Crime Analysis Technology

As noted in previous chapters, crime analysis relies heavily on computer technology, and over the past 15 years significant improvements in computer hardware and software have led to tremendous development in this field. This chapter provides a brief overview of the types of technology currently being used in the various stages of the crime analysis process.1

Computer Hardware

The computer hardware used for crime analysis is similar to that used in other disciplines that rely on the help of computers. Crime analysts use desktop personal computers to complete most of their work and use laptop computers for fieldwork and presentations. In many cases, police departments’ crime analysis units have their own servers to house tabular data, geographic data, and software applications that are shared by users. Other kinds of hardware used in crime analysis include color laser printers that can produce high-quality documents quickly, plotters (printers that produce poster-size color maps for display), scanners, and digital cameras (used to obtain pictures of people and locations as well as to capture documents that are not available in electronic form).

Data Collection and Storage

The tabular and geographic data (secondary data) used in crime analysis are commonly obtained from three main kinds of data collection and storage systems: computer-aided dispatch (CAD) systems, records management systems (RMSs), and geographic data systems. The first two of these are typically located within police departments, whereas geographic data systems are maintained by city, county, or state governments. Other systems also produce data used in crime analysis, such as national data systems, court systems, and parole and probation systems, but CAD systems, RMSs, and geographic data systems are the most common data sources.
**Computer-Aided Dispatch System**

A computer-aided dispatch system is a highly specialized system that uses telecommunications and geographic display to support police dispatch and response functions (as well as those of public safety agencies, such as fire and ambulance services). Police departments use CAD technology to dispatch officers, to keep track of officers’ locations and activities, and to track officer-initiated activity (e.g., traffic stops). Most communication between police officers and dispatchers is recorded in a CAD system. However, a CAD system is not a 911 system, which receives and records actual phone calls from citizens about emergency activity. Typically, a police department transfers key pieces of information about citizen calls for service from the 911 system to the CAD system, which records all information pertaining to dispatched calls. These data are often called unit history because they track officer activity. Typically, one record represents each communication, resulting in multiple lines of data for each call for service.

As noted in Chapter 6, crime analysts do not need all of the information recorded about calls for service to conduct their analyses. The unit of analysis for calls-for-service data is an individual call, not each communication (as in unit history). Hence, for crime analysis purposes, analysts download summary data about calls for service from the CAD system, where there is one record for each call that includes variables relevant for crime analysis, such as time of the call, type of call, time officers dispatched to the scene, and disposition of the call. CAD systems collect, store, and allow downloading of data, but typically they do not include crime analysis capabilities. Other technology is used to conduct crime analysis.

**Records Management System**

A records management system is a data entry and storage system designed especially for police records. Some police agencies enter information directly into the RMS, whereas others download information to the RMS from other software programs, such as CAD or crime report-writing software. Ideally, the RMS contains all relevant data within the police agency and can include separate databases such as crime reports, arrest reports, persons information, property and evidence information, vehicle information, accident reports, field information, calls for service (i.e., snapshot data), and investigations. The contents of RMSs vary, but their purpose, to store crime incidents data and link them with related data, is consistent across different software products and police departments.

In addition to collecting and storing information, an RMS is used to check the quality of data, retrieve incidents, and provide information. Police agency employees, typically called records clerks, check data entry and police reports to be sure the information is accurate and the reports are in compliance with the appropriate laws and departmental policies. Police agencies also use RMSs to search reports and to locate individual reports for court cases and insurance purposes (e.g., accident reports) as well as to obtain lists of cases and summaries (e.g., the Uniform Crime Report). Like CAD systems, most RMSs do not have crime analysis capabilities;
analysts download data from these systems into other software in order to conduct crime analysis.

**Geographic Data System**

A geographic data system creates, maintains, and stores geographic data. Typically, city or county agencies use geographic data systems to create and maintain data concerning parcels, buildings, streets, roads, and highways, and to store aerial photographs and other geographic information to be used by various departments and agencies (e.g., planning, utilities). In addition, such agencies often obtain tabular and geographic data from other sources—such as census information, demographic information, and typological information—and store them along with local geographic data. It is important to note that crime analysts do not collect or maintain the data housed in geographic data systems; rather, they only borrow and use these data in their analyses.

