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Predictive Policing: What Can We Learn from Wal-Mart and Amazon about Fighting Crime in a Recession?

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In the current economic climate, police departments are being asked to do more with less. In some localities, significant budget reductions are requiring police managers and command staff to consider reductions in the retention of sworn personnel. Personnel costs represent the single largest budget line item in most public safety organizations. The ability to use this resource more efficiently has become absolutely essential to police managers under current budgetary restrictions. Now, new tools designed to increase the effective use of police resources could make every agency more efficient, regardless of the availability of resources.

As these new budgetary restraints and limitations are faced, the question to ask with more urgency is "Why just count crime when you can anticipate, prevent, and respond more effectively?" Predictive policing allows command staff and police managers to leverage advanced analytics in support of meaningful, information-based tactics, strategy, and policy decisions in the applied public safety environment. As the law enforcement community increasingly is asked to do more with less, predictive policing represents an opportunity to prevent crime and respond more effectively, while optimizing increasingly scarce or limited resources, including personnel.

Reporting, collecting, and compiling data are necessary but not sufficient to increase public safety. The public safety community relies heavily on reporting what has happened already. Annual crime reports, monthly summary reports, and year-to-date reports all focus on events in the past. Even alerts focus almost exclusively on incidents that occurred in the past, albeit with increasing speed and efficiency. The predictive-policing vision moves law enforcement from focusing on what happened to focusing on what will happen and how to effectively deploy resources in front of crime, thereby changing outcomes.

PREDICTIVE POLICING: THE NEXT ERA IN POLICING

The law enforcement community is noteworthy for its openness to innovation. As a direct result of this openness to change, four distinct eras have emerged in policing over the last 40 years.[1]

The professional era of policing began in the 1960s. The policing strategy was based largely on the three Rs: random patrol, rapid response, and reactive investigation. Unfortunately, the emphasis on response times and an associated reliance on technology resulted in a model that included faceless cops chasing radio calls, which markedly increased detachment from the community.

In response, the community-policing model emerged in the 1990s and continues to this day. Community policing was noteworthy for its emphasis on addressing the underlying conditions that enable and foster crime and for shifting some decision-making responsibilities to line officers. In a dramatic departure from the professional-policing era, community policing is outward facing. It emphasizes problem solving that includes the public as an active, involved partner. Its adherents put value on the three Ps: partnership, problem solving, and prevention, with the most important being prevention.

The arrival of intelligence-led policing (ILP)[2] can be traced to a single event: the 9/11 terrorist attacks on the United States. In the days after the attacks, it became readily apparent that the law enforcement community represented the front line and would play a significant role in the war on terrorism.[3] Homeland security increasingly has become hometown security. Policing changed profoundly with that event in ways that will continue to shape the profession for years.

ILP does not replace the community involvement and problem-solving approaches in the community-policing model; it extends them to include research-based approaches, information and communications technology, and increased information sharing and accountability. Moreover, ILP encourages the use of criminal intelligence in support of collaborative, multijurisdictional approaches to crime prevention; and it emphasizes the role of analysis in tactical and strategic planning. ILP also includes attention to privacy and civil liberties. As a policing approach, ILP deftly integrates the exploitation of technology embodied in the professional-policing era, and the emphasis on community involvement implicit in community policing.

The concept of comprehensive computer statistics (CompStat)[4] accountability meetings emerged from the emphasis on information-based decisions and accountability that formed the foundation of ILP.[5] Technology made it possible to quickly identify and focus on crime hot spots, enabling police practitioners to respond rapidly and to counter crime problems successfully. As this approach gained wider acceptance and use, the limiting factor in the effective execution of the concept was the information depth and related breadth of analysis. Information was not the problem. Public safety agencies collect an abundance of data every day. Rather, the ability to pull operationally relevant knowledge from the data collected represented the next challenge in the evolution of professional policing.

The predictive-policing model envisioned by the Los Angeles Police Department and Police Chief William J. Bratton builds on and enhances the promise of ILP.[6] With new technology, new business processes, and new algorithms, predictive policing is based on directed, information-based patrol; rapid response supported by fact-based prepositioning of assets; and proactive, intelligence-based tactics, strategy, and policy. The predictive-policing era promises measureable results, including crime reduction; more efficient police agencies; and modern, innovative policing. Predictive policing already has been shown to enable doing more with less, while significantly improving policing outcomes through information-based tactics, strategy, and policy.

