element. By “stacking” the results of individual micro level analytic results and treating time as a dimension, it should be possible to isolate one spatial pattern and at least three distinct temporal crime patterns. These are:

1. Comets: Trails across the map indicating a criminal operation that is moving in a linear fashion across the geography;

2. Pulsar: A single area of space that cycles between low and high levels of activity;

3. Binary: A pair of locations that alternate high and low counts over a period of time. This may indicate that the criminals are rotating between two areas. Activity peaks in one location and drops in the other.

4. Constellation: A number of areas that appear to cycle together. In an ideal situation, these areas would rotate from high to low in such a way that one area would bottom out as the next rises.

The use of astronomical terms is intentional. Since before recorded history, people have looked at the night sky. Some noticed that specific elements in the night sky change; some follow an annual or lunar cycles, and others a linear track. The method of looking at a night sky and seeking differences from prior nights has become more sophisticated. The process is now digitized and subjected to mathematical analysis. Think of your jurisdiction mapped as a “night sky”. Compare stacked overlaid maps and it should be possible to make analytical statements about crime patterns.

It is common for crime analysts to map pictures of criminal activity over time. It is possible to animate maps, demonstrating the flow of crime across time. Maps may demonstrate around-the-clock, per-quarter and other time-related data.

“Comets” represent a special case. Most hot-spot techniques cannot isolate a linear crime pattern. Linear crime patterns rarely create statistically significant concentrations of activity. Like a comet, this pattern is time limited and will move across areas. It would be useful to have tools that look through quantities of data and isolate trails of criminal activity. Such an analysis could provide predictive statements about future hits.

“Correlated Crime Walk” analysis already exists. Given a number of events, known or suspected to be related, it is possible to treat them as dimensional vectors and produce location, distance and time calculations. What is suggested here does not pre-suppose related events or an assumed movement vector.

Pulsars and Binaries

A pulsar should produce a sine wave. Like a pulsar, criminal activity in a location would regularly alternate between a high and a low value. This concept is very similar to cold spotting. In both the assumption is made that an area cycles through higher and lower levels of activity and that lows levels may be predictor of
more activity in the future. The major change in this formulation is to supply the suspected curve of activity.

Binaries assume negative correlation. If a criminal stops working one area it may be because he is switching between areas. This suggests a pattern where one area goes cold, another goes hot. The change in the one is directly related to a change in the other. Each area should produce a sine curve of activity rotated to be negatively correlated in time with a matched area. First, identify areas that demonstrate this reversal of activity. A correlation matrix compares every pulsar with every other pulsar matching waves with or nearly 180 degrees out of phase as potential Pulsars. Initial pairings of potential pulsars can be further analyzed using Tobler’s first law of Topography, near pairs are more related than distant pairs. Local experience should be considered. For example criminals might be willing to undertake longer journeys to crime.

**Constellations**

A Constellation is the suggested term for groups of more than two areas that appear to be operating in some statistically improbable relation. In the same way that a group may be rotating between two locations, or between several locations. The goal of this analysis is to establish that several areas co-vary in a predictable manner. A criminal operation may have several favored areas for their attacks. The assumption is that these areas form a relatively stable group of hunting grounds. Reading of applicable cases may be required to confirm that these are the same criminals.

**Conclusion**

Spatial-temporal analysis is not new. Almost all mapping includes a temporal element. Maps can be animated by day of week, time of day and etc. Threshold analysis is also not new. These calculators may identify levels of unusually high or low activity. Also not new is the concept of near and repeat victimization. Models that interpret unusually low levels of activity seem to be unusual.

The next step for crime analysts to take is to layer micro area data. Layering time should allow for analytical techniques drawn for astronomy. Star gazers look at the changing sky and ask: What is different? Crime Analysts should be able to track events on the ground, across time and answer this same question.
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His wife of almost 30 years, Ms. Gloria Connelly, just retired as the Grants Director of the New Orleans Police Department.
CrimeStat IV was released early in 2014 and has been updated several times. Funded by the Mapping and Analysis for Public Safety program at the National Institute of Justice (NIJ), CrimeStat IV is a stand-alone spatial statistics program for the analysis of incident locations. It was developed by Ned Levine & Associates from research grants by the NIJ. The NIJ is the sole distributor of CrimeStat and makes it available for free to law enforcement and criminal justice analysts, educators, and researchers.

The program is Windows-based and interfaces with most desktop GIS programs. The purpose is to provide supplemental statistical tools to aid law enforcement agencies and criminal justice researchers in their crime-mapping efforts. The program reads event locations that could represent both incidents and the number of events in zones (e.g., census tracts, traffic analysis zones). It has more than 100 spatial statistical routines that are useful for crime analysts and researchers, including those for identifying...
overall spatial distribution, hot spots, and broad regional trends through interpolation as well as those for analyzing the behavior of serial offenders and offender travel behavior.

It has an extensive collection of hot spot analysis tools for identifying clusters of crimes that are concentrated, as well as those for identifying where the number of events is higher than expected (risk analysis). For example, Figure 1 shows a kernel density estimate of 2006 burglaries in the City of Houston (TX). Superimposed over the estimate are 1st-, 2nd-, and 3rd-order burglary hot spots identified with the Nearest Neighbor Hierarchical clustering algorithm (Nnh). The Nnh hot spots provide specific information about the location of the hot spots that is missed in the kernel density interpolation.

