Geography & Public Safety

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The Office of Community Oriented Policing Services (COPS) and the National Institute of Justice (NIJ) are excited to bring to you the premier issue of *Geography and Public Safety*, a quarterly newsletter that examines four substantive areas. "Practice" examines practices related to crime mapping and problem analysis; "Policy" describes policy related to the use of mapping to better understand crime; "Technical Tips" aids practioners in completing specific spatial analysis tasks. "News Briefs" and a list of upcoming geography events, such as conferences and training opportunities, complete the newsletter. This newsletter will be useful for police practitioners at all levels who are interested in geography and its relationship to crime, as well as for researchers, policy makers, and others interested in understanding the impact of geography on public safety.

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What Is Applied Geography for the Study of Crime and Public Safety?

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With widespread use of desktop Geographic Information Systems (GIS) since the mid-1990s, crime analysts have been using geographic principles to understand law enforcement and public safety issues. During the last decade crime mapping has expanded from tracking criminal activity on maps with dots or pushpins to using advanced spatial statistics to understand and analyze crime. In the coming years, crime analysts will be able to use applied geography to assess why crime occurs where it does and the characteristics of high-crime environments.

This publication was developed to assess the many ways crime mapping can be used to advance public safety. Ideas for this publication were drawn from two books—*Mapping the Next Millennium: How Computer Drive Cartography Is Revolutionizing the Face of Science*[1] by Stephen S. Hall, and *Rediscovering Geography: New Relevance for Science and Society*[2] by the National Geographic Council's Rediscovering Geography Committee.

NIJ National Institute of Justice

maps mapping & analysis for public safety

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Mapping the Next Millennium looked at the impact of digital cartography on common geographical analysis and on mapping a wide variety of spatial patterns. Hall calls this a "renaissance" of geographical thinking:

> *Here, we are poised to enter the next millennium, and we find ourselves in the midst of what is arguably the greatest explosion in mapping, and perhaps the greatest reconsideration of "space"... (p. 6)*

Hall refers to the way in which computerized mapping has had an impact on understanding crime and public safety problems. Today, mapping is a common procedure for many police departments, emergency management agencies, and homeland security organizations.

Where Hall described the "explosive" growth of new mapping technology, *Rediscovering Geography* describes the resurgence of geography as an aid in solving society's problems. An early chapter provides an accurate description of why geography is needed when studying crime and public safety:

> *Geographers focus on "real world" relationships and dependencies among the phenomena and processes that give character and location to any location or place. Geographers also seek to understand relationships among places: for example, flows of people, goods and ideas that reinforce differentiation and enhance similarities. (p. 10)*

No place is unaffected by neighboring places. The book's authors suggest that by understanding the way that one geographic place affects surrounding places, a person can understand why events happen in that place and how they happen. When translated to the field of crime mapping, for example, if an analyst knows that a poor, overcrowded neighborhood is located near a wealthy neighborhood, he might predict that robberies would occur most frequently on the border between the two neighborhoods.

Together, the two books show that a combination of geographic technologies, theories, and principles has helped create effective applied science. During the past decade, such technology has helped research and practice converge, helping officers analyze complex crime and public safety problems with a full complement of tools—including those used for data capture, visualization, analysis, modeling, and problem solving. Geographic principles connect social theories with observations by using geographic data to make decisions about policing practices and to influence public safety outcomes.

Using Software for Crime Mapping

In the 1980s, geographic analysis principles were operationalized into software for use in analysis. This software enabled researchers to test the theories propounded in earlier decades. Public safety problems and policies can now be explored with software programs that map and analyze the spatial aspects of crime and public safety data.

The most notable software used for crime mapping is Geographic Information System (GIS) software. This software helps researchers visualize data, assess human behavior over geographic space, follow spatial patterns, validate theories, and examine how geography affects crime and public safety. With widespread GIS software availability, crime mapping has become a common practice for studying the spatial aspects of crime and making decisions about how best to use law enforcement and public safety resources.

