Advances in Policing—New Technologies for Crime Analysis

Chapter 13
Identify the stages of technological advancement in policing and the implications of technology utilization in the field.

Understand the different types of crime analysis and the technologies available for them, such as GIS.

Know the variety of applications of GIS technology.

Appreciate the many types of technology available to modern law enforcement.
Throughout its history, the U.S. Border Patrol has faced the seemingly insurmountable task of detecting and apprehending an ever-present stream of drug traffickers and illegal immigrants. The 60-mile area around the U.S.–Mexico border in the San Diego area alone requires the management of more than 2,000 agents and 900 seismic sensors (DeAngelis 2000).1 To aid them in their efforts, the U.S. Border Patrol San Diego Sector has many high-tech tools at their disposal, such as geographic information systems (GIS), seismic sensors, and infrared night vision equipment.

Agents use GIS technology to map the locations of alien apprehensions to determine why certain areas are higher in illegal migration and drug trafficking than others. Using real-time sensor feeds from the Intelligent Computer Aided Detection System (ICAD), agents monitor “hits” corresponding to potential illegal migrant entry into the country. Armed with the knowledge of a possible entry point, agents are able to map out the travel route that has the highest probability of leading to the apprehension of the illegal border crossers.

Illegal traffic has also found underground avenues of escaping detection. To combat this, the Border Patrol has used global positioning system (GPS) receivers and GIS to plot storm drain and sewer systems that are facilitating traffic from Mexico into the United States.

The application of such technologies to the practice of law enforcement has revolutionized the capacity of police to both respond to crime that is taking place in real time and to proactively identify problems, analyze their causes, and develop strategic plans that truly enhance an agency’s crime prevention capabilities. For example, the U.S. Border Patrol also targets high-risk areas with warning signs in Spanish informing immigrants of the dangers of crossing the border illegally.

In this technological era, law enforcement has had to evolve to fulfill its mandate of contributing to overall public security. Technology has proven invaluable in responding to the problem of linkage blindness across jurisdictions as well as with other criminal justice agencies and sectors of the community. In an age faced with the continuing threats of transnational crime and terrorism, the importance of continued technological advances cannot be ignored.

However, the increasing reliance upon and availability of technology to law enforcement can be intimidating.
This technology brings with it new legal challenges, particularly with regard to the balance between crime control and the private interests of citizens, which was discussed at the beginning of this book. This chapter will begin with a brief overview of the development of technological advances in law enforcement, followed by descriptive coverage of key technological applications in policing. Particular attention will be paid to the use of GIS in facilitating proactive police management in the twenty-first century.
The Stages of Technological Advancement in Policing

Soulliere (1999) provides a useful conceptual framework for describing the advancement of technology in policing since its early professional origins. Although there is significant overlap with Kelling and Moore’s (1987) three eras of policing (see Chapter 2), Soulliere (1999) offers four useful stages that help to conceptualize technological development in policing. Table 13.1 summarizes Souillere’s stages of technological advancement.

### The First Stage (1881–1945)

As described in Chapters 2 and 3, many of the initial technological advances in policing can be attributed to the work of August Vollmer, who headed the early twentieth-century police department (1909–1932) in Berkeley, California. Under his guidance, law enforcement increased its mobility through motor vehicle patrol and enhanced officer-precinct communications through telephone and radio. With his establishment of the first forensic laboratory, criminal investigators had access to an increasing array of technological expertise that would continue to increase exponentially throughout the development of law enforcement. For example, Vollmer’s crime laboratory pioneered the use of the polygraph as well as fingerprint and handwriting classification systems (Seaskate 1998). Soulliere (1999) cites several ways in which these early technological advances had an impact on police organization, including:

- The development of increasingly complex police organizations through the creation of specialized sections within large police organizations to handle the new technology, such as radio communications and forensic labs.
- Increased mobility for patrol activities offered by the use of automobiles.

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Increased officer safety made possible with enhanced communications and the use of automobiles.

The Second Stage (1946–1959)

Roughly corresponding with the beginnings of Kelling and Moore’s (1987) reform era of policing, Soulliere (1999) notes that the second stage of advancement saw the bureaucratization of policing organizations that, to some degree, was a result of technological advancements. During this stage, traffic police received a significant boost with the advent of the first instruments to measure both speeding violations and the condition of the driver. Although early instruments were rather crude indicators, they would grow over time to include the significant automobile surveillance mechanisms and blood-alcohol measures discussed briefly in Chapter 6.

The Third Stage (1960–1979)

As society in general entered the computer age, Soulliere (1999) claims that police technology began to truly emerge. It is during this stage that call distribution centers, computerized databanks, and computer-aided dispatch (CAD) became commonplace in police agencies. Some of the significant technological advancements in this stage can be attributed to President Lyndon B. Johnson. In 1967, Johnson created the President’s Commission on Law Enforcement and the Administration of Justice to analyze U.S. crime patterns and provided resources to combat crime. Importantly, the report generated by the Commission on Law Enforcement highlighted the slow infusion of societal technological advances into the criminal justice system, with particular attention paid to policing. To this end, the report stated (President’s Commission on Law Enforcement and the Administration of Justice 1967):

The police, with crime laboratories and radio networks, made early use of technology, but most police departments could have been equipped 30 or 40 years ago as well as they are today. . . . Of all criminal justice agencies, the police have had the closest ties to science and technology, but they have called on scientific resources primarily to help in the solution of specific serious crimes, rather than for assistance in solving general problems of policing. (p. 125)

A notable gap existed between the technologies that were currently available that had potential law enforcement applications and what police agencies were actually using. In response to this gap, the Johnson administration began “the flow, a trickle at first, of what eventually became billions of dollars in direct and indirect assistance to local and state law enforcement” (Seaskate 1998, p. 2).

