



National Institute of Justice

R e s e a r c h i n A c t i o n

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Highlights

Computerized mapping has many crime prevention and control applications. Mapping software's unique ability to overlay disparate data sets makes it an excellent tool for identifying factors related to the multidimensional, multifaceted crime problem. On the basis of a literature review and telephone interviews, this Research in Action focuses on some organizations that use mapping technologies in crime control and prevention programs, assesses the overall utility of these technologies, and identifies some obstacles to increased use of mapping. Highlights of this discussion are as follows:

- For crime control and prevention, mapping software has two primary goals: to further an understanding of the nature and extent of criminal and social problems in a community, particularly the relationship between criminal activity and possible contributing factors, and to improve the allocation of resources to combat these problems.
- Mapping efforts for crime prevention and control rely on police department data, particularly call-for-service and incident data. Community groups and multiagency task forces also use geographic and demographic data from the Census Bureau, other State and local government agencies, or commercial vendors.

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The Use of Computerized Mapping in Crime Control and Prevention Programs

by Thomas F. Rich

Although computers have been used to display and manipulate maps since the 1960's, widespread use of mapping software is a relatively new phenomenon due, in large part, to the availability of inexpensive yet sophisticated PC-based mapping software packages.

The National Institute of Justice (NIJ) has long shown an interest in mapping. In 1986, NIJ funded a study in Chicago to implement and assess the impact of a map-based crime analysis system.¹ In 1989, NIJ's Drug Market Analysis Program (DMAP) funded five teams of police departments and researchers to assess whether mapping tools could be used to assist police department efforts

to combat street-level drug sales. More recently, NIJ has funded the Institute for Law and Justice (ILJ) to synthesize the results of the DMAP program and to illustrate how mapping software is used in police departments.²

This Research in Action offers an overview of current uses of mapping technologies based on a literature review and interviews (see "Methodology"). It first discusses the general application of mapping software to crime prevention and control and then discusses specific applications by police departments, community organizations, multiagency task forces, and other types of government agencies.



Methodology

This Research in Action is based on a limited literature review and telephone interviews with approximately 30 individuals from Federal, State, and local government agencies, universities, private firms, and nonprofit organizations. Sources for the literature search include the National Criminal Justice Reference Service and the mapping-related periodicals *GIS World* and *GeoInfo Systems*. Because most relevant published articles concern only one particular use of mapping software—map-based

crime analysis in police departments—most of the information collected for this Research in Action was obtained via telephone interviews. The individuals interviewed were selected based on word-of-mouth recommendations rather than through a systematic sampling of large police departments, community groups, and other organizations involved in crime control and prevention. Initially, recommendations were sought from NIJ officials and persons involved in NIJ-funded mapping-related efforts.

Highlights

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- Mapping software is most widely used for crime analysis in medium and large police departments where computerized, “geocoded” data are a byproduct of routine, day-to-day work.
- Examples of mapping software applications in police departments include Chicago patrol officers’ ability to produce their own maps (based on incident type or date range) and dispatchers’ ability to locate calls for service and the nearest patrol cars and other response units.
- Examples of applications of mapping by community organizations include mapping data on street-specific problems (Hartford) and abandoned houses and bars (Chicago).
- Multiagency task force applications of mapping include the Denver PACT program’s goal to map crime and delinquency risk factors as well as efforts in Savannah, Georgia, to map factors contributing to the city’s crime problem.
- The main obstacles to mapping software use in crime control and prevention relate to hardware and software costs, user expertise, data acquisition costs, and data quality. Lower costs, increased data availability, improved data quality, and growing user sophistication are expected to lower these obstacles.

Target audience: Policymakers, police officers, community leaders, and State and local government agencies.

Mapping and crime control and prevention

Mapping software has many crime control and prevention applications. In addition to the location of a crime, geographic data that can be helpful in crime control and in efforts to apprehend a perpetrator include the perpetrator’s last known address, the location of the person who reported the crime, the location of the recovered stolen property, and the locations of persons known or contacted by the perpetrator. Geographic information valuable in planning, conducting, and evaluating crime prevention programs includes the locations of crimes committed during the past month; the locations of abandoned houses, stripped cars, and other “broken windows” conditions in a neighborhood; and the locations where persons who could benefit from crime prevention and other social programs actually live.

Some industry experts believe that mapping software will soon join word processors, spreadsheets, and data base software as one of the mainstream business applications. Recent announcements that Microsoft, Lotus, and Novell will incorporate mapping modules in future releases of their integrated business software packages lend credibility to predictions that desktop mapping software sales will grow from \$60 million in 1993 to \$500 million by 1999.³

Perhaps the most important feature of mapping software is its ability to “join” or overlay disparate data sets. A map showing a multidimensional view of crime and potential contributing factors often requires the involvement of a number of different agencies. For example, one “layer” of a map display could represent a descriptive variable, such as the locations of crimes in the past month, while another layer could represent a

possible explanatory variable, such as the unemployment rates of persons living on each city block, the locations of abandoned houses, or citizen reports of drug activity. These disparate data sets are often maintained or collected by different organizations—for example, the local police department and a neighborhood crime prevention group.