Using Applied Geography to Understand Crime and Public Safety

In addition to mapping crime with computer software, crime analysts combine applied geography, a type of research that uses geographic principles to solve problems, with criminology theories, often examining a range of issues about society and the environmental factors that contribute to crime.

Applied geography informs police chiefs and other decision-makers about the physical environments in their jurisdiction, using data from two primary sources. The first is incident data, which include data from calls for service, incidents, or arrests. The second is base data, or data that contain information about the physical, demographic, and economic makeup of the jurisdiction. Base data include street information, building footprints, land use data, and census data. The combination of applied geography, crime theory, and crime mapping help crime analysts turn a working theory into a real-time solution.

GPS Technology: Mapping in the Future

Around 10 years ago, law enforcement officers began to leverage new desktop GIS software and automated dispatch and records data to support crime intervention and suppression strategies. Today, the widespread availability of global positional system (GPS)-equipped devices and the spatial data sets they can produce have set the stage for another fundamental change. These technologies will help analysts evaluate long-standing questions about where offenders spend their time and how officers patrol areas.

Putting Theory into Practice

The foundations of crime mapping came from environmental criminology, the study of how crime and victimization relate to geographic places and the individuals and organizations that occupy those places. They include a variety of theories, such as defensible space, situational crime prevention, routine activity theory, analysis of crime patterns, and social disorganization theory. These theories have been used as a basis for inquiry in the field since the 1950s, but until recently had not been tested.

Problem-oriented policing puts the results of crime mapping, applied geography, and theoretical analysis into practice in the field. In addition to helping investigate individual crimes, this work has supported law enforcement in field and special operations, staffing and deployment decisions, and event planning. Crime and public safety analysts have begun to use crime data to answer questions about budgets, community development and redevelopment inquiries, environmental impact reports, traffic engineering considerations, and more.

These practitioners must examine empirical research in their analysis to respond to crime and other law enforcement challenges proactively. Although GIS system and spatial analysis data address the underlying elements that lead to crime and disorder, without external empirical research, crime analysts can only decide how to respond to an immediate situation and will have less success implementing a long-term plan for patrolling and intervention. For instance, analysts may observe a hot spot on a city map and send patrols to resolve the situation; however, studying empirical research would help them decide how to patrol the area over the next year, assess what factors were causing crime in the area, and devise a way to intervene. Analysts who recap crime counts and map locations without applying the lessons of research are acting only as "crime summarists."

Creating Policy to Prevent Crime

Once research and technology have been combined to produce a working practice, law enforcement may be interested in proposing policy solutions to city officials, and operational decisions about crime and public safety problems. Policy implementation has six outcomes, the first two of which rarely occur:

1. Nothing happens.
2. The problem completely vanishes.
3. The problem diminishes.
4. The problem disperses.
5. The problem intensifies.
6. The problem is replaced by another problem.

The last possibility can occur following any of the other outcomes. Often, one problem is replaced with another because of open opportunities to move into a geographic area or because a conflict occurs and the more pervasive problem begins to dominate.

GIS and spatial analysis software can help visualize and analyze trends that result from new policies. When analysts and policymakers understand where problems are, they can create focused solutions to resolve them, or follow them if they change.

Putting It All Together

To support practical decision-making, applied geography uses theories and techniques that describe where crime or other public safety problems occur and why they occur in those places. Crime analysts can use theories and research to make real-time decisions for practice. They integrate the spatial and geographic aspects of criminology into police planning, problem solving, and catching particular offenders, bringing the researchers and practitioners together.

Intention for This Newsletter

As a community, we should commit to delivering high-quality geographical research and practice. This will improve the effectiveness of police departments and other public safety agencies that use these applied techniques and strategies to develop better policies.

This publication hopes to provide a resource for applying geographic principles to law enforcement problems and public safety issues. Crime-related topics may include geographic profiling, resource deployment, urban geography. Other topics may include motor vehicle crashes, parolee and probationer tracking, and evacuation planning. We will also highlight important events for practitioners and policymakers, discuss work being conducted through the National Institute of Justice's Mapping and Analysis for Public Safety (MAPS) program, and review books and other materials.