Importantly, the commission argued for the establishment of a single telephone number that citizens across the country could use to contact the police in the case of an emergency. In only a matter of years following AT&T’s announcement of the first 911 system in 1968, its use became a driving force for police departments across the country (Seaskate 1998). As highlighted throughout earlier chapters, this increasing emphasis on calls for service would have both benefits (the seeming ease of access to the police in times of emergency), as well as detriments (this became the principal means of determining police resource deployment and performance evaluation). Skolnick and Bayley (1986)
point out that patrol personnel can easily be exhausted by rushing between calls for service, rather than taking the time needed to truly digest and understand the human situations into which they are thrown constantly.

During this third stage of development, large municipalities began to centralize the dispatch of all fire, police, and medical services (Seaskate 1998). The over-reliance of the average citizen on the use of 911, regardless of the nature or seriousness of the problem, has led to the establishment of 311 systems in many metropolitan areas to try and decrease the significant burden 911 has had on city emergency resources. The 311 system is available for all calls to police and fire personnel that are not emergencies. Other recent strategies for handling the call volume brought about by 911 include the differential response approaches described in Chapter 6.

Increased research on law enforcement applications and technological development was also a key characteristic of the third stage. The National Institute of Justice (NIJ) was created in 1968 and it continues to play a leading role in enhancing the field of law enforcement both nationally and internationally (Soulliere 1999). An increasing reliance on civilian specialists within large police organizations also continued throughout this stage because of developments in the areas of forensics and communication technologies.

**The Fourth Stage (1980–present)**

Information access and use characterize Soulliere’s (1999) fourth stage of technological development. In addition to simply amassing a volume of information—a task that law enforcement agencies have been successful at since their creation—technological advancement now focuses on the speed and ease of information use. Moreover, technology developed throughout the fourth stage now provides law enforcement with access to data that would be unavailable to them without these tools. Collaboration between traditional law enforcement and the military has resulted in many of the technologies introduced in this stage. Examples of such new tools include those in telecommunications, mobile computing, expert systems, imaging, and biometric technologies (Soulliere 1999). Each of these areas will be described further in this chapter.

The importance of law enforcement access to such technological advancements is in many ways a balancing act between concerns for personal liberties and public security, as illustrated by Cowper (2003) (Figure 13.1).

Kurzweil (2001) discusses the significant rate of technological development in modern society. He notes that although technology has always increased exponentially, earlier generations were at such early stages of development that the trends appear flat due to the low baseline. Kurzweil argues that although everyone in society generally expects technological progress to continue, the rate of change is accelerating. Rather than incremental increases every year, technological advancement is characterized by exponential growth, doubling every year. He organizes these observations into the **law of accelerating returns**:

- The enhanced methods resulting from one stage of progress are used to create the next stage.
- Consequently, the rate of progress of an evolutionary process increases exponentially over time.
In addition, the speed and cost-effectiveness of a technological advancement will also increase exponentially over time. Finally, current methods of solving a problem in technology (such as shrinking transistors on an integrated circuit as an approach to making more powerful computers) will provide exponential growth until the method exhausts its potential. At this time, a fundamental change will result that will allow the exponential growth to continue.

Cowper (2003) summarizes the law of accelerating returns by saying that we will have 100 years of progress in the next 25 years and 20,000 years of progress in the next 100 years. Thus, the technology of science fiction that we often think of as being so far in the future is perhaps not as distant as it might seem. The applications available to policing now or in the near future might seem more the work of science fiction than reality. Certainly the applications of technology to policing have greatly enhanced the ability of law enforcement organizations to meaningfully engage in the problem-solving process. Although many police departments continue to be behind the curve in terms of integrating new technologies into day-to-day operations, the success of many applications to sound policing will make ignoring progress increasingly difficult over time.

**Crime Analysis**

Integral to the process of problem solving discussed in Chapter 12 is crime analysis. Crime analysis has been defined as involving “the collection and analysis of data pertaining to a criminal incident, offender, and target” (Canter 2000, p. 4). Ideally, crime analysis will guide police managers in making deployment and resource allocation decisions that are linked to a true understanding of the nature of the problem. The more important data collected and analyzed
related to all components of the crime triangle (victim, offender, location) (see Chapter 12), the better equipped police organizations will be to develop innovative, out-of-the-box solutions that include the full spectrum of suppression, intervention, and prevention options.

An important note of caution must be stressed here. Crime analysis will only be as good as the data or information that is collected. There are three **essential criteria for crime analysis** that departments should use when designing data collection processes as well as when interpreting the meaning of information resulting from crime analysis. These criteria are:

1. **Timeliness**: Does the pattern or trend presented reflect a current problem or issue or is it more representative of a previous situation? Deployment decisions with respect to both prevention and offender-apprehension efforts must be based on information that is as current as possible.

2. **Relevancy**: Do the measures used in the analysis accurately reflect what is intended? For example, whether a pattern is based upon **calls-for-service data** or **incident data** can be a very important determination depending on what the police manager is trying to understand.

3. **Reliability**: Would the same data, interpreted by different people at different times, lead to the same conclusions?

Canter (2000) categorizes crime analysis into both strategic and tactical functions.

**Strategic Crime Analysis**

The collection and analysis of data spanning a long period of time is **strategic crime analysis**. This type of analysis is said to be research focused because it includes the use of statistics to make conclusions (Canter 2000). This form of analysis can be useful to departments in terms of **crime-trend forecasting**, or using data to estimate future crime based on past trends (Canter 2000). With crime-trend forecasting, important decisions can be made as to the deployment of patrol as a reflection of the changing volume of criminal activity.