ADVANCED ANALYTICS AS A TOOL FOR LAW ENFORCEMENT

The strategic foundation for predictive policing is clear enough. A smaller, more agile force can effectively counter larger numbers by leveraging intelligence, including the element of surprise. A force that uses intelligence to guide information-based operations can penetrate an adversary's decision cycle and change outcomes, even in the face of a larger opposing

force. This strategy underscores the idea that more is not necessarily better, a concept increasingly important today with growing budget pressures and limited resources.

Specific tactics and techniques to execute the predictive-policing model can be found in business analytics. E-commerce and marketing have learned to use advanced analytics in support of business intelligence methods designed to anticipate, predict, and effectively leverage emerging trends, patterns, and consumer behavior. Taking a cue from e-commerce and marketing, the professional law enforcement community began exploring innovative methods for the analysis of crime data.[7] These early experiments confirmed the hypothesis that the ability to anticipate or predict crime provides unique opportunities to prevent, deter, thwart, mitigate, and respond to crime more effectively, ultimately changing public safety outcomes and the associated quality of life for many communities. Embracing this promise of applied predictive analytics in the policing environment, the LAPD defined the predictive-policing vision as a system that allows policing professionals to effectively deploy resources in front of crime in support of fact-based approaches to prevention and response.

Predictive policing leverages advanced analytics to enable information-based approaches to law enforcement tactics, strategy, and policy, enhancing public safety and changing outcomes. Advanced analytics tools, techniques, and processes support meaningful exploitation of public safety data necessary to turn data into knowledge and guide information-based prevention, thwarting, mitigation, and response. These tools, techniques, and processes also give the public safety community the ability to identify and characterize trends, patterns, and relationships in data associated with illegal or otherwise threatening behavior—information that is essential to making information-based public safety decisions and policy and ultimately changing outcomes.

Many in law enforcement are familiar with the use of advanced analytics in support of fraud detection and identity theft prevention programs. Similar computational methods have been used to prevent and solve violent crimes, enhance investigative pace and efficacy, support information-based risk and threat assessment, and deploy police resources more efficiently.[8] Used effectively, predictive policing can change, has changed, and will change public safety outcomes.

The ability to anticipate or predict crime represents a paradigm shift in law enforcement. The opportunity to enter the decision cycle of our adversaries—drug dealers, gang members, terrorists—affords unique opportunities for prevention, thwarting, and information-based response, ideally preventing crime. At a minimum, being able to mount information-based responses in support of consequence management—measures designed to preserve public health and safety, restore essential services, provide emergency relief, and preserve order in response to a man-made or natural disaster—can significantly mitigate those incidents that do occur.

Advanced analytics includes the systematic review and analysis of data and information using automated methods. Through the use of exploratory graphics in combination with advanced statistics, machine learning tools, and artificial intelligence, critical pieces of information can be identified and extracted from large repositories of data. By probing data in this manner, it is possible to prove or disprove hypotheses while discovering new or previously unknown information. In particular, unique or valuable relationships, trends, patterns, sequences, and affinities in the data can be identified and used proactively to categorize or anticipate additional actions or information. Simply stated, advanced analytics includes the use and exploitation of mathematical techniques and processes that can be used to confirm things that we already know or think that we know, as well as discover new or previously unknown patterns, trends, and relationships in the data.

Advanced analytics are used in almost every segment of society to improve service and optimize resources. Some examples include customer loyalty programs that track purchases and provide specifically targeted coupons that are based on recent or related purchases and algorithms that create models of customer preferences and recommend products to similar customer groups. Similarly, agile supply chain management programs ensure the timely delivery of products and can anticipate changes in demand related to seasonal differences, recent purchases, or events likely to result in rapid changes in need or

consumption like hurricanes, large winter storms, or other significant events.