Informative discussion on a variety of topics will demonstrate that better policy decisions can come from these forms of analysis. Technology articles will illustrate how applying geographic principles to spatial analysis can be used to solve problems. Other articles will discuss how policy results from practical decisions, such as where to deploy resources or how to change agencywide practices.

We hope that this publication will enable readers to apply geographic principles in their practices and encourage further crime research. Future issues will entertain ideas from the field—please send topic ideas to Ronald.Wilson@usdoj.gov.

Notes

1. Hall, Stephen S., *Mapping the Next Millennium: How Computer Driven Cartography Is Revolutionizing the Face of Science.* New York, New York: Vintage, 1993.

2. National Research Council Rediscovering Geography Committee, *Rediscovering Geography: New Relevance for Science and Society,* Washington, D.C.: National Academies Press, 1997.

Targeting Crime in Hot Spots and Hot Places

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Crime has a tendency to concentrate in specific problem areas, known as "hot spots," rather than spreading out evenly across space. Crime can be extremely localized and varies widely from address to address. Hot spots are areas with a greater than average number of criminal or disorder events or higher than average risk of victimization.

Crime theories and practical studies support the idea that focusing police efforts at crime hot spots can effectively reduce crime. Efforts may include directed patrols[1] or problem solving for individual hot spots. Situational crime prevention measures that address criminogenic characteristics (e.g., vacant lots, bad lighting) of a place may result in longer lasting effects. Additionally, research has shown that hot spot policing may improve crime reduction beyond the boundaries of the hot spots.

Crime analysts in police departments work with crime incident data to find and analyze hot spots and provide information to crime and justice professionals. They often work with Geographic Information Systems (GIS) software to create crime maps to visualize data and identify patterns and hot spots. GIS and related mapping and analysis tools have been advancing to include sophisticated statistics software that allows rigorous analysis of crime hot spots and testing against