**Data Collation and Analysis**

CAD systems, RMSs, and geographic data systems all produce data that are used in crime analysis, but these are not analysis systems; as noted above, other software is used for crime analysis activities. Crime analysts use four basic types of general desktop software applications to organize data as well as to conduct analyses: spreadsheet software, database management software, statistical software, and geographic information system (GIS) software.

**Spreadsheet Software**

A spreadsheet displays information in rows and columns of cells. Spreadsheet software applications allow users to create and change spreadsheets easily. In spreadsheet software, each unique entry or value is contained in a cell, and the user defines the type of data contained in each cell (e.g., time or date format, numeric or string variable). In addition, cells are usually named by rows and columns (called labels), and the software uses formulas to create relationships between cells. Most spreadsheet applications are multidimensional; that is, they contain multiple individual spreadsheets that can be linked together by formulas. If a change is made to one cell of one spreadsheet, that change is reflected in all other spreadsheets linked to that cell. Some powerful spreadsheet applications support graphics features such as charts and graphs. Many different kinds of spreadsheet software are available; some of the most widely used are IBM’s Lotus 1-2-3 and Microsoft’s Excel.

Crime analysts use spreadsheet software for both data organization and analysis purposes. An analyst typically downloads data into a spreadsheet, links with other databases, and reworks the data (e.g., makes consistent changes to addresses and creates new variables). Crime analysts also use spreadsheet programs for statistical
analysis, as they provide a wide range of basic statistical capabilities. More advanced uses of spreadsheets include the creation of miniature computer programs (called macros) that can automatically execute tasks, such as summarizing data and formatting reports. Because spreadsheet applications are not actual database applications, they can be somewhat limited in their capabilities (e.g., Excel allows only approximately 65,000 records in one spreadsheet).

Database Management Software

Database management software (DBMS) allows users to enter, store, and modify data in and extract data from a database. CAD systems and RMSs are large database management systems that police agencies use to obtain and store data for crime analysis. However, crime analysts also use smaller desktop applications (most commonly Microsoft Access) to organize and analyze data. These database programs facilitate data entry, recognize multiple relationships among records, provide exporting capabilities, create automated reports, and provide powerful query tools, all of which are important in crime analysis. Typically, the analyst downloads data from larger systems into smaller desktop software or, when the agency does not have a large enough system, enters data directly into the desktop software.

Statistical Software

Statistical software accesses data obtained from spreadsheets and DBMS and facilitates data entry. The core purposes of statistical software are statistical computation and data manipulation, and these applications are designed to handle large numbers of records (e.g., more than a million). In recent years, the presentation and table-making capabilities of these applications have been dramatically enhanced. Some crime analysis units use statistical programs such as SPSS (Statistical Package for the Social Sciences), SAS, and StataQuest. However, the use of spreadsheet and DBMS applications is much more common, because advanced statistical functionality is not particularly relevant to everyday crime analysis. Nevertheless, statistical software is available for those analysts who need to conduct advanced data manipulation and analysis that other types of applications cannot handle.

Geographic Information System Software

As noted in Chapter 4, a GIS is a set of computer-based tools that allows a person to modify, visualize, query, and analyze geographic and tabular data. It is a powerful software tool that enables the user to view the data behind geographic features, combine various features, manipulate data and maps, and perform statistical functions. As examples throughout this book highlight, crime analysts use GIS software primarily to bring data together through geographic variables, to analyze spatial relationships, and to display data through maps. A GIS utilizes data from other
sources and does not have a specific capability for entering data even though it may have limited data entry, manipulation, and statistical functions. The most common GIS software packages used in crime analysis today are produced by ESRI (Environmental Systems Research Institute) and MapInfo.

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**Dissemination**

Crime analysts use six basic types of software applications, alone or in combination, to create reports, publications, and presentations: word processing software, spreadsheet software, graphics software, publication software, presentation software, and software related to use of the Internet and intranets.

**Word Processing Software**

Probably the most commonly used nonquantitative software is **word processing software**, which allows users to create, edit, and print documents (e.g., Microsoft Word and Corel WordPerfect). Word processing software primarily supports the creation and manipulation of text, but it can also enable users to incorporate tables, charts, and pictures in documents. Crime analysts use word processing software regularly to create memos, reports, and bulletins.