Complementing the mapping software packages is a wide range of commercially available data. Computerized street maps, as well as city block, census tract, ZIP code, and other “boundary” maps, are available from the Census Bureau and from geographic data vendors. Data vendors also offer city block-level demographic, housing, employment, income, and other data useful to agencies involved in crime control and prevention efforts. Crime risk data bases, designed to merge a variety of crime, demographic, and social data to compute an overall risk measure for any location in the country, are also commercially available. Additional data bases not specifically created for mapping software packages can be “imported” into mapping packages. In fact, it is estimated that 85 percent of all data bases contain a geographic or locational component.⁴

The organizations involved in crime control and prevention efforts using maps and mapping software include police departments, community organizations, and multiagency task forces.

Police departments

The potential for institutionalized use of mapping software is far greater in police departments than in other organizations involved in crime control and prevention activities because *computerized “geocoded” data are the byproduct of routine, day-to-day police department work*. Computer-aided dispatch (CAD)

and records management systems that store and maintain call-for-service, incident, arrest, and other potentially mappable data are now common in most medium and large police departments. Geocoding, a standard feature of CAD and records management systems, verifies addresses and associates other geographic information with addresses, including police reporting areas, beats, districts, and in more sophisticated systems, geographic coordinates (e.g., latitude and longitude).

Although a comprehensive survey has not been conducted on the extent of mapping software use in police departments, the International Association of Chiefs of Police (IACP) recently conducted an informal poll of the 280 police departments in its Law Enforcement Management Information Section. Thirty percent of respondents indicated that they have used mapping software. The IACP believes that this is an honest number—one that reflects the percentage of departments using mapping software on a regular basis in contrast to departments that have purchased mapping software but are not regular users.⁵ It should be noted that the police departments in the IACP's Law Enforcement Management Information Section are among the more active users of computer technology; thus, a similar survey of a random sample of all police departments in the country would likely indicate a lower percentage of departments using mapping software.

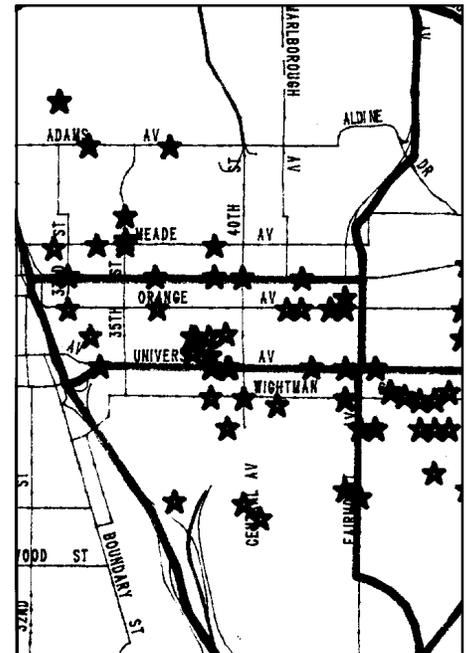
Within police departments, mapping software producers and users fall into three main categories: planners and researchers, patrol officers, and dispatchers.

Planners and researchers. The most common use of mapping software in police departments is in the area of

crime analysis. Police department crime analysts have long used paper "pin-maps" to indicate criminal activity in an area. Mapping software is a natural extension of the paper pin-map that offers far greater flexibility and analytical capabilities. Crime analysts use mapping software to prepare crime alert bulletins and other reports used by police commanders in planning operations (e.g., helping to select locations for short-term intensive patrol operations or to reconfigure patrol sectors) and by patrol officers in obtaining quick visual overviews of current crime conditions in their patrol areas.

The degree of institutionalization of map-based crime analysis varies widely. Some larger police departments (e.g., San Diego, Los Angeles, and Dallas) routinely use mapping software in their crime analysis units. Typically, this high degree of institutionalization requires tight integration between the mapping software and the department's CAD system to electronically transmit mappable data from the CAD system to the mapping system. A "lower tech" solution often involves double entry of data—first into the CAD system and then into the mapping system. For example, the lead crime analyst in the Vacaville, California, Police Department requires 3 hours each morning to produce daily crime alert bulletins provided to police officers at roll call. The analyst manually scans a printout listing the calls for service received during the previous 24 hours from the department's CAD system, manually enters facts about selected calls for service into a data base package, and uses a mapping software package to produce the crime alert maps. The total cost of the mapping system (including a PC and printer) was just \$3,300, illustrating that map-based crime analysis can be initiated with limited funds.⁶