Another important benefit of strategic crime analysis is the analysis of changing community dynamics and risk factors that might be contributing to the particular crime trends of a specific area (Canter 2000). Once again, this type of analysis over time can result in more informed decision making that can lead to police partnerships with other city and community agencies that can help create more long-term, sustainable reductions in criminal activity.

**Tactical Crime Analysis**

Whereas strategic crime analysis involves the review of data spanning generally a year or more, **tactical crime analysis** uses real-time data spanning several days. One of the principal uses of this type of analysis involves problem identification, or the **pattern detection** of multiple offenses over a short period of time that have common characteristics, such as the type of crime, modus operandi, and type of weapon used (Canter 2000). One example of tactical crime analysis that will be discussed later in this chapter is geographic profiling, which
can be used to suggest the likelihood of where an offender lives based on the pattern of where victims and offenses occur. Tactical crime analysis can occur on as large an area as a department’s entire jurisdiction or as small as the few block radius of a hot spot.

**Linkage analysis** involves connecting a suspect to a series of incidents based on commonalities in modus operandi and suspect description as well as known offenders that live in close proximity to a given area (Canter 2000). Following a nationwide effort by state legislatures to implement sex offender registration laws (Terry and Furlong 2004), many police departments regularly search their databases of registered sex offenders when a known series of sexual offenses is identified.

Finally, **target profiling** involves the use of data to determine the potential risks certain areas may have for criminal victimization based on known offense patterns in the area. Following the previous example, some departments have experimented with community-risk profiles (i.e., day care centers, presence of parks, etc.) as a means of notifying the community of the presence of registered sex offenders.

**Geomapping Crime Patterns: Moving Beyond Push Pins**

Based on the previous discussion of the applications of crime analysis to policing, the integral role that **geographic information systems (GIS)** play in the process is readily apparent. A GIS is an automated system for the capture, storage, retrieval, analysis, and display of spatial data (Clarke 1990). Others have noted that “GIS technology is to geographical analysis what the microscope, the telescope, and computers have been to other sciences” (Cowen 2001, p. 3). By visually representing diverse data sources that can be geographically located, such as crime events, land usage, property values, racial ethnic composition, and so on, GIS enables planners to “manipulate and display geographical knowledge in new and exciting ways” (Cowen 2001, p. 3). Despite its diverse applications across various fields, the common focus of GIS is the enhancement of decision making.

In law enforcement, GIS has revolutionized the practice of electronic **crime mapping**, or visually displaying crime incidents on a mapped surface of a particular jurisdiction. However, the use of crime maps has a long history within policing. For example, the NYPD used pin maps to represent crime patterns at least as far back as 1900 (Harries 1999). Moreover, criminologists and sociologists have examined the spatial trends of crime and delinquency since as far back as mid-nineteenth-century France’s Quetelet (Phillips 1972) and the **social ecology of crime** efforts pioneered by Shaw and McKay (1942). The difference is, of course, that until the use of GIS became more commonplace in policing practice throughout the 1990s, crime patterns were literally represented by inserting push pins into the map of a jurisdiction that was usually mounted on the wall.

Although these early crime maps proved to be useful in visually showing where crimes occurred, patterns would be lost over time as more and more pins
were added to the map. Additionally, these maps were very difficult to archive for later retrieval and analysis unless they were photographed (Shaw and McKay 1942).

What Crime Maps Do: GIS as a Technical Aid to Problem-oriented Policing

GIS has revolutionized the way in which problem-oriented policing is conducted internationally. This is largely due to the police's ability to now overlay seemingly diverse types of data that all contribute to a true understanding of a particular problem. For example, a series of burglaries taking place between the hours of 1:00 AM and 3:00 AM might be the first thing visually displayed on a crime map. This would correspond with the scanning (problem-identification) part of the problem-solving model detailed in Chapter 12. However, getting at the underlying causes of the burglary problem requires deeper probing and innovative thinking. In this case, the crime analyst might overlay the burglary incident data with available data about land usage in the area. The crime analyst might then learn that the burglaries are occurring within walking distance of an area high school.

Although this might seem to be an obvious linkage to many, individuals often overlook such connections. By visually displaying overlays of various potential data combinations, GIS can play a critical role in jump-starting the analysis process. With the current example, the police manager might begin to develop a series of hypotheses related to the fact that the burglaries might be caused by troublemaking youths playing hooky from their afternoon classes. In addition to providing a large pool of individuals from which investigators might seek to learn information about the incidents, police planners may also begin to
collaborate with the school to develop responses that increase truancy enforcement in area schools.

Types of Data with Mapping Applications

Many types of data can be used for mapping purposes. Any data that can be geocoded, or for which there is geographic reference information, can be used for GIS analysis (Harries 1999). Although early forms of geocoding only permitted street addresses as the geographic unit upon which to map data, blocks and census tracts can now be used. Crime incidents are readily applicable for geocoding purposes given that they are almost always available as street addresses or are otherwise locationally based (Harries 1999).

To summarize, direct crime mapping pattern applications of GIS can include (Harries 1999):

- Mapping incident types and modus operandi
- Mapping attributes of victims and suspects

Based on the initial pattern analysis, overlays of other forms of data can help to present a broader understanding of the problem. For example, a pattern analysis might indicate a problem of disorderly conduct and assaults in an area. An overlay with available liquor stores and bars in an area may present the planner with a series of hypotheses as to what factors might be driving the problem. An additional benefit of GIS is that they are directly compatible with statistical analyses to further refine causal projections. Thus, a city planner might be able to statistically link the rate of disorderly conduct and assaults in city jurisdictions with the overall density of alcohol availability or other possibilities.
GIS Applications to Sex-offender Management

GIS applications can also help to increase law enforcement’s capacity to engage in the collaborative problem-solving process with other criminal justice and community agencies. The visual representation of information can be a powerful tool in coming to a common understanding of the nature of problems even across planning groups with diverse perspectives.