**Spreadsheet Software**

In addition to using spreadsheet software to enter, manipulate, and analyze data, as described above, crime analysts use such software to create tables and charts that can stand alone, be inserted into reports or presentations, or be posted on the Web. Crime analysts often use the automated functions of spreadsheet software to produce reports that are disseminated repeatedly.

**Graphics Software**

**Graphics software** enables users to create and manipulate pictures and other images. The graphics programs widely used in crime analysis include Corel Paint Shop Pro and Adobe Photoshop. A crime analyst might use this software for tasks such as adding labels to an aerial photograph for a report, cropping a picture of a suspect, or creating a logo for the department’s crime analysis unit.

**Publishing Software**

Crime analysis units often produce flyers, brochures, newsletters, and/or electronic reports for the public. **Publishing software**, such as Microsoft Publisher and Adobe
Illustrator, allows users to create professional-looking products. Additionally, software is available, such as Adobe Acrobat, that allows users to create electronic versions of reports that cannot be modified by others.

**Presentation Software**

Presentation software, such as Microsoft PowerPoint, allows users to create visual aids that can enhance in-person presentations of information, such as the presentations crime analysts often give to police personnel, community members, and fellow analysts at conferences. The slides this software creates can include text, tables, charts, maps, and other images. The software also allows users to prepare notes and outlines for presenters and includes printing capabilities.

**Internet/Intranet**

The Internet is a global network that connects millions of computers. (The terms Internet and World Wide Web are generally used interchangeably, although technically not everything on the Internet is also on the Web.) Independent computers connect to the Internet through a wide range of software applications (e.g., Netscape, Explorer). In recent years, police departments have been using the Internet to disseminate information to their communities (and to others) about crime and police activities. Many police department Web sites post maps and/or allow users to access specialized mapping applications so that citizens can find out about crime in their area. (For further discussion of police agencies’ use of the Internet, see Chapter 14.)

In recent years, many public and private organizations, including police departments, have established computer networks known as intranets. An intranet functions much like the Internet, but it connects only a limited number of users, usually people associated with a particular organization. It is accessible only to selected users (usually organization members, employees, or other associated individuals), who log on with user IDs and passwords, and has security features (typically called a firewall) designed to prevent unauthorized individuals from gaining access.

Police departments have begun to use intranet applications to disseminate crime analysis information to their personnel. In many cases, information is provided through a crime mapping application that allows officers to query recent crime incidents and other activity by location and time period. The software that police departments use for both Internet and intranet dissemination of information is typically managed by the departments or their cities but is often created by outside vendors.

**Specialized Crime Analysis Software**

The kinds of software discussed so far have all been adapted for use in crime analysis but were not created specifically for that purpose. In addition to these, a number of
Software applications have been created specifically for crime analysis. These include smaller applications for data entry and creating reports as well as more comprehensive programs that provide numerous capabilities needed for the crime analysis process. Most of the applications designed specifically for crime analysis have been created to perform functions that are not available in other existing software. For example, the ATAC (Automated Tactical Analysis of Crime) software that accompanies this book was created to provide users with techniques specific to tactical crime analysis because these functions were not available previously in one comprehensive program.

The following list of software programs designed for crime analysis, compiled by the Police Foundation (2003), is in no way intended to be comprehensive; it is offered simply to illustrate the range of programs currently available.