Exhibit 1: DMAP Map of San Diego

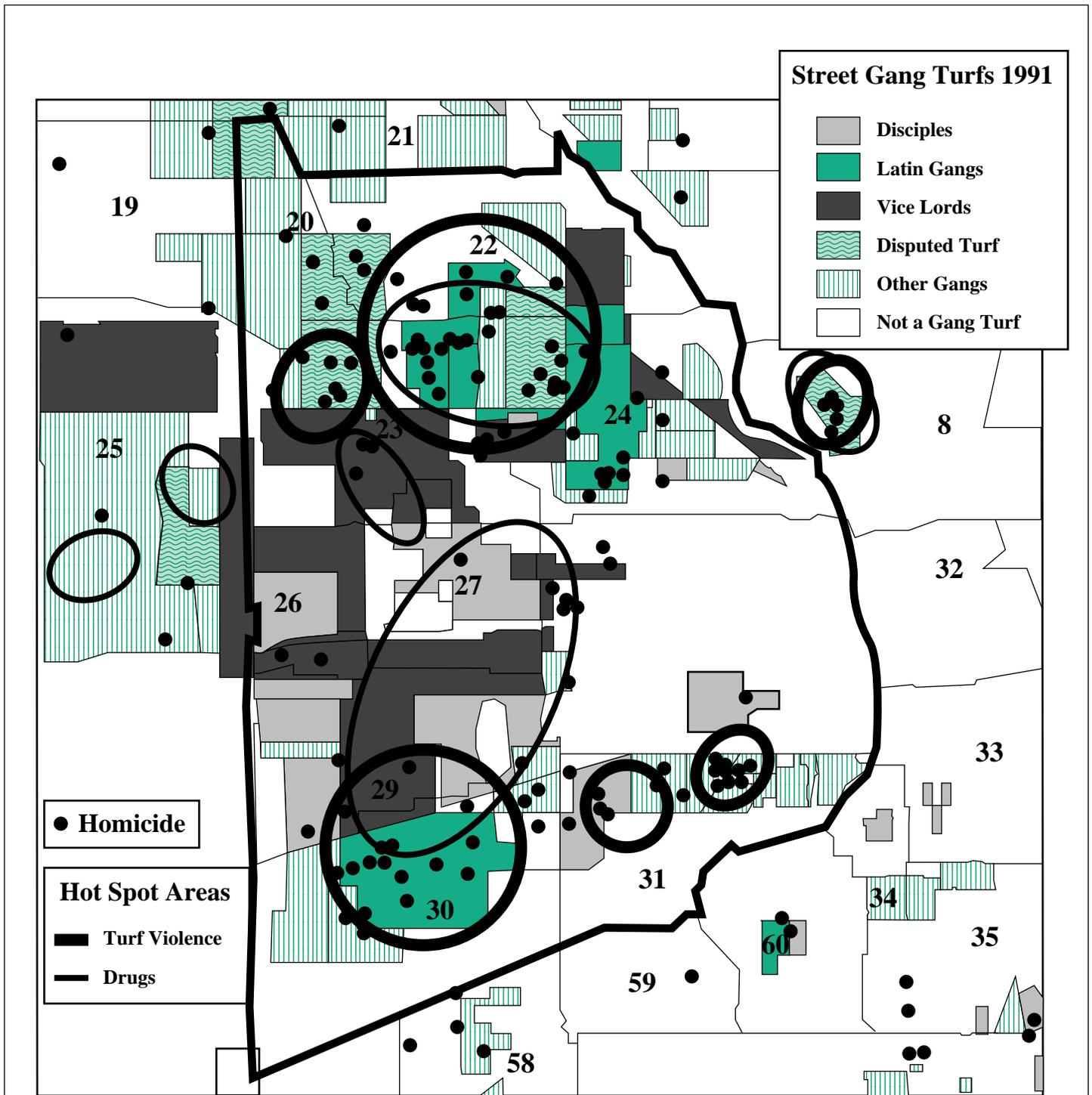


A section of a San Diego Police Department Crime Analysis Unit DMAP showing narcotic arrests for December 1991. (each ★ indicates a location where a narcotic arrest occurred.)

Researchers have also teamed with police departments and used mapping software to better understand crime patterns. The NIJ-funded Drug Market Analysis Program is probably the best known effort in this area. Under DMAP, five sites have developed sophisticated computerized drug information and mapping systems that assist police department efforts to combat street-level drug trafficking (see exhibit 1).