The authors of this text participated on a citywide task force in New York City composed of representatives from law enforcement, probation and parole, family and criminal courts, mental health, treatment providers, and victim advocates to examine the issue of sex-offender management in the community (Grant and Terry 2000). Although New York City had a large registered sex offender population at the time (over 3,000 offenders), there was no comprehensive plan for the management of these offenders in the community involving collaboration between each of the key stakeholders. Building on the recognition across team members of the clear need for such a collaborative approach to sex-offender management, as well as a need to better understand the dynamics of the problem through data collection, the New York City Sex Offender Management Team had tremendous momentum from the start, with agencies opening their doors to facilitate the data collection process.

Beginning at the first team meeting, partners sought to identify a mechanism for gaining a complete understanding of the sex offender population currently residing in the community. Although it was initially suggested that each of the five District Attorneys represented conduct searches on sex offenders within their own databases to form an initial population for study, it became immediately apparent that the most efficient access to such data would be to use a database of all registered sex offenders in the city. Based on this initial database, the team sought to get complete information on probation conditions, employment, treatment, living situation, probation officer contacts, mental status, substance abuse history, and so on. In addition, complete criminal histories on the offenders were requested in order to gain a true understanding of the nature of the population being managed so that accurate comprehensive strategies could be devised. At all points, ethical considerations were paramount in the use of this information, which was always presented in aggregate form and never published beyond the law enforcement planning team purposes.

In a city the size of New York, and with such a large number of offenders, GIS mapping of offender residences is essential for two reasons: First, depending on the plan developed by the team, it might have been necessary to pilot the demonstration project within one borough given the tremendous task and the resources required for a citywide approach. Having a visual display of where offenders are most concentrated can help aid planners in making decisions as to where to target initial resources. Second, offender mapping had the tremendous ability to demonstrate to the team the scope of the problem, particularly given the obvious clustering of offenders in several city locations. Mapping allowed researchers to present the planning team with buffer zones around each offender, combining offender density in a given area with overlays of key risk factors for reoffending drawn from the relapse-prevention literature and connected to each offender residence location. Examination of this data by school and daycare locations, parks, available treatment resources, and so on were all part of the process for meaningful informed problem solving, to which GIS proved to be the essential core tool.
Although such analyses can only show planners of possible relations between two variables, or correlations, rather than saying conclusively that X causes Y (causation), there can be no doubt that such findings greatly enhance the level of informed decision making by law enforcement and other key stakeholders in a city.

**Mapping and Accountability: GIS in Action**

Crime mapping can greatly increase the accountability of a department by visually demonstrating incident patterns for which departmental administrators can hold commanding officers accountable for over time. A proactive police manager should use GIS and other problem-solving tools to create sound strategic and tactical decisions related to such things as officer deployment, resource allocation, and partnerships with other agencies for sustained crime reductions. The CompStat model of the NYPD institutionalized the use of GIS for departmental planning purposes. The program was such a success that similar versions of CompStat have been implemented in departments across the country.

The NYPD Crime Control Model, or CompStat, cannot be oversimplified to simply refer to quality-of-life policing, aggressive policing, or even data-driven policing, as is commonly found in the literature about the model. Rather, as po-

**Questions**

1. Discuss different ways GIS might be applied to community policing and specifically problem-solving related to crime concerns in your community.

2. What are the ethical considerations of mapping offender residence locations? Research national approaches to sex offender registration and notification.
lice scholar Phyllis McDonald (2002) emphatically states, “this proliferation of singularly focused descriptors does a disservice to the management principles of CompStat and its potential for use in other jurisdictions. CompStat (from “computer-driven crime statistics”) is a comprehensive, continuous analysis of results for improvement and achievement of prescribed outcomes” (p. 7). In other words, CompStat involves managing police operations by institutionalizing accountability and analysis processes that are the embodiment of the problem-oriented policing model.

McDonald (2002) offers a concise overview of the key elements of the CompStat model and issues involved in its replication in other departments. To summarize, these elements include:

- Specific objectives
- Accurate and timely intelligence
- Effective tactics
- Rapid deployment of personnel and resources
- Relentless follow-up and assessment

As we have seen in earlier chapters, police organizations, like any other form of bureaucracy, are often extremely resistant to change. How then, did such a seemingly proactive, forward-looking model become implemented in the country’s largest police department? In his prior position as head of the New York City Transit Police in the early 1990s, former NYPD police commissioner William Bratton had seen tremendous successes in focusing departmental operations on specific measurable objectives and an ongoing review of outcome achievement. Following a series of complementary strategies in the notoriously dangerous New York City subways, such as increased undercover and uniformed police presence and the removal of graffiti and other signs of disorder, dramatic declines in robberies, fare evasion, and general disorder resulted. New Yorkers once again began to feel safe about riding the subways.

When Bratton came to the helm of the NYPD in 1994, he began a dramatic reengineering effort that included interviews and focus groups involving representatives of every rank and bureau in order to assess the state of command in the department (Silverman 1999a). Seven specific objectives were created to guide the future direction of the department (McDonald 2002):

1. Get guns off the street.
2. Curb youth violence in the schools and on the streets.
3. Drive drug dealers out of NYC.
4. Break the cycle of domestic violence.
5. Reclaim the public spaces of NYC.
6. Reduce auto-related crime in NYC.
7. Root out corruption and build organizational integrity in the NYPD.

