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From Description to Prediction: Crime Mapping

Nearly 70 percent of law enforcement agencies that employ 100 or more officers and 40 percent of agencies with 50 to 99 officers now perform mapping and analysis, according to preliminary findings of a Police Foundation study. "Some are just getting started with purchasing the hardware and software and they're preparing to climb what promises to be a very steep learning curve,"says Rachel Boba, director of the Police Foundation's Crime Mapping Laboratory.

"Most people aren't using mapping and analysis in novel ways—it's still that new," Boba says. "Some departments use [mapping] every month for their stats. But people have done that for a long time. Being inventive is trying to use mapping every day or every week, not limiting its use to putting out canned reports, a list of crimes, or a table showing your statistics." [The Police Foundation study, *COMPSTAT and Organizational Change: A National Assessment*, funded by the National Institute of Justice (NIJ), is scheduled to be released in late 2001.]

Spotting crime trends is part of the job, but so is finding more complex relationships, such as how crime and the environment affect each other, or the relationship between crime and a suspect's behavior, says Dan Helms, a crime analyst with the Las Vegas Metropolitan Police Department.

Helms might look at whether streetlights influence robbery locations. He can pull up data on locations, times, and victims of robberies (businesses and individuals), then correlate them with data on streetlight locations. (Was a streetlight close to the robbery location? Was it on or even working? Did nearby trees or buildings create deep shadows?) He can break down the robberies into areas that might be "naturally vulnerable," such as parks, or into geographic or demographic areas to see what the locations have in common.

"We can do the analysis on desktop in a matter of seconds," Helms says. "Without this technology it would take months or years, and you could never do it with just a map." He adds that information from this type of analysis links the police department and the city to make vulnerable areas safer.

In a case involving sexual attacks on juveniles, Helms says "dynamic movement maps" that showed the movements of suspects under surveillance were compared to the past movements of a serial offender. Helms says the serial offender struck only in neighborhoods with single-family homes. He always made two trips—the first to identify his victim; the second to commit the crime. He never picked houses on a corner, but chose houses that allowed for quick entry and exit.

When the maps of the suspects' movements were overlaid with the past movements of the serial offender, "it quickly became clear who the right one was," Helms says. This information, coupled with other evidence, enabled officers to clear the case.

"Our real goal is to intercept crime," Helms says. "We want to predict the next one. We did that in 1997 with a series of armed robberies. We started with a 150-square-mile area and 20,000 small businesses that matched our parameters. Through analysis and mapping the suspect's underlying movement pattern, we came up with three target locations. We were correct to within 1 hour of the robbery at the second location on our list."

But analysts such as Helms are taking crime analysis a step further by borrowing from other disciplines. He says the epidemiological model that the Centers for Disease Control and Prevention (CDC) uses to map the spread of a disease can be applied to the way criminal gangs are created and operate. Just as CDC tracks down the original carrier of a disease, law enforcement can trace the origins of a gang and identify and remove the "carriers."

Similarly, according to some crime analysts, models drawn from studying animal behavior may even help predict human behavior. Crime analysts are borrowing from game hunting and the study of predatory movement. (Does the animal pursue its prey or wait for the prey to come to it? What environmental factors determine how,

when, and why the animal hunts?) Analysts are applying information gathered from the U.S. Geological Survey, the Alaska Biological Research Center, and game parks in South Africa to the predatory behavior of criminals.

Where To Get Help

Whether for law enforcement or corrections, an important requirement for any crime mapping or crime analysis program is training. The NIJ Crime Mapping and Analysis Program (CMAP) provides free training in crime mapping and crime analysis. Courses are offered regularly at the National Law Enforcement and Corrections Technology Center (NLECTC)–Rocky Mountain in Denver, Colorado, and at NLECTC–Southeast in Charleston, South Carolina. To learn more about geographic information systems (GIS) or the CMAP training schedule, contact Sean Bair at NLECTC–Rocky Mountain, 800–416–8086.

NIJ's Crime Mapping Research Center (CMRC) supports the development of analytic mapping in criminal justice agencies. CMRC has developed training and software to make it easier for agencies that are interested in using spatial analysis to do so. CMRC has four training modules that are available on the website at www.ojp.usdoj.gov/cmrc/training/download.html. They are all PowerPoint presentations with extensive notes.