With assistance from the Bureau of Justice Statistics (BJS), researchers at the Illinois Criminal Justice Information Authority (ICJIA) have developed a software package called Spatial and Temporal Analysis of Crime (STAC), which locates clusters of criminal activity. (STAC is not actually a mapping package but, rather, is used in conjunction with mapping packages. To display

Exhibit 2. Street Gang-Motivated Homicide, Other Violence, and Drug Crime, 1987–1990



Source: Chicago Police Department

the clusters on a map, the results of STAC analyses must be imported into a mapping package.) Currently, 115 organizations, including 69 police departments, use STAC, which is provided at no charge to law enforcement organizations with some inhouse expertise in computers and mapping software.⁷ An application of STAC was the subject of a recent NIJ Research in Brief⁸ concerning gang violence in Chicago (see exhibit 2).

From this effort, which was also notable for its use of an extensive data base of law enforcement and community data,⁹ the ICJIA developed a handbook on the use of geographic information in crime analysis.¹⁰ The handbook describes the various data that could be included in a geographic data base, or GeoArchive, such as police data (incidents, arrests, offender data, victim data, calls for service, street gang territories, recovery of property data, and criminal justice jurisdiction boundaries); other criminal justice agency data (addresses of persons released on probation or from corrections facilities); street and other landmark data (locations of liquor stores and taverns, public transportation, schools, community organizations, city parks, fire departments, police stations, and public housing); community-derived data (nuisance addresses and citizen survey results); population data; and public health data. The ICJIA suggests that this law enforcement and community data base could become “an information foundation for community policing.”

Patrol officers. Within the Chicago Police Department (CPD), the Information Collection for Automated Mapping (ICAM) program has enabled patrol officers to become producers of maps rather than simply users of map-

based information produced by crime analysts.

ICAM was developed by CPD officers to display current crime and community conditions. What distinguishes ICAM from the other crime analysis-related mapping applications discussed above is that ICAM is a “walk up and use” application designed for patrol officer use—it does not require considerable user expertise.¹¹ ICAM does not demand use of a keyboard; to produce a map of crime activity, officers use a mouse to select an incident type, a beat or district name, a location type, and a date range. With two mouse clicks, officers can also obtain a list of the top 10 crime problems within a specific beat. Thus, the police officer obtains the information he or she *desires* rather than the information a crime analyst *thinks* the officer wants.

Two months of incident data are currently stored in the ICAM system. New incident data are immediately available in ICAM because the data are electronically transmitted to ICAM after they have been entered into the CPD’s main records system. Locations of abandoned buildings, liquor establishments, and other businesses are also downloaded from the city’s mainframe to ICAM. Plans call for additional data from other agencies to be available in ICAM after a citywide fiber-optic network has been implemented.

The scope of this effort is also a distinguishing feature. As of January 5, 1995, ICAM had been installed in 12 of CPD’s 25 district stations.¹² ICAM will be installed in all 25 stations and, in addition, the CPD hopes to have ICAM installed on laptop computers in 3,000 patrol cars by the end of 1995.

The CPD is also exploring the possibility of making ICAM accessible at information kiosks in public areas. Funding for the necessary equipment has been provided by a million-dollar grant from the Illinois Motor Vehicle Theft Prevention Council, an agency created to help curb auto theft within the State, which thus recognizes the benefits mapping software could bring. A periodic CPD publication, *ICAM News*, details specific instances in which ICAM has been used successfully.

ICAM is an important component of the Chicago Alternative Police Strategy (CAPS), CPD’s community policing program. As Mayor Daley stated when ICAM was unveiled at a district station: “[T]he only way community policing can work is for police officers and citizens to have all the facts.”¹³ Indeed, community policing’s approach calls for creative problem solving by police officers, which in turn requires innovative approaches to providing and analyzing information, such as ICAM.

Dispatchers. Community policing emphasizes a proactive approach to crime control and prevention, whereas the more traditional role of police departments emphasizes providing rapid response to calls for service. In this context, mapping software can provide police dispatchers with two key types of information:

- **The location of a call for service.** The ability to display on a map the location of a call for service is becoming a standard requirement in new CAD system installations. Such maps help the dispatcher verify the caller location and provide additional directional and status information (e.g., closed roads) to response units.

● **The current locations of patrol cars and other response units.** The decreasing cost of global positioning system (GPS) receivers has heightened interest in automated vehicle location systems. GPS receivers mounted on patrol cars transmit real-time location information to a police dispatch center, where a map display can show unit locations. This information enables dispatchers to select the nearest response units more easily, thereby reducing response times to calls for service. In addition, and perhaps more important, dispatchers can more accurately estimate response times and thus appropriately condition callers' expectations.

Community organizations

Community involvement in crime control and prevention efforts is a central tenet of community policing. The National Crime Prevention Council calls partnerships between law enforcement and community groups "among the most promising assets in the ongoing struggle against violence and other crimes."¹⁴

Three community organizations that have used or are using mapping software are discussed below. Brief descriptions of these efforts illustrate both the utility of mapping software and the special obstacles facing these groups.¹⁵

Neighborhood problem solving in Hartford.¹⁶ Hartford Areas Rally Together (HART) is one of the most well-organized community organizations in Hartford, Connecticut. In 1992, HART formed the Frog Hollow Revitalization Committee to develop strategies for combating increased violence in the city's Frog Hollow area, where HART is based. The committee recognized the need to better understand the neighborhood's crime, infrastructure, and social problems. To support this need, HART purchased mapping software and related hardware in 1994 with the help of a State grant. HART hired an intern to learn the mapping software.