WHAT BIG RETAILERS ALREADY KNOW, POLICE LEADERS ARE LEARNING

Companies like Wal-Mart have long understood the importance of being able to anticipate or predict future demand. For example, in anticipation of a large weather event, Wal-Mart may shift its supply chain to send duct tape, bottled water, and Pop-Tarts to the affected area in advance of the storm. Products like duct tape and bottled water make intuitive sense based on what we know of emergency preparations and response. This represents the confirmation in predictive analysis, confirming what we already know or think that we know. The Pop-Tarts, on the other hand, may seem odd. After years of experience with large weather events, Wal-Mart has found increased sales of Pop-Tarts associated with large weather events —strawberry Pop-Tarts, to be accurate.[9] While speculation regarding the reasons for this observation may exist—Pop-Tarts can be eaten cold; they are tasty; kids like them—the important outcome in this situation is the ability to anticipate the increased demand and being able to adjust the supply chain accordingly to ensure that an adequate supply of strawberry Pop-Tarts is delivered to the stores in the affected area in advance of the storm when people are making their preparations. This is the discovery part of predictive analysis, which can be tremendously powerful in policing.

Risk-based deployment[10] supports the optimization of public safety resources and assets, including personnel. Like the just-in-time supply chain analytics used by Wal-Mart to ensure that there are enough Pop-Tarts on hand in advance of an approaching storm, risk-based deployment has been demonstrated to effectively address the main goals of police deployment: allocate police resources when and where they are needed to prevent or deter crime through a strong police presence and to ensure the ability to respond rapidly by proactively positioning resources when and where they are likely to be needed in order to ensure a timely response. Ultimately, the incorporation of meaningful, operationally relevant analysis into information-based police tactics, strategy, and policy has been shown to increase public safety and change outcomes.

Risk-based deployment was tested on New Year's Eve 2003 and found to markedly reduce random gunfire complaints associated with the holiday.[11] Using a risk-based deployment strategy, police identified locations and times expected to be associated with increased complaints of random gunfire and proactively deployed police resources to those locations to prevent or deter crime or respond more rapidly. The results demonstrated increased public safety associated with the predictive-policing strategy. Random gunfire complaints were decreased by 47 percent, highlighting the deterrent effect associated with information-based deployment, while the number of weapons recovered went up 246 percent, underscoring the rapid response possible with effective prepositioning of resources. In addition, these marked increases in public safety were associated with a reduction in police resources required, resulting in a $15,000 savings in personnel costs alone during the eight-hour initiative. The ability to anticipate the time, the location, and the nature of crime supports the police manager's ability to proactively allocate resources—preventing or deterring crime through targeted police presence and enabling rapid response by pre-positioning police assets when and where they are likely to be needed.

The online retailer Amazon has distinguished itself as an organization that has leveraged the complexity of its problem space. Patrons of this Web site are familiar with the phrase "Customers who bought this item also bought. . . ." This simple phrase demonstrates Amazon's ability not only to segment their customer population but also to extend from it in a meaningful way. The ability to understand the unique groups in their customer base and to characterize their purchasing patterns allows Amazon not only to anticipate but also to promote or otherwise shape future behavior. This type of market segmentation and associated prediction of likely future behavior can be used to prioritize and preferentially allocate resources.

SIMILAR METHODS HELPED MINE VIRGINIA DATABASE

These and similar methods were used to characterize DNA cold hits in Virginia several years ago.[12] Advanced analytics were used to characterize patterns and trends in large offender databases, leading to the finding that most DNA cold hits were associated with a prior nonviolent property crime—specifically, burglary.

Further analysis revealed that these burglaries differed from most in that they frequently were associated with occupied dwellings and little if any monetary gain. The results of this research were used to confirm the DNA collection criteria in Virginia and were used subsequently by other states creating inclusion criteria for convicted felon DNA databases.

These findings also were used to characterize risk and prioritize investigative resources locally. As the name implies, predictive policing affords unique opportunities to prevent, thwart, respond more effectively, and generally change outcomes.