In order to achieve these outcomes, as well as to measure departmental progress towards them, ready access to timely data was essential. However, a significant problem became immediately apparent: The NYPD was not equipped to
provide up-to-date crime reports. In fact, there was generally a reporting lag of three to six months for crime statistics, and even then, any meaningful analysis at the incident-based level was near impossible (Silverman 1996). Headquarters was not systematically tracking crime activity in the precincts, let alone using such information to evaluate the performance of its commanding officers (Silverman 1999a). As a result, precinct commanders did not view crime reduction as a primary job responsibility. Common to departments across the country, efficiency concerns in responding to crime were seen as more important. Detective bureaus and other specialized functions thus only rarely collaborated with patrol, and often directly clashed over territory and other concerns.

CompStat was devised as a means of reforming these organizational issues by pushing all precincts to generate weekly crime activity reports so that they could be held accountable for the achievement of the seven specific objectives outlined in the reengineering process (McDonald 2002). In the beginning, the Patrol Bureau staff computerized this data and compiled it into the “CompStat Book,” offering year-to-date crime complaints and arrests for every major felony category in addition to gun arrests (Silverman 1999a). These data would then be compared at citywide, patrol-borough, and precinct levels. In addition, precinct commanders quickly became accountable for not only crime activity, but also for any inaccuracies in the data. Over time, these data became even more readily available and could be downloaded directly from the department’s On-Line Booking Service (OLBS). Headquarters would come to rank order the precincts in terms of overall crime changes within their jurisdiction.

By providing timely and accurate data it quickly became clear to precinct commanders that their role had changed; they were now being held accountable for the crime under their charges. As such, they began to realize that they had to stop simply responding to crime and had to begin to proactively think about ways to deal with it from all angles: suppression, intervention, and prevention.

In order to solidify this message, NYPD headquarters began to hold regularly scheduled CompStat meetings in which precinct commanders and their staff met directly with top departmental brass to discuss crime trends and issues in their precincts. In a very intimidating environment, precinct commanders must stand before a lectern in front of three large video screens that flash GIS-generated maps of recent crime patterns (Figure 13.2). During this meeting, commanders are asked about what tactics they have tried to address the patterns, what resources they have tried or need, and with whom they have collaborated. The session thus becomes a brainstorming problem-solving session about how better to proactively respond to crime. Suggestions for strategy directives are made and at subsequent meetings are relentlessly followed up by top brass to further ensure accountability. Having the top brass available as part of this process ensures that departmental resources will be directed to precinct needs, even across precinct and unit lines. Thus, in addition to implementing accountable problem solving, CompStat seeks to reduce the problem of linkage blindness, which has been an important theme of this book.

In order to better prepare for CompStat meetings, each borough implemented Pattern Identification Modules (PIMS) composed of housing, transit, patrol, detective, organized crime, and robbery squads to review daily index
crime reports and thus identify crime clusters or patterns that need to be addressed. Figure 13.3 provides a conceptual framework of this planning process.

Over time, CompStat has evolved to include other data: Census demographics, arrest and summons activity, available resources, average response time, domestic violence incidents, unfounded radio runs, and personnel absences (Silverman 1999a). Former Commissioner Howard Safir also added citizen complaints and charges of officer misconduct to the process. Time-of-day photos might also be presented in CompStat meetings to monitor changes in precinct dynamics by shift period.

Many scholars and practitioners have argued that CompStat has played a critical role in the significant crime reductions witnessed by New York City fol-
Following its implementation (Silverman 1999a). Others are more skeptical of these claims, arguing that the crime reductions in New York City can be attributed to larger patterns in society (Karmen 1996). The answer is likely somewhere in the middle; however, the tremendous impact CompStat has had on police management practices cannot be denied. Although some reports have pointed to the demoralizing effects of the process on precinct commanders and officers who feel a pressure to produce numbers, many others cite the significant increases in job satisfaction found by those who feel empowered by the problem-solving aspects brought to the job.

An important concern that has been raised is whether the pressure to keep crime statistics low has led to a zero-tolerance policing style that loses sight of community concerns, damaging police-community relations. The answer to this issue is unclear, as it is probably too soon to come to concrete conclusions. These questions will have to be tracked by practitioners and academicians alike as the model is implemented across diverse contextual conditions within the United States and abroad.

**GIS and the Patrol Officer**

As GIS crime mapping became recognized as an important tool in both tracking and responding to crime at the neighborhood level, departments across the country sought to expand its use beyond administrative planning to patrol officers and community residents. For example, the Camden New Jersey Police Department began providing officers with access to crime-mapping
information on desktop computers and even on wireless laptops in patrol cars (American City and Country 2002). The department allowed officers to access information on crime based on location, type, and time in order to better focus their patrol efforts. The maps have also been designed to allow officers to pinpoint business contact information when an alarm is sounded, rather than having to call a dispatcher for the information (American City and Country 2002). Moreover, in 1998 the NIJ awarded the leading GIS software provider, Environmental Systems Research Institute, Inc. (ESRI), a $500,000 grant to work with local law enforcement agencies and universities to effectively use GIS as a crime-fighting tool (Carney 1998). Collaborating with several local law enforcement agencies, ESRI developed an accessible GIS software program with a simple interface that would be easily transferable to large-scale departmental use outside of a specialized civilian analyst capacity.

**Other Applications: Geographic Profiling**

Geographic profiling, or the combined use of geography, psychology, and mathematics to identify the location of an offender, is most commonly associated with tracking down serial killers, rapists, and arsonists. However, it is a useful investigative tool in any case in which an individual offender has committed criminal activity across a series of locations (including crimes as diverse as robbery, burglary, theft, and fraud). Building from the significant empirical efforts of Brantingham and Brantingham (1981), geographic profiling suggests investigative alternatives based on the “hunting behavior” of the offender. Leading geographic profiler Kim Rossmo argues that criminals are no different in their pattern of carrying out their offenses as ordinary citizens are in going about their day-to-day activities (Onion 2002).