At the same time, the Hartford Police Department (HPD) initiated an effort to involve Hartford neighborhoods in

crime prevention and neighborhood revitalization. Central to this effort is the HPD's recognition that neighborhood-based problem solving offers "the best opportunity to provide actual improvements while at the same time encouraging and actively involving the residents, businesses, and institutions that serve and occupy these neighborhoods." As part of this program, the HPD is implementing a Neighborhood Problem-Solving and Analysis System.

Currently, the system is being pilot tested with HART, and plans have been developed to involve organizations in the city's other 16 neighborhoods within the next 12 months.

HART is augmenting data provided by the HPD and other city agencies with data on street-specific problems obtained from affiliated neighborhood block-watch groups. HART plans to use the data and the maps for four primary purposes:

- Better understand neighborhood conditions and problems.

Neighborhood Problem-Solving and Analysis System

In Hartford, Connecticut, community organizations are working with city agencies, including the Hartford Police Department (HPD), to use mapping software to help resolve community issues. System features include the following:

- Key neighborhood organizations are to receive a personal computer, printer, modem, basic office automation software, and mapping software.
- The HPD is to develop and provide at no cost to neighborhood organizations a custom map-based application that auto-

mates the pertinent map display and reporting functions. The custom application is to be designed to insulate users from features of the base mapping software that are not relevant to their tasks.

- The city's assessment department is to provide neighborhood organizations with computerized street maps, property-specific data, and city demographic data.
- The following agencies are to provide data to neighborhood organizations on a weekly, biweekly, or monthly schedule:

police department (crime data, call-for-service data, and neighborhood complaint data), fire department (arson reports, fire inspection reports), licensing and inspections department (building inspection reports, enforcement actions), and finance department (tax delinquency reports). The data are to be provided electronically to neighborhood organizations in a format that organizations can easily use to display event-related locations on a map.

- Facilitate discussions with landlords and other property owners.
- Facilitate discussions with city agencies.
- Assess changes in neighborhood conditions.

Chicago Alliance for Neighborhood Safety.¹⁷ The Chicago Alliance for Neighborhood Safety (CANS) is a consortium of community organizations. In the mid-1980's, CANS recognized the need to better understand neighborhood crime problems and began requesting crime data from the Chicago Police Department. This eventually led to an NIJ-funded effort involving CANS and the CPD. The goal of this effort was to determine whether mapping technologies jointly implemented by the CPD and CANS could enhance the effectiveness of police and community group crime control efforts. At the time, CANS had some experience with mapping software and the CPD did not, so it was decided that CANS would produce maps depicting criminal activity based on data provided by the CPD.

The researchers' pre-project vision on how the maps would be used offers a general model for police–community group interaction:

The icons on the map that represent crimes were to be 'surrounded' by icons that represent incivilities. The incivilities were to be contributed by the community, the crime data by the police. The information was to be shared in working sessions which were to be held on a regular basis, during which time the police and community crime

analysts would search for patterns in the data, the police contributing their general knowledge about offender behavior and the community contributing their specific knowledge about community conditions. This joint effort would create a context of community–police dialogue in which crime and crime-related community concerns would be better understood and handled.¹⁸

Although regular meetings between the CPD and the community groups did not take place, they did meet on several occasions to address specific community concerns. In these instances, the maps "were not only a more graphic way of communicating, they were a more powerful tool because the maps made [the community group's] concerns more tangible and concrete to the police and were a more professional and polished means of transmitting their concerns." A leader of CANS felt that the project was important in terms of getting the CPD to acknowledge the importance of working with community organizations.

In the end, although the project demonstrated the feasibility and utility of mapping software in this context, the project failed to institutionalize the use of mapping software, in large part owing to a lack of funding and the time-consuming and labor-intensive data processing activities required to produce the maps.

Since the project concluded, CANS has continued to receive monthly incident data from the CPD and has occasionally obtained data on locations of liquor establishments, abandoned buildings, and building code violations from the city.

The department's use of mapping software has been difficult to sustain, but these data have been used to create maps in support of efforts to address specific crime problems. Because of limited funding, CANS has had to rely on VISTA and AmeriCorps volunteers to use the organization's mapping software. When the volunteers leave, the mapping capability of CANS, in effect, also leaves. Perhaps more important, CANS must continuously assess the value of mapping in relationship to other community organization initiatives—that is, "do we want community leaders studying maps or knocking on doors?" In general, however, CANS recognizes mapping as "useful" and a tool with "great potential" for community groups.