- "What Is Crime Mapping?" provides a general introduction to crime mapping and how it can be used in criminal justice agencies.
- "Mapping for Managers" informs police managers about the types of questions that can be answered using crime mapping.
- "Crime Mapping for Community Policing and Problem Solving"offers specific examples of how crime mapping can support problem solving efforts.
- "Integrating GIS Into a Law Enforcement Agency" explains how to implement a GIS. Special attention is paid to specific challenges of working within a law enforcement agency.

For new users of mapping technology who need to get a good overview but do not have a lot of time to invest, CMRC has two new publications. First, new users can get a comprehensive overview in plain language by reading *Mapping Crime Principle and Practice*, which can be downloaded at www.ojp.usdoj.gov/cmrc/pubs/welcome.html.

For more hands-on experience, the center has a hands-on tutorial available called CrimeMap. In order to meet the demand for more widely available crime mapping training, CMRC commissioned the development of CrimeMap Tutorial, a distance-learning tool developed by Professor Wil Gorr of Carnegie Mellon University. This tutorial enables students to learn crime mapping from their desktop or laptop computers at home or at work and is designed for self-paced instruction. The purpose of the tutorial is to provide police with the skills and knowledge to produce the day-to-day crime maps that have been proven to help reduce crime. It has three parts: 1) using a crime-mapping GIS, 2) geocoding police data, and 3) building area and pin maps. The tutorial has been tested at the 1999 Crime Mapping Research Center's Annual Conference and is available on the Internet at www.icpsr.umich.edu/NACJD/cmturorial.html.

One major barrier to using GIS is the lack of software that is specifically geared toward basic law enforcement tasks. The Community Policing Beat Book and the Crime Analysis Extension software packages were developed to address this need for easy-to-use software that automates routine crime analysis tasks.

- Community Policing Beat Book, developed under a cooperative agreement between NIJ and the Environmental Systems Research Institute (ESRI) using MapObjects, is designed for use by officers on laptops in their cars or at substations. Free download information is available at www.ojp.usdoj.gov/cmrc/tools/welcome.html.
- Crime Analysis Extension for ArcView is designed to provide easy-to-use tools for geographic crime analysis, data management, mapping, and reporting. The software was developed under a cooperative agreement between NIJ and the Environmental Systems Research Institute. Free download information is available at www.ojp.usdoj.gov/cmrc/tools/welcome. html.
- CrimeStat 1.0, a spatial statistics program for analyzing crime incident locations, was developed to serve the needs of advanced users who are interested in applying spatial statistics to criminal justice problems. The program provides supplemental statistical tools to aid law enforcement agencies and criminal justice researchers in their crime mapping efforts.

NIJ's Crime Mapping Research Center also holds an annual conference that offers an extensive array of workshops and presentations covering state-of-the-art techniques in spatial analysis for criminal justice. This year's conference will be held December 1–4 in Dallas, Texas, and will emphasize the translation of research into practice. For the first time, NLECTC–Rocky Mountain will be teaching a 2-day sequence on November 29 and 30 that will feature hands-on desktop mapping training in both ArcView and MapInfo. This is a great opportunity to get 6 days of training in one trip. For more information about the conference and the hands-on training, please check the CMRC website at www.ojp.usdoj.gov/cmrc/conferences/welcome.html.

Research Grants

CMRC uses GIS to support multijurisdictional data sharing projects—the Strategic Approaches to Community Safety Initiative (SACSI) and the Community, Mapping, Planning, and Analysis for Safety Strategies (COMPASS) initiative—that promote collaborative problem solving. NIJ has funded an array of five different predictive modeling grants to develop techniques that will allow police to become more proactive. In other words, the center is trying to move beyond "description" to "prediction."

One grant is testing the "broken windows" theory, which is based on the idea that if the first broken window (or other signs of disorder) in a building is not repaired, then people will assume that no one cares about the building and more vandalism will occur. Eventually, burglars and robbers will begin victimizing buildings and people in the area because they feel it is safe to do so since no one "cares" what happens. In other words, their chances of being confronted are very low so their probability of successfully completing their crimes is very high. This theory endorses the belief that crime results from lack of guardianship, as evidenced by signs of disorder (e.g., graffiti, broken windows, etc.). So the best way to reduce crime is to concentrate on "cleaning up" an area. The results of this grant to examine whether disorder breeds crime or crime breeds disorder are expected by the fall of 2001 and will be available on the NIJ website.