Following this logic, geographic profiling uses the nearness principle as a key rule. The nearness principle argues that offenders will remain within a limited range that is comfortable to them when committing their offenses (Rossmo 1998), just as animals will tend to forage within a limited range from their base (Onion 2002). Geographic profiling incorporates all possible methods of transportation available to an offender when calculating the area in which the offender is most likely to reside.

This research has led to the creation of a computerized geographic profiling workstation called Rigel that includes statistical analyses, GIS features, and database management functions to aid in the process of offering calculated investigative suggestions. Crime scenes are broken down by type (remember the primary and secondary distinctions discussed in Chapter 8) and then entered by location. Based on the theoretical principles of geographic profiling, addresses of suspects can be evaluated based on their probability of being the actual offender (Harries 1999). This can help investigators sort through their existing databases, such as those of registered sex offenders, and other investigative information available to them. When a specific suspect pool is not known, geographic profiling can help to pinpoint the highest probability areas in which to focus the search. As with the offender-profiling process discussed in Chapter 8, geographic profiling should only be considered as an additional tool for investigators; solving a series of offenses ultimately requires a sound investigative strategy.
In addition to the introduction of GIS into everyday crime-fighting activities, over the past decade numerous other technologies have become available, from record management systems (RMS) that help departments to store and readily retrieve the immense amounts of data they receive on a day-to-day basis to sophisticated weaponry and intelligence technologies that have reached law en-
forcement by way of the military. Covering all of these advances in significant detail is beyond the scope of this text; however, the remainder of this chapter will provide an overview of some significant technological developments that are becoming part of everyday law enforcement activities.

### Surveillance Technologies

**Surveillance technologies** represent the wide array of systems currently available to law enforcement, the military, and even private entities, to track the movements of individuals and/or provide capable guardianship to a specific location. Examples of advancements in this area include, CCTV, GPS, Biometrics, and A PIS systems.

**Closed-Circuit Television**  The use of closed-circuit television (CCTV) and other forms of public-surveillance technology in the United States has grown significantly in recent years as not only police departments, but also airport security and other public entities, have increasingly turned to video surveillance in their efforts to reduce crime and increase public safety. The use of this technology may not be nearly as prevalent in the United States as it is in countries such as Britain, where there is a camera on every street corner and in every public building. However, it is becoming increasingly popular, particularly following the events of September 11. Law enforcement is now turning to surveillance systems such as CCTV as a means of trying to sort through the tremendous traffic at our borders, airports, and dense city streets.

After spending almost two years in CCTV control rooms across England, Goold (2001) concluded that in many cases actual surveillance outcomes have less to do with technological factors than they do with the working culture and the attitudes of individual camera operators. In particular, Goold found that, once established, many public-area surveillance systems quickly become prone to institutional inertia, with both camera operators and scheme managers being either unwilling or unable to update their systems or change their working practices in response to technological advances. Technology does not exist in a vacuum; it is both socially shaped and it shapes the attitudes and practices of those who use it (Bijkker et al. 1987). In addition, technical workers, such as CCTV operators, often shape the implementation of new technology by fitting it into their existing routines. Technological change may as often be subsumed into existing organizational structures as it affects organizational change (Barley 1986).

No one can erase the images caught on airport CCTV cameras of the September 11 hijackers boarding their plane in Boston. Certainly such retrospective images can be used as evidence of what transpired in a given incident, but law enforcement has become increasingly more interested in finding better ways to harness CCTV technology to readily identify known offenders passing through a checkpoint, such as a wanted felon or individual on a terrorist watch list. As such, new advances have sought to merge CCTV systems with promising approaches in the field of biometrics, as will be discussed later.

Some agencies have also developed innovative ways of using private security systems to aid responding units at the scene of an incident. For example, the Seal Beach Police Department, which is located in a high-robbery-incident suburb of Los Angeles, installed a network that transmits the output of bank security cameras directly to dispatch and to responding units in real time (Garcia 2001). This
network transmits video over the air in the same manner that images are sent over the Internet through encrypted wireless communication paths.

**Global Positioning Systems**  Global positioning systems have been used to enhance the tracking of offenders and officer deployments. **Global positioning systems (GPS)** use satellite-based technologies for the purpose of tracking the movement of patrol cars or specially equipped stolen vehicles. In some cases, an officer’s cell phone can be equipped with GPS technology, providing an important alternative to conventional address-matching for an officer responding to a call. GPS technology has also proven to significantly enhance aerial photography of crime incident locations, allowing for greater visualization of the complete context of a situation (Harries 2001). The state of Iowa has capitalized on the surveillance capacity of GPS to monitor the real-time location of high-risk offenders released from prison. With offender-monitoring systems, law enforcement and correctional agencies can “prevent offenders from venturing near schools, daycare centers, and other restricted areas” (Greene 2001).

The Escambia County Sheriff’s Department’s SWAT team in Florida used a broadband-via-satellite system when responding to an emergency call involving a shooting victim and a barricaded suspect. Communicating through the Mobile Command Center’s satellite system, the SWAT officers were able to determine that the suspect had fled the scene and the victim was likely dead (Hughes Network Systems 2002). Pictures of the suspect were immediately obtained via satellite and distributed to patrol, rather than taking hours or days, which was the norm before such technology was available to law enforcement agencies.
Biometrics

Biometric technologies involve the automatic, real-time identification of individuals based on their physiology or behavior (Cowper 2003). Biometrics thus covers a diversity of technologies, including voice/speech recognition, fingerprint scanning, lip movement recognition, retinal scanning, facial recognition software, DNA profiling, and thermal imagery, to name just a few.