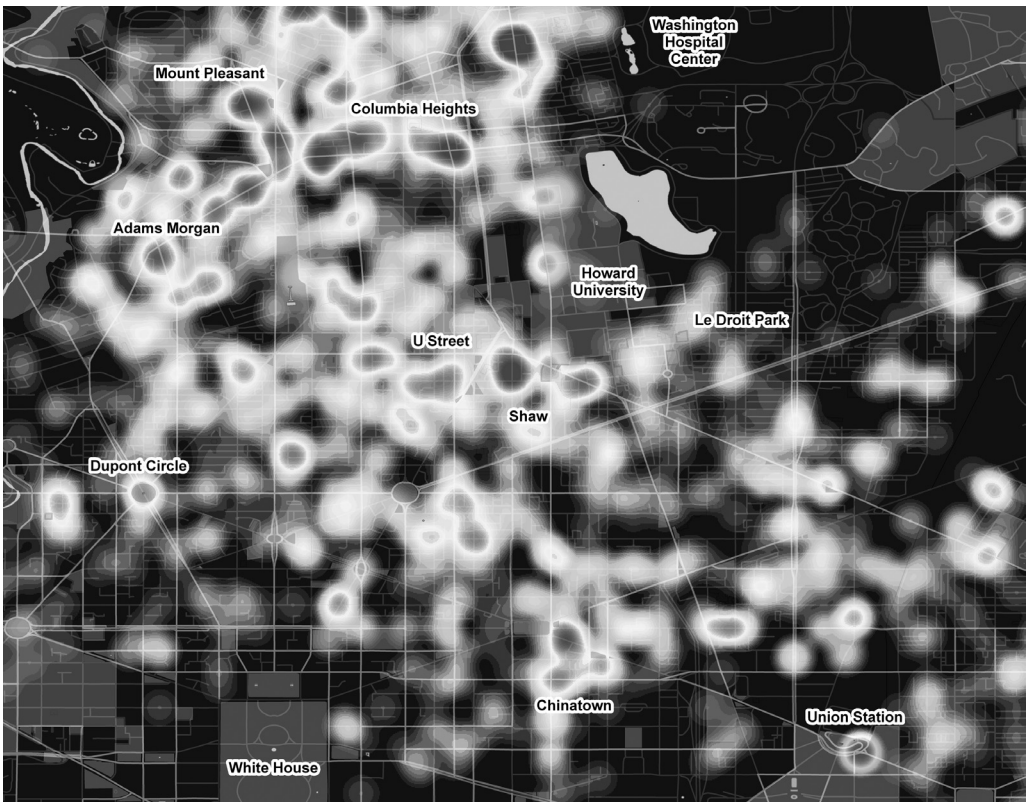

Figure 1. This is a hot spot map for robberies during 2007 in Washington, D.C. The Adams Morgan-Columbia Heights area, U Street/Shaw, and Chinatown have experienced gentrification in recent years, with homicide rates going down. Robberies remain a problem in specific locations. The hot spot map identifies places and street segments that help the police deploy resources and resolve crime problems in these places.

random patterns and variation. In addition to statistical analysis, researchers use spatial analysis to devise problem-solving approaches and reduce crime and disorder.

What are "Hot Spots" and "Hot Places"?

A neighborhood or cluster of blocks may be a crime hot spot. However, places (e.g., a bar, liquor store, bus stop, or park), street segments, or stretches of road may also be considered hot spots. Because of their small geographic size, these spots are usually referred to as hot places. Crime hot spots and places can be very different in size, and the techniques used for mapping and analyzing them will vary depending on their geographic level.

What other factors make an area hot?

Crime may occur more frequently at "hot" times of the day and week. For example, assaults most frequently occur between 3:00 and 7:00 a.m., where as residential burglaries are more likely to occur during daytime hours on weekdays.

Theories for Countering Crime in Small Places or Individual Residences

The term "places" describes small areas—such as residences, bars, or restaurants—that are known spots of criminal activity. When assessing hot places and creating a crime intervention strategy, researchers ask questions about crime, police response, and analysis techniques.

For instance, a researcher may ask, "Which bars experience frequent assaults and which do not?" Once they have identified these hot places, analysts use crime theories to assess and respond to the problem.

Routine activity theory. Routine activity theory helps explain why crime is often concentrated at certain places. This theory suggests that an establishment's management affects the behavior of its patrons. For instance, a bar with frequent assaults may employ staff who do not regulate the behavior of patrons to minimize the chances of an assault.

Behavior regulation has three effects. It directly prevents criminal activity through early intervention (e.g., controlling the number of drinks a patron can consume), it attracts customers who desire a well-regulated location over a weakly regulated place (and are less likely to create problems), and it repels customers who desire a weakly regulated location over a well-regulated place.

Police response. Police response to a problem varies depending on the scale of the problem. Offenders may be attracted to places where people congregate (e.g., bars, bus stops, parks). These places present crime opportunities and have a large number of potential victims with minimal levels of social control.

Situational crime prevention measures (e.g., improving lighting in a high-crime area) or other specific responses (e.g., working with agencies that regulate liquor licensing to issue sanctions) may help reduce crime at a hot spot or hot place. Increased police presence can also help guard these places and reduce opportunity for crime. Several patrols could come to a crime hot spot in succession, each remaining for 10 or 15 minutes.

Theories for Countering Crime in Neighborhoods

Neighborhoods are often too large for concentrated patrols. Researchers have identified a number of theories that may explain and help control neighborhood violence.

Landmark discoveries. In *Social Factors in Juvenile Delinquency* (1931), Shaw and McKay observed persistent concentrations of deviancy in the 1920s. They suggested that some neighborhoods had high levels of juvenile delinquency year in and year out, decade after decade, regardless of who lived in the areas. Since that time, many explanations for differences in neighborhood crime levels have surfaced. Most of these theories focus on local residents' ability to control deviancy.

Social disorganization theory. This theory suggests that people's natural ability to control deviancy in their neighborhoods is impaired in some areas by constant residential turnover and the number of residents who leave the neighborhood. These changes disrupt social networks or prevent them from forming. Since these networks are responsible for most social control in neighborhoods, their absence leads to higher levels of deviancy. Other factors, such as poverty and racism, also have been identified as undermining social networks.