- **ATAC** (Bair Software, Inc.; http://www.bairsoftware.com): This tactical crime analysis software allows data entry, manipulation, and analysis. It also provides temporal analysis and a function that identifies potential crime patterns. (This software is included on the CD-ROM that accompanies this book.)
- **Crime Analysis Extension** (National Institute of Justice and ESRI, Inc.; http://www.ojp.usdoj.gov/nij/maps/software.html): This free mapping software was developed through a partnership between the U.S. government and a software vendor; it contains specific mapping functions used in crime analysis.
- **CrimeStat** (Ned Levine and Associates; http://www.icpsr.umich.edu/NACJD/crimestat.html): This spatial statistical software works with GIS software to allow users to conduct analyses with various techniques using incident locations.
- **CrimeView** (The Omega Group; http://www.theomegagroup.com): This software links directly to an agency’s CAD system or RMS and provides specific crime mapping and analysis techniques.
- **GeoBalance** (Corona Solutions; http://www.coronasolutions.com): This redistricting software identifies the best possible arrangement of police areas (such as beats and districts) based on several statistics.
- **RCAGIS** (Regional Crime Analysis Geographic Information System) (U.S. Department of Justice; http://www.icpsr.umich.edu/NACJD/RCAGIS): This software is intended for use by numerous agencies in a region with the same data format (all the data are linked into the software automatically). It includes various crime analysis and crime mapping functions.
- **School COP (School Crime Operations Package)** (Abt Associates; http://www.schoolcopsoftware.com): This mapping software program is specifically designed to allow users to enter, analyze, and map incidents that occur in and around schools.
- **Staff Wizard** (Corona Solutions; http://www.coronasolutions.com): This software helps to optimize the placement of current staff (patrol deployment) as well as determine staffing needs.

In addition to these commercially produced programs, many police departments have created their own software to perform crime analysis. For example, one analyst
created a data entry module and database in Microsoft Access because his department had not yet acquired a records management system; he simply had no other way of accessing electronic data for analysis. Another analyst with advanced computer programming skills created a program in Visual Basic to speed up the process of address cleaning (bringing the time needed down from 4 hours to 30 seconds).

In many cases, because crime analysis is a fairly young discipline and police data are unique by agency, analysts and agencies find that off-the-shelf software is not a good fit with their data, analysis, and presentation needs. As a result, they hire computer experts to customize existing software or create new software that provides the functionality they require.

Summary Points

This chapter has provided an overview of the hardware and software used in crime analysis. The following are the key points addressed in this chapter:

- Crime analysis is a discipline that relies heavily on computer technology, both hardware and a variety of software programs.
- The hardware used in crime analysis is similar to that used in other disciplines that rely on the help of computers; it includes desktop personal computers, laptop computers, servers, laser printers, plotters, scanners, and digital cameras.
- Crime analysts obtain secondary data from three main kinds of data collection and storage systems: computer-aided dispatch systems, records management systems, and geographic data systems.
- A CAD system is a highly specialized system that uses telecommunications and geographic display to support police dispatch and response functions (as well as those of public safety agencies, such as fire and ambulance services).
- An RMS is a specialized data entry and storage system that contains relevant data within the police agency.
- A geographic data system creates, maintains, and stores relevant geographic data. Such a system is usually maintained at the city or county level, and crime analysts “borrow” data from it.
- Crime analysts use four basic types of general desktop software applications to manipulate data and conduct analyses: spreadsheet software, database management software, statistical software, and geographic information system software.
- Crime analysts use six basic types of software applications to create reports, publications, and presentations to communicate their analysis findings: word processing software, spreadsheet software, graphics software, publication software, presentation software, and software related to use of the Internet and intranets.
- Among the software applications that have been created specifically for crime analysis are small applications for data entry and creating reports as well as more comprehensive programs that provide numerous capabilities needed for the crime analysis process.
• Many police agencies do not find off-the-shelf software to be a good fit with their data, analysis, and presentation needs, so they hire computer experts to customize existing software or create new software that provides the crime analysis functionality they require.

Exercises

Exercise 7.1

Many local and county police agencies allow citizens to observe the 911 call-taking process and/or the work that takes place at agency dispatch centers. It is very important for anyone using police data for analysis to understand how those data are collected. With permission from your instructor, request a “ride-along,” not with an officer but with your local 911 and/or dispatch center. While you are there, think about the following issues:

• How are calls documented in the system?
• Do the call takers use mapping to identify addresses and/or locate officers?
• Do the call takers use numerical codes or literal descriptions (words) to label crime and other activity?
• How can the data collected by call takers be accessed at a later time?

Exercise 7.2

Go to three of the Web sites mentioned above in the list of available crime analysis specialty software, and review the purpose and nature of each of the three software programs. Why do you think these software programs were developed?

Notes

1. Specific information about the software provided with this book is contained on the accompanying CD-ROM.
2. Crime analysts use “unit history” for the specific purpose of assessing staffing needs and scheduling officers, because it provides information about officers’ specific activities on individual calls.