Facial Recognition Software

The field of biometrics, particularly facial recognition software, is seen as offering the chance to overcome the limitations of CCTV systems, both by reducing the need for expensive human operators and by making the process of suspect identification faster and more reliable. Several promising studies support the potential applications of facial recognition software; however, little is known about how they will function in practical situations (Norris and Armstrong 1999).

Like any technology, the potential impact of facial recognition technology on preventing crime versus infringing on civil liberties rests upon the quality of the database from which possible “hits” are derived. For example, an underinclusive database might exclude potential terrorists but “catch” a child-support violator; whereas, a mistargeted database may send out too large a net that might unnecessarily infringe civil liberties and reduce the effective application of the technology. Cole’s (2001) groundbreaking analysis of the history of identification technologies highlights the need for further study of the information elements being used to comprise biometric databases.

Fingerprint Identification Systems

Automated fingerprint identification systems (AFISs) were introduced in Chapter 8 and require little additional explanation here. An advanced system to aid in the processing, storage, and match-
The use of fingerprints has been introduced by the FBI. Called the Integrated Automated Fingerprint Identification System (IAFIS), this enhanced technology offers a two-hour turnaround on electronically submitted criminal print searches from federal, state, and local law enforcement agencies (Smith 1998).

**Interjurisdictional Communication Technology**

At the core of linkage blindness is the lack of or minimal amount of critical communication that occurs between different law enforcement jurisdictions as well as other sectors of the criminal justice system and community at large. Given the diversity of criminal justice core functions, including community policing, crime prevention and investigation, prosecution, adjudication, punishment, restitution, release, and rehabilitation, the gathering and sharing of criminal justice information is particularly complex (Tomek 2001). The need to build information-sharing capacities, both technological and organizational, is evidenced by the NIJ’s recent decision to make information sharing the number one priority for information technology solutions among state and local agencies, as well as internationally (Tomek 2001).

The need for information continuity and access is key to informed decision making by all criminal justice stakeholders. One of the biggest challenges to larger information-sharing collaborations, however, is the large differences across agencies in terms of agency protocols, standards, and even measures for the collection and utilization of data (Tomek 2001).

**Offender Databases**

Efforts have been made in recent years to develop sufficient technologies capable of overcoming many of the barriers involved in cross- and interjurisdictional information sharing.

The San Diego County Automated Regional Information System (ARJIS) warrants further description as to the possibilities in interjurisdictional information sharing. ARJIS compiles information from thirty-eight state, local, and federal law enforcement agencies into one Web site that registered police, court, and correctional officials can access (Walsh 2003). ARJIS includes crime-incident data that are updated every twenty-four hours, most-wanted lists, and interactive maps. Similarly, the Pennsylvania Integrated Justice Network (JNET) connects all of the state’s criminal justice agencies together for the sharing of critical information, including offender photos and images of distinguishing marks. In one case, an offender was able to be apprehended because a victim was able to describe the perpetrator’s tattoo to the police (Walsh 2003).

**Cross-Jurisdictional Radio Communications**

Federal efforts to improve cross-jurisdictional radio communications include the NIJ’s development of the Advanced Generation of Interoperability for Law Enforcement (AGILE) program in 2001. AGILE provides direct connections across the radio systems of neighboring law enforcement agencies with overlapping or adjacent jurisdictions (Kaluta 2001). The possibilities of such technologies for enhancing national security needs has been demonstrated by early evaluation successes of the system as an enhancement to communication in San Diego County (ARJIS) (Scanlon 2000). AGILE has also been used to establish an emergency-only radio channel for presidential inaugurations, linking the Secret Service, the FBI, the Capitol Police, the U.S. Park Police, and the Metropolitan Police Department (Kaluta 2001).
Electronic Warrant Processes  A number of jurisdictions have responded to the numerous problems involved in the arrest-warrant process. This cumbersome process has traditionally involved the issuance of paper warrants by courts that are subsequently used by law enforcement agencies to create a wanted person record in their own system, which can then be checked by law enforcement officials throughout the country through the use of the FBI’s National Crime Information Center (see Chapter 8). What is most problematic about this process is that there is often a delay between the time the court either issues or cancels a warrant, which can create serious officer safety concerns if an officer comes in contact with a dangerous individual that has not yet been entered into the NCIC system (Perbix 2001). Additional concerns arise from the lack of synchronization across the systems, in which warrants entered into one system are not entered into the other.

Electronic warrant processes, such as the Colorado Integrated Criminal Justice Information System (CICJIS), link the state’s main criminal justice systems (including law enforcement, prosecutors, courts, adult and juvenile corrections) so that data entered by one agency’s system is automatically transferred and loaded into another agency’s system, thereby reducing concerns of linkage blindness and inconsistent data (Perbix 2001).

Information Security Through Encryption  Given the confidential information being shared by criminal justice agencies through these enhanced technologies, serious privacy concerns inevitably arise. Secure law enforcement communication over the Internet or an intranet can be achieved through virtual private networking (VPN) technologies. VPNs involve the use of encryption software to scramble the contents of communications so that even if the system becomes available to hackers, they are unable to read the information (Taylor 2000). In addition to an advanced encryption algorithm that is virtually impossible to break, VPNs pass encrypted communications through a “tunnel” between communicating agencies, ensuring that users meet a high level of identification to be able to access the information (Taylor 2000). With the establishment of proper identification and access protocols, VPNs offer law enforcement agencies the ability to exchange and track important information over a secure channel.