CrimeStat III introduced a Crime Travel Demand module that allows analysts to model crime trips over a jurisdiction or even an entire metropolitan area. For example, a study was conducted of 258 bank robberies that occurred in Baltimore County, MD, from 1993 to 1997 (Levine, 2007). The crime travel demand model showed that bank robbery trips tended to originate in poorer, denser neighborhoods and, in general, involve banks that were close to the offender’s residence. Likely travel routes to the banks were modeled as well as possible escape routes on the assumption that there would be higher police presence around the bank after the robbery. Figure 2 shows the trip and escape routes that were modeled for bank robberies committed in west central Baltimore County (MD).

![Figure 2: Main Driving Routes for Bank Robberies](image)
CrimeStat IV includes a Head-Bang module. The Head-Bang statistic was developed by the National Cancer Institute as a way to smooth zonal data in calculating rates. Zones with small populations will often produce exaggerated incident rates due to low numbers of events (e.g., cancer incidents, violent crimes). The Head-Bang weights the smoothing by the size of the zone. Large zones with many events keep their value whereas smaller zones are generally smoothed. For example, Figure 3 below shows the effect of smoothing 2006 Houston burglaries by Traffic Analysis Zones. The overall distribution of the data was maintained but zones that are small tended to have their numbers smoothed using information from adjacent zones.

New to CrimeStat IV was a Bayesian Journey-to-crime routine that adjusts the usual journey-to-crime (geographic profiling) model with additional information on where other offenders lived who committed crimes at the same locations as the offender that the analyst is trying to profile. This model was tested on more than 1,100 serial offenders in four cities (Baltimore County; Chicago; The Hague in the Netherlands; Manchester in the U.K) and produced a substantial improvement in the accuracy of predictions while maintaining reasonable reliability. The model was further improved by allowing the user to add other geographic information to improve the estimates, such as the location of low-income areas or the distance of each neighborhood from the central city.

Figure 4 is the result of a Bayesian model that incorporated such information in predicting the residence location of a serial offender in Baltimore County, MD who committed 14 crimes between 1993 and 1996 (shown in black). Note that in spite of the dispersion of this offender's crimes as far away as five miles from his residence (shown in green), the model predicted the location of his residence that was quite close to it. The cell with the highest probability estimate is outlined in light blue (approximately 0.25 miles away).
Also new in CrimeStat IV are multivariate modeling tools. There is a regression module that allows non-spatial and spatial regression using both Maximum Likelihood Estimation (MLE) and Markov Chain Monte Carlo (MCMC) simulation. The MCMC method was developed during the U.S. Hydrogen Bomb Project as a means for estimating complex functions that MLE could not solve. CrimeStat IV is one of the few programs that includes MCMC spatial regression routines and is the only program that can handle very large datasets with this approach, such as those found in large and medium-sized police departments. It will be useful for researchers who want to incorporate spatial autocorrelation in their regression models as well as for advanced analysts who want to develop predictions of crime based on factors associated with the neighborhoods where crime occurs.

Another new module in CrimeStat IV is for discrete choice modeling, which allows the estimation of a multivariate model where the dependent variable is a discrete, nominal variable rather than the usual continuous variable. This module includes both the Multinomial Logit and the Conditional Logit models. The first allows the choices to be related to characteristics of the decision-maker (e.g., the offender) while the second allows the choices to be related to characteristics of the choices themselves.
of identifying months when the number of violent crimes was much higher than ‘normal’, adjusting for seasonality and trend over time. See chapter 23 in the CrimeStat manual for details.

There are other new routines in CrimeStat IV as well (e.g., new tools for measuring spatial effects in zones; the ability to output KML files to Google Earth if the coordinate system is spherical; a utility for converting Excel files to dBase IV files which are used in CrimeStat). CrimeStat IV includes extensive documentation of all the routines in the program plus many examples that we have made as well as those by other researchers. There is also a set of CrimeStat Libraries (version 1.1) that allows data base managers to integrate many of the routines into a records management system.

Both the program and documentation are free and are available from the NIJ website. It also includes sample datasets to allow users to learn a technique. The latest version is 4.02 and is available from: http://www.nij.gov/CrimeStat

References


For example, a Multinomial Logit model was constructed relating the choice of a weapon during a Houston robbery to characteristics of the offenders and the environment in which the robberies occurred (Levine, Robertson, & Fosberg, 2013). On the other hand, a Conditional Logit model was constructed of neighborhood choice by burglars in The Hague, Netherlands where the predictive variables were characteristics of the neighborhoods and the distance that the burglar lived from the crime location (Bernasco & Nieuwbeerta, 2005).

There is also a time-series forecasting module in CrimeStat IV that allows police to monitor crimes by week or month for specific geographical districts. Using at least three years of data by time period, the routine incorporates seasonality adjustments and estimates the expected number of crimes per district for any single week or month and then compares it to the actual number that occurred (Gorr & Olligschlaeger, 2013). If the discrepancy is larger than what would be expected by chance, the routine outputs a signal (the Trigg index) that can inform the police department that there is a larger number of crimes occurring than expected (or, occasionally, that there are much fewer than expected). The routine also makes a prediction for the next time period. It can help police monitor crime to better manage resources since they can direct extra resources if there is a sudden outbreak of crime in any one district.

For example, Figure 5 shows monthly Trigg signal trips for both excessively high and excessively low numbers of violent crimes in a single census tract in Pittsburgh over a 10-year period. The monthly data were collected for all census tracts in Pittsburgh over the period and the model was run using a jurisdiction-wide seasonality adjustment. As seen, the model does a good job

Figure 5:
Trigg Signal Trips with Simple Smoothing
Jurisdiction Seasonality & L=1.5
(Pittsburgh Tract 20100)