Crime prevention is almost always the economical alternative. When considering the total cost of crime, the numbers include far more than the direct economic costs associated with the specific crime itself. In addition to the readily identifiable costs associated with investigative and prosecutorial resources and incarceration and court supervision, a number of additional, frequently unseen costs also must be considered when calculating the true cost of crime. These include the long-term cost of crime to the victims and their families, fear of crime, and the opportunity costs to communities struggling with crime. The Rand Corporation recently estimated the social cost of individual crimes, which includes both the direct and intangible costs, for an array of violent and property crimes.[13] Rand then used these figures to generate an annual cost of crime for a major city and a county that includes both rural and suburban areas. Rand's research suggests that the total, extended cost of crime in 2007 ranged from almost $150 million for Prince William County, Virginia, to just under $6.1 billion for the city of Los Angeles, California. These are staggering figures, particularly given the increasing budgetary shortfalls being addressed by most localities.

Police departments increasingly are experiencing severe budget cuts. Many organizations are being asked to consider reductions in sworn personnel and services. A recent report underscores this point, highlighting the measures that some police departments are considering to address budget deficits and required cutbacks, even among sworn personnel.[14] In an effort to address budget shortfalls and curb expenses, some localities have hired private security agencies to provide an array of services typically reserved for sworn personnel, and many other agencies are considering this option.

While outsourcing may or may not represent a viable solution, the emphasis that predictive policing puts on information-based prevention, targeted response, and resource allocation—sworn or otherwise—supports the ability to do more with less, without compromising public safety. Again, personnel resources represent law enforcement's single largest budget line item. Approaches that support the efficient allocation and effective use of resources, including personnel, are needed now more than ever before. The ability to allocate police resources more effectively using predictive-policing methods will enable law enforcement agencies to prevent crime and respond more rapidly, changing outcomes in communities.

Advanced analytics have been used to prevent violent crimes, increase investigative efficacy, support information-based deployment decisions, and enhance response planning and policy decisions.[15] The LAPD has assumed a leadership role in translating these successes into the next era of policing: predictive policing. By developing, refining, and successfully executing on the predictive-policing model, the LAPD is leveraging the promise of advanced analytics in the prevention of and response to crime.

One challenge that LAPD is beginning to see, however, is the desire to find a one-size-fits-all approach to predictive policing. LAPD experience suggests that different policing problems have different analytic solution requirements and constraints, a finding that is consistent with the literature on predictive analytics.[16] In law enforcement, there is no single approach, technology, or mathematical algorithm that will address accurately all aspects of the job requirements. In other words, there

are no perfect analytic solutions that will universally address the entire scope of policing. The one-size-fits-all approach simply will not work. Different law enforcement challenges will require different analytic strategies and solutions; there is no analytic panacea.

With this experience in mind, the LAPD is working to both develop and evaluate existing methods and processes to determine the best fit between specific policing problems and solutions. As part of the emphasis on accountability and outcome, the LAPD also is actively involved in the rigorous and uncompromising evaluation of the efficacy of each implementation of the predictive-policing model, a process that is essential to identifying and replicating specific applications that work and revising or discarding programs that do not.

CAN COPS ARREST PERPETRATORS BEFORE THEY COMMIT THE CRIME?

The 2002 movie *Minority Report*, may create the impression that "predictive" analytics will be used to target individuals inappropriately for future crimes, or bad acts that they may commit but have not. It is important to note that predictive policing, like any public safety resource or tool, must be used legally and ethically. The analytic methods used in the predictive-policing model do not identify specific individuals. Rather, they surface particular times and locations predicted to be associated with an increased likelihood for crime. Identifying and characterizing the nature of the anticipated incident or threat increase the ability to create information-based approaches to prevention, thwarting, resource allocation, response, training, and policy. These fact-based approaches promise to increase citizen and officer safety alike.

What next? Experts predict that the world will come out of the current recession, which started in 2008. The predictive-policing model is useful to policing during economic hard times, but it also makes good sense during times of plenty. Why just count crime when you can anticipate, prevent, and respond more effectively? As responsible stewards, law enforcement's goal should be to create and support safe neighborhoods through the responsible use of the resources available, regardless of the prevailing economic conditions.

This recession will end, but the predictive-policing model will continue to change public safety outcomes through information-based approaches to tactics, strategy, policy, and resource allocation, allowing us to effectively deploy resources in front of crime in order to do more with less and change outcomes. ■

Notes:

[1] Jerry H. Ratcliffe, *Intelligence-Led Policing* (Devon, U.K.: Willan Publishing, 2008).

[2] Ibid.