The World Wide Web and Community Policing  With its focus on collaborative problem solving and communication with the public, community policing is even more information intensive than traditional policing methods (Monahan 1998). New communication technologies such as the Internet have proven to be important mechanisms for furthering departmental-community policing objectives. Important features that are used by many departmental Web sites in reaching their constituent audiences include (Hart 1996):

- Officer photo galleries, including photos and biographical sketches
- Libraries devoted to crime prevention and safety tips, including information about known scam cases operating within the jurisdiction
• Virtual tours of the department
• Recruitment tool with links to personnel information about the hiring process
• Recent citywide and neighborhood crime statistics, including crime mapping capabilities on the more advanced pages
• Departmental wanted lists and upcoming court cases
• Capacity for anonymous and/or confidential reporting of crime information or complaints about officer conduct

It should be noted that department home pages on the Internet have moved beyond the realm of being public relations tools and towards the true support of community policing activities to the extent that the department shares important details about activities and arrests rather than the filtered information generally provided to citizens by the media (Price 2001). Departmental posting of such information, however, should be balanced against the privacy needs of victims and nonconvicted offenders.

**Improving Accountability—Mobile Communications with Patrol**

Radio communications with patrol cars revolutionized the ability of departments to monitor the activities of line officers. Although such technology did not take away the high level of discretion available to officers, enhancements to dispatch communications capabilities had a profound effect on the nature of their job. More recently, cellular phone technology has provided an alternate communication forum for some jurisdictions.

**Mobile Digital Communications (MDC)** Mobile digital communications offer nonverbal means of communicating information between communication centers and patrol (Thibault et al. 2001). Such communication is achieved through the use of a mobile digital terminal in the patrol car. In some jurisdictions, MDC options allow for electronic submission of reports, thereby reducing the volume of paperwork. More recently, some departments have installed new laptop computers into patrol cars, allowing officers instant access to information, such as notes from the communications officer and even the Internet. Soon officers will not have to leave their cars to write even the most detailed reports (Johnson 2003). Available Internet capabilities will also facilitate interjurisdictional information exchange opportunities, providing an important tool in the reduction of linkage blindness.

**Automatic Vehicle Monitoring** Through the use of automatic vehicle monitoring (AVM) technologies, departments are able to know the location and status of patrol vehicles, including whether the door of the vehicle has been left open (Thibault et al. 2001). AVM systems are thus vitally important in aiding officers in high-speed pursuit situations and determining whether an officer is in need of back-up.
Chapter Summary

- There has been significant advancement in technology in the past twenty years, and the application of this technology to policing has benefited law enforcement officers in both proactive and reactive methods of policing.
- The most important factors in crime analysis are timeliness, relevancy, and reliability, all of which are necessary in order to effectively examine data.
- GIS crime mapping is a virtual map that allows police officers to analyze the areas in which crime occurs. It has many benefits, particularly in proactive policing. It can help the police to understand spatially where crimes occur and how to make strategies to combat crime, particularly in hot spots.
- Advanced technology enables the collection of more timely and accurate data, and it helps patrol officers respond more quickly and effectively to crimes in neighborhoods.
- One of the leading technologies of twenty-first-century policing is CompStat, which envelops the problem-oriented policing model and assists in more effective management of areas where crime occurs.
- Surveillance technologies such as CCTV are extremely beneficial in tracking all types of criminals, from shoplifters to terrorists. Through the taped monitoring of movements, combined with emerging biometrics of face recognition technology, there are many potential applications of CCTV. GPS also has proven important in facilitating law enforcement operations in both investigatory and deployment capacities. Fingerprint identification systems have aided in the identification of individuals who have offended across boundaries. Other interjurisdictional communication technologies include offender databases and electronic warrants system.

KEY TERMS

- 311 system
- 911 system
- Advanced Generation of Interoperability for Law Enforcement (AGILE)
- Automated Regional Information System (ARJIS)
- Automatic vehicle monitoring (AVM)
- Biometrics
- Buffer zones
- Computer-aided dispatch (CAD)
- Calls-for-service data
- Causation
- Chicago Alternative Policing Strategy (CAPS)
- Closed-circuit television (CCTV)
- CompStat
- Correlations
- Crime analysis
- Crime mapping
- Crime-trend forecasting
- Electronic warrant processes
- Environmental Systems Research Institute, Inc. (ESRI)
- Essential criteria for crime analysis
- Facial recognition software
- Geocoded
- Geographic information systems (GIS)
- Geographic profiling
- Global positioning systems (GPS)
- Incident data
- Information Collection for Automated Mapping (ICAM)
- Integrated Automated Fingerprint Identification System (IAFIS)
- Law of accelerating returns
- Linkage analysis
- Mobile digital communications (MDC)
- Nearness principle
- Pattern detection
- Pattern Identification Modules (PIMS)
- Record management systems (RMS)
- Relevancy
- Reliability
- Rigel
- Social ecology of crime
- Souillere’s stages of technological advancement
- Strategic crime analysis
- Surveillance technologies
- Tactical crime analysis
- Tactics
- Target profiling
- Timeliness
- Truancy enforcement
- Virtual private networks (VPN)
Linking the Dots

1. What have been some of the most significant technological advancements in policing since 1980?
2. What are some of the dangers associated with advancements in police technology? How are these dangers balanced with the benefits of such technology?
3. Do you think CompStat is partially responsible for the significant drop in crime in New York City over the past decade?
4. How does police technology benefit the community?
5. How can technology be used to help combat terrorism?

REFERENCES


Chapter 13: Advances in Policing—New Technologies for Crime Analysis


1. This introduction draws upon information found in DeAngelis (2000).