Loyola Community Safety Project.¹⁹ Two umbrella community organizations in the Loyola section of Chicago have used computer-generated maps for nearly 2 years to pinpoint high-crime areas in their community and to target specific locations for crime prevention activities. In contrast to HART and CANS, which have developed an inhouse capability to use mapping software and produce maps, the Loyola community organizations rely on researchers at Loyola University for mapping expertise and periodically submit requests for specific types of maps. To produce the maps, the researchers use incident data provided by the Chicago Police Department and data bases provided by other Chicago agencies that contain the locations of important landmarks, such as institutions, abandoned houses, and bars. The maps typically depict current crime conditions, particularly crime density near locations such as bars and rapid transit stations.

Multiagency task forces

The third major user of mapping software appears to be multiagency task forces charged with planning and coordinating crime control and prevention programs involving many agencies and organizations. This section discusses two such efforts.

Denver PACT program.²⁰ Project PACT (Pulling America's Communities Together) is designed to assist communities in developing comprehensive and interdisciplinary approaches to violence; it is based on the premise that "only broad, holistic, and multidisciplinary solutions hold real promise for success." To date, four sites have been funded: metropolitan Denver, the State of Nebraska, metropolitan Atlanta, and the District of Columbia.

Mapping technologies play an integral role in Denver, the only PACT site using mapping. The program's goal is to map crime and delinquency risk factors, preferably at the block level, and then use these maps to identify high-risk neighborhoods and populations. Once these areas are identified, crime prevention funds, social service funds, and other funds can be more appropriately allocated.

Working from a list of crime and delinquency risk factors, the Denver PACT Committee will prioritize its data collection efforts.²¹ Initially, data collection efforts are expected to focus on health-related risk factors, especially the geographic distribution of low-birth-weight babies and sexually transmitted diseases. In general, data will be collected on the risk factors for which data are accessible, are disaggregated at a small geographic level, and for which there is a reasonable chance that an impact can be shown in the next 2 to 3 years. Project planners recognize that

the data collection efforts will be significant research projects in and of themselves.

Denver's mapping efforts are just beginning as the city is in the process of hiring individuals with mapping expertise. Within the next 6 months, mapping coordinators hope to provide direction for the PACT program.

Savannah Crime Control Collaborative.²² To address the violent crime problem in Savannah, Georgia, the city commissioned a comprehensive assessment of the problem. A major task in this assessment was a map-based analysis of criminal activity, particularly Part I crimes, public disorder, and other disturbances. Map overlays depicted neighborhood blight and deterioration data (e.g., substandard housing, vacant housing, and unmaintained private property) and social and demographic data (e.g., teenage pregnancy, child abuse, juvenile unrest, and per capita income). Although maps of Part I crimes had been prepared weekly, an analysis of the relationships between crime and other problems had not been previously attempted.

In all, 29 different factors were assessed. The Savannah Police Department (SPD) coordinated this monumental data collection effort, drawing on data sets maintained by the County's Health Department, Family and Children's Services Department, and other social service agencies. A series of more than 50 maps documenting the violent crime problem and possible contributing factors were prepared. The study "found a marked association between Savannah's crime and violence and conditions of substandard and dilapidated housing, fires, unmaintained

properties, derelict vehicles, sewerage and drainage problems, unemployment, female-headed households, child abuse, child neglect, teenage pregnancy, drug abuse and juvenile delinquent residence."

As a result of this mapping effort and other analyses, the city identified and has initiated a number of strategies aimed at reducing conditions correlated with high crime rates, including the establishment of a multiagency Crime Control Collaborative (CCC). The maps have also been used as the basis for selecting a target area for the city's Weed and Seed project, supported by Office of Justice Programs agencies. In conjunction with this project and in recognition of the value that mapping has added to the initial assessment, the CCC and SPD are planning to repeat the map-based analysis in 1995.

Other uses of maps and mapping software

Numerous other types of agencies either directly or indirectly involved in crime prevention and control have used mapping software for different purposes.

Targeting Federal housing funds. In October 1994, the U.S. Department of Housing and Urban Development (HUD) made a major investment in mapping software to improve its ability to manage the distribution of Federal funds.²³ HUD's Office of Community Planning and Development purchased mapping software for 1,000 city and county offices. Custom software applications enable community planners to view maps of communities color-coded by unemployment rates and income. The maps can also show locations of existing and proposed government programs, including housing rehabilitation

and job training centers. This visual depiction should help better identify areas in greatest need of HUD funds.