Another initiative examines the behavior of drug dealers in creating illegal drug markets to predict where drug markets tend to form and where they are likely to be displaced if police action is taken.

For more information about the Crime Mapping Research Center, call 202–514–3431 or e-mail cmrc@ojp.usdoj.gov. For a list of the publications CMRC offers, see the Center's website: www.ojp.usdoj.gov/cmrc/pubs/welcome.html.

The following websites provide additional resource information concerning crime mapping and crime analysis. Once logged on to each site's homepage, locate the "Search" function and type in "crime map(ping)" or "crime analysis" to generate a list of information resources that can be accessed.

- Bureau of Justice Assistance: www.ojp.usdoj.gov/bja
- Crime Mapping Research Center: www.ojp.usdoj.gov/cmrc
- National Law Enforcement and Corrections Technology Center system: www.nlectc.org
- National Institute of Justice: www.ojp.usdoj.gov/nij
- National Institute of Justice, Office of Science and Technology: www.ojp.usdoj.gov/nij/sciencetech/welcome.html
- Office of Community Oriented Policing Services: www.usdoj.gov/cops
- Office of Justice Programs: www.ojp.usdoj.gov
- Police Foundation: www.policefoundation.org

Getting Corrections on the Map

Managing data is a huge task, but so is giving that data meaning. Rather than dryly recounting statistics, agencies today use crime mapping and analysis tools to turn data into useful information.

Geographic information systems (GIS), which include crime mapping, global positioning systems, and automatic vehicle locator systems, make this conversion possible. GIS combines traditional database systems with graphics components, allowing administrators to see crime trends on a map and analyze that information in relation to other components such as time of day, area of the city, or proximity to other facilities.

GIS technology is not new to criminal justice. Police departments were creating crime maps as early as 1960, but the technology came into widespread use in the late 1990s. A recent example of the use of GIS in criminal justice is New York City's COMPSTAT program, created in 1994. Using GIS, COMPSTAT enables department executives and operations commanders to see criminal activity displayed on a map for instant analysis. This capability allows the department to identify and address crime patterns, trends, and hotspots as they emerge. Some credit COMPSTAT with playing a part in the decline in crime in New York City.

But GIS is not just a tool for police departments. Corrections and probation and parole agencies have begun to explore how GIS can assist them in daily operations in institutional and community settings.

Institutional Corrections

The use of GIS in institutional settings requires a floor plan of the facility. Once the facility layout is incorporated into the program, inmate demographics, gang affiliations, location of assaults, or attempted escapes can be incorporated and analyzed. Spatially displaying this data can lead to a better understanding of events and incidents within the facility. For example, GIS can help analyze inmate-on-inmate assaults so officials can prevent future assaults. GIS can show whether the assaults are occurring in the same general location, on the same shift, or where certain activities are in progress.

Community Corrections

Caseload Assignments: Administrators can create a map of where offenders live, then assign cases to probation or parole officer by neighborhood, so that officers need not travel across the city or county to visit offenders' homes. Many GIS software packages can also plan out the most efficient route an officer can take to conduct home visits. The officer becomes more familiar with the area, affording a greater opportunity to understand the offender's environment and to work more closely with local treatment providers and law enforcement agencies.

Resource Allocation and Planning: Agencies can use GIS to plan and allocate resources. If an agency plans to open a new reporting center, a map displaying the density of offender residences, with an overlay of the public transportation system, would be useful in determining its location.

Managing Sex Offenders: Maps can highlight locations within a specified distance of another location. Administrators can select and display all day care centers, schools, or parks within a 1,000-foot radius of a registered sex offender's residence. When a sex offender wants to move, GIS provides an easy way to determine the new address's proximity to child care facilities.

Getting Started With GIS

To implement a GIS program, an agency must acquire the necessary hardware, software, and base maps. The minimum hardware requirements include a 400 MHz computer containing at least 128 MB of RAM. A 21-inch monitor is recommended and a printer/plotter is required to generate charts and reports. Desktop GIS software is available for approximately $1,000 per license.

For community-based applications, GIS maps may be available free of charge through a city, State, or county engineering department. An institutional application requires the conversion of the facility floor plan or blueprint into data readable by the GIS software.

For more information on corrections and crime mapping, contact Joe Russo at the National Law Enforcement and Corrections Technology Center–Rocky Mountain, 800–416–8086 or e-mail, jrusso@du.edu.

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