[3] William S. Lind, et al., "The Changing Face of War: Into the Fourth Generation," *Marine Corps Gazette* (October 1989): 22–26.

[4] William Bratton and Jack Maple developed and deployed CompStat, the internationally acclaimed computerized crime mapping system developed by the NYPD in 1993 and now used by police departments nationwide. By bringing all crime and arrest data together by category and by neighborhood, CompStat revolutionized policing, enabling officers to focus their efforts in problem areas, armed with real-time information, accurate intelligence, rapid deployment of resources, individual accountability, and relentless follow-up. For more information on CompStat, see H. Dean Crisp Jr. and R. J. Hines, "CompStat in a Midsize Agency: The CompStat Process in Columbia," *The Police Chief* 74 (February 2007): 46–48; John D. Wintersteen, "CompStat in a Smaller Agency: CompStat and Crime Prevention in Paradise Valley," *The Police Chief* 74 (February 2007): 52–56; and "CompStat: A Selected Bibliography," *The Police Chief* 74 (February 2007): 59–61.

[5] Bureau of Justice Assistance, "Intelligence-Led Policing," http://www.ojp.usdoj.gov/BJA/topics/ilp.html (accessed September 28, 2009).

[6] William J. Bratton and Sean W. Malinowski "Police Performance Management in Practice: Taking COMPSTAT to the Next Level," *Policing* 2, no. 3 (2008): 259–265.

[7]Colleen McCue, *Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis* (Burlington, Mass.: Butterworth-Heinemann, 2006).

[8]Colleen McCue and Andre Parker, "Connecting the Dots: Data Mining and Predictive Analytics in Law Enforcement and Intelligence Analysis," *The Police Chief* 70 (October 2003): 115–122.

[9]Kirk D. Borne, "Scientific Data Mining: Digging for Nuggets," seminar, Space Science Data Operations Office, July 5, 2006, http://74.125.93.132/search?q=cache:Anh6srZxtyEJ:classweb.gmu.edu/kborne/kborne-SSDOO-BBU-5july2006.ppt+Scientific+Data+Mining+for+Nuggets&cd=4&hl=en&ct=clnk&gl=us (accessed October 6, 2009).

[10]Colleen McCue, "Data Mining and Predictive Analytics in the Applied Public Safety and Security Setting," *IT Pro* 8, no. 4 (2006): 10–16.

[11]Colleen McCue, Andre Parker, Paul J. McNulty, and David McCoy, "Doing More with Less: Data Mining in Police Deployment Decisions," *Violent Crime Newsletter* (U.S. Department of Justice, Spring 2004): 4–5.

[12]Colleen McCue, et al., "Why DNA Databases Should Include All Felons," *The Police Chief* 68 (October 2001): 94–100.

[13]Paul Heaton, "Crime Costs and Public Policy" (Rand Corporation, Safety and Justice Program, 2009).

[14]Bobby White, "Cash-Strapped Cities Try Private Guards over Police," *Wall Street Journal*, April 21, 2009, A4, http://online.wsj.com/article/SB124027127337237011.html.

[15]Colleen McCue and Paul J. McNulty, "Guns, Drugs, and Violence: Breaking the Nexus with Data Mining," *Law and Order* 51 (2004): 34–36.

[16]The so-called No Free Lunch theorem postulates that there is no perfect, universal algorithm for all problems. Each problem requires a specific, matched solution. See Yu-Chi L. Ho and David L. Pepyne, "Simple Explanation of the No Free Lunch Theorem of Optimization," *Cybernetics and Systems Analysis* 38, no. 2 (March 2002): 292–298.

Top

Return to Article

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They argue that predictive policing perpetuates racial prejudice in a dangerous new way, by shrouding it in the legitimacy accorded by science. Crime prediction models rely on flawed statistics that reflect the inherent bias in the criminal justice system, they contendâ€”the same type of bias that makes black men more likely to get shot dead by the police than white men. Privacy is another key concern.Â One commonly used approach in predictive policing seeks to forecast where and when crime will happen; another focuses on who will commit crime or become a victim. Diagram: G. GrullÃ³n/ Science. Postdoctoral scholar George Mohler, now a mathematician at Indiana University-Purdue University, Indianapolis, suggested that borrowing models from seismology might be useful.