Monitoring probationers. A pilot test with the Cuyahoga County, Ohio, Probation Department showed that mapping software has served a number of purposes.²⁴ Since probationers have tended to change addresses frequently, the mapping system’s address verification function has helped probation officers maintain contact with their clients. A map displaying probationer addresses with overlays showing the locations of potential risk areas (e.g., schools, high-crime areas) and service providers (e.g., employment training and drug treatment facilities) also has been helpful. Finally, supervisors have used the mapping package to manage probation officers’ workloads by producing maps showing the locations of each probation officer’s clients, color-coded by the required level of supervision (i.e., minimum, regular, or intensive). Although the Cuyahoga pilot test demonstrated the usefulness of mapping software in probation departments, “little or no work” has been carried out in this area in other parts of the country.²⁵

It is not known whether attempts have been made to continuously monitor the location of probationers using, for example, a global positioning system receiver. The cost of the receivers, although decreasing, is certainly a factor. Electronic ankle bracelets have been used to monitor probationers; typically, these devices trigger a telephone call to the probation officer when the probationer moves more than a specified distance from a location. Such devices could, in theory, also be used to detect violations of restraining orders or other special conditions of

probation or parole (e.g., a person must keep a certain distance away from schools or child care facilities).

Mapping crime in public housing. NIJ recently funded an effort to implement and assess crime prevention programs in six Jersey City public housing buildings.²⁶ As part of this effort, project personnel will use mapping software to track criminal activity in the city’s public housing. The effort is attempting to extend the use of mapping software by depicting the geographic relationship of crime in multilevel buildings.

Tracking missing children. The National Center for Missing and Exploited Children in Washington, D.C., uses mapping software to track information on missing children.²⁷ The center maps the roughly 600 calls it receives each day to detect data patterns and to facilitate communication with law enforcement agencies.

Obstacles to increased use of mapping software

The main obstacles to increased use of mapping software are related to hardware and software costs, user expertise, data acquisition costs, and data quality.

Hardware and software costs. The cost of hardware and mapping software starts at just a few thousand dollars. Still, the cost of a minimum configuration—a PC, monitor, printer, and desktop mapping software—can be prohibitive to small organizations, particularly community crime prevention organizations that must continuously weigh the costs and benefits of mapping against other crime prevention activities.

Expertise. Mapping software packages on the market today are much more complicated and harder to learn than a

word processor or spreadsheet, and special training courses are often required to use the products effectively. This requirement is also a serious obstacle for community groups and, to a lesser extent, for medium and small police departments. These organizations usually depend on one or two persons who are familiar with mapping; when these persons leave or, in the case of police departments, are transferred to another area, the organization also loses its mapping capability. One approach to overcoming this obstacle is to develop a “custom” mapping application, thereby eliminating the need for users to interact with a general purpose mapping software package.

Data acquisition costs. The cost of acquiring data for map-based analyses can be significant, depending on the organization doing the analyses, the organization (if any) that has the required data, and the form the data are in. Geographic data (e.g., street maps, block maps, census tract maps) and demographic data are often available from city or State agencies, or if necessary, can be obtained at a higher cost from the Census Bureau or commercial data vendors. For crime data, organizations obviously depend on police agencies; this is not an obstacle for a multiagency task force, but it could be a serious obstacle for a community organization. “Community conditions” data (e.g., locations of abandoned houses), if available, are likely to be outdated; organizations may have to undertake special data collection efforts.

Another component of data acquisition costs is the expense of moving data from one system or organization to another system accessible by the data user. Obviously, data available

in nonelectronic form implies data entry costs. Even within a police department, the costs of moving data electronically from a computer-aided dispatch system to a PC-based mapping system may be significant. As noted above, an advantage for police departments is that mappable data are a byproduct of routine day-to-day work; for other organizations, special data collection efforts are often required to do map-based analyses.

Data quality. Ensuring data quality is perhaps the most serious obstacle. If the data are not complete, accurate, or timely, the analyses will be less valuable or the mapping system may not be used at all. The issue of data timeliness is particularly important for operational (as opposed to strategic) decisionmaking—for example, 6-month-old crime data are of little value to a patrol officer compared with data from the previous week. Two other issues related to data accuracy are also particularly relevant to mapping. The first concerns whether the location information in a data base is actually the location information of interest to the user. Sometimes an address associated with an organization is a billing or administrative office address rather than the location where services are provided. And second, often addresses stored in data bases are, at least initially, not mappable—either the address is misspelled, the address is in a different form from the addresses in the underlying street map (e.g., 100 Main St. East versus 100 East Main St.), or the underlying street map is incomplete or inaccurate. In fact, organizations typically must undertake a one-time, and often lengthy, effort to edit the data associated with street maps.

Finally, an additional obstacle related to certain mapping software applica-

tions is the difficulty involved in showing three-dimensional spaces. Mapping crime data for multistory buildings (e.g., certain public housing buildings or office buildings) on a two-dimensional street grid obviously provides little visual information about the part of the building in which the crimes are occurring.

Conclusion

These obstacles will not, however, prevent the rapid growth in use of mapping software. A combination of forces—decreasing costs of personal computers, decreasing costs and increasing sophistication of mapping software, increasing availability of geographic and demographic data, and the need to improve performance while controlling costs—point to increased use of mapping software. Individuals interviewed have noted that computerized mapping is a valuable tool whose potential is just beginning to be tapped. Mapping software can help users maximize use of funds by indicating where resources can best be used.

Notes

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4. MapInfo Corporation. *Think Visually: Products and Services*. Troy, New York, 1994.
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8. Block, Carolyn Rebecca and Block, Richard. *Street Gang Crime in Chicago*. *NIJ Research in Brief*. NCJ 144782. Washington, DC: December 1993.
9. Green, Lynn A. and Whitaker, Robert Bennet. *Early Warning System Geoarchive Codebook*. Chicago: Illinois Criminal Justice Information Authority, October 1994.

10. Block, Carolyn Rebecca and Green, Lynn A. *The Geoarchive Handbook: A Guide for Developing a Geographic Database as an Information Foundation for Community Policing*. Chicago: Illinois Criminal Justice Information Authority, August 1994.

11. The San Diego Police Department also has a “walk up and use” map-based crime analysis tool. While this tool is currently accessible only to the Department’s crime analysis unit, the Department plans to make it available in the future to personnel at the Department’s seven area command stations [telephone interview with Julie Wartell, Crime Analyst, San Diego Police Department].

12. Telephone interview with Officer Jonathan Lewin, Research and Development Division, Chicago Police Department.

13. Spielman, Fran. High-Tech Tools Beef Up Beat Patrols. *Chicago Sun-Times*. November 30, 1994.

14. National Crime Prevention Council. *Bureau of Justice Assistance Bulletin: Working as Partners With Community Groups*. NCJ 148458. Washington, DC: September 1994.

15. As is the case with police use of mapping software, no survey documenting the extent of mapping software use in community crime prevention groups has been undertaken. In all likelihood, however, use is quite limited.

16. This section is based on Hartford Police Department. *Neighborhood Problem Solving Support System*. Hartford (CT), 1994 and telephone inter-

views with Captain James Donnelly, Hartford Police Department, and Reina Koistinen, HART.

17. This section is based on a telephone interview with Warren Friedman, Chicago Alliance for Neighborhood Safety; and Maltz, Michael D., Gordon, Andrew C., and Friedman, Warren. *Mapping Crime in Its Community Setting: A Study of Event Geography Analysis*. Washington, D.C.: National Institute of Justice, 1989.

18. Maltz et al., p. 91.

19. This section is based on a telephone interview with Richard Block, Loyola University.

20. This section is based on telephone interviews with Kim English, Colorado Division of Criminal Justice, and Pat Malak, Bureau of Justice Assistance; and Bureau of Justice Assistance. *Project PACT: A Community and Federal Partnership for Pulling America’s Communities Together*. Washington, DC: 1994.

21. The risk factors were obtained from the Seattle-based firm Development Research and Programs, Inc. The main groups of risk factors are family history of high-risk behavior; family management problems; parental attitudes and involvement in crime and drugs; early antisocial behavior; academic failure; lack of commitment to school; antisocial behavior in early adolescence; friends who engage in the problem behavior; alienation, rebelliousness, lack of social bonding; favorable attitudes toward the problem behavior; early initiation of the problem behavior; community laws and norms favorable toward crime and drugs; availability of drugs; extreme

economic and social deprivation; low neighborhood attachment and community disorganization; and transition and mobility.

22. This section is based on Donahue, Michael E. A Comprehensive Program to Combat Violent Crime: The Savannah Experience. *The Police Chief*. September 1993; Lyght, W., Renner, B., and Donahue, M. *Comprehensive Community Crime Control Strategy*. Savannah (GA): 1991; and telephone interviews with Brian Renner, Planning and Research Director, Savannah Police Department, and Michael Donahue, former Planning and Research Director, Savannah Police Department.

23. Betts, Mitch. Mapping Software Helps HUD. *Computerworld*. October 3, 1994, p. 41.

24. Boros, Alec and Lee, Jay. Applying Geographic Information System to Monitor Probationers in an Urban Environment. *GIS/LIS Proceedings*. Phoenix (AZ), October 25–27, 1994.

25. Telephone interview with Alec Boros, Department of Geography, Kent State University.

26. The research project is entitled “Crime Prevention Programs in Public Housing: The Jersey City Approach to Drug and Violent Crime Problems in Public Housing” and was submitted by the Jersey City Police Department, Lorraine Green (Northeastern University), and David Weisburd (Hebrew University and Rutgers University).

27. Capital District Business Review. *Sharing Success in Business and Info With the Authorities*. October 3–9, 1994, p. 35.

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