Social efficacy. Social efficacy is a characteristic of groups of people, or "the willingness of local residents to intervene for the common good" (Sampson, Raudenbush, and Earls, 1997). Social efficacy may help prevent crime—neighborhoods that have high social efficacy have less crime and disorder.

Broken windows theory. The broken windows theory claims that in most well-functioning neighborhoods, small transgressions of social norms (e.g., failure to keep one's yard tidy) result in social pressures to bring the offending party into compliance. Once a place becomes untended, it undermines the willingness and ability of residents to enforce social order. Consequently, further deviancy occurs, residents experience withdrawal and fear, and the neighborhood begins to spiral downward.

Crime opportunity theories. Routine activity theory and related theories point to crime opportunities as the principal cause of crime. Rather than concentrations of offenders or the absence of social controls, opportunity theories suggest that analysts should look for concentrations of crime targets. For example, a dense urban neighborhood with no off-street parking will have many cars parked on the street and may become an area hot spot for thefts from vehicles.

Another example might involve a suburban subdivision with dual-income families that have few people at home

during weekdays. Since the property is unprotected, their neighborhood can become an area burglary hot spot. In this situation, several layers of hot spots can exist simultaneously. Some streets in the suburban neighborhood may have greater numbers of burglaries, and some of the homes on these streets may be broken into multiple times.

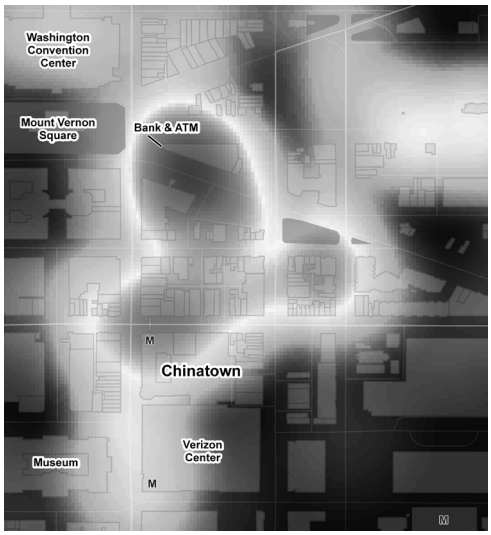

Figure 2. This map shows hot spots at the scale of specific places or streets in Washington, D.C. There is a higher rate of robberies around the Metro station entrance, as well as a more intense hot spot two blocks north. Once the hot spot has been identified, an analyst can look at specific incident reports. Most of the robberies in the hot spot involved victims who were using the ATM, often in the evening or later at night. As a result of the analysis, the bank has since limited the ATM hours to the daytime.

Identifying and Analyzing Hot Spots

Identifying Hot Spots

A number of approaches can help identify crime hot spots. These include creating density maps and using spatial statistics.

Analysts may want to use crime incident data and call-for-service data in hot spot analysis. Call-for-service data capture reports of disturbances and other forms of disorder that are not collected in crime incident data.

Identifying incidents on multiple geographic levels. Some hot spots may cluster in small areas, such as street segments, street corners, and other such places. These could include a small entertainment district or strip of bars that has a high number of assault incidents clustered there. For identifying these types of hot places, point mapping is also needed. For incidents in a particular neighborhood or cluster of blocks, analysts may wish to map with graduated color (i.e., choropleth) maps and density maps.

Creating Density Maps

Kernel density maps show crime rates as they vary continuously across space without boundaries. Analysts use these maps to identify crime hot spots. Areas with high concentrations of crime stand out on density maps.

GIS packages with raster (i.e., grid) mapping capabilities, such as ArcView Spatial Analyst,[2] can be used to create density maps. CrimeStat,[3] a free software program for analysis of incident, or "point," data, also has kernel density analysis capabilities.

Density maps are created when an analyst takes a point map of crime incidents (or calls for service) and places an arbitrary grid on the map. Each grid cell is then assigned a score based on the number of incidents (points) in each cell. The score also takes into account the number of points in nearby cells or within a search radius determined by the analyst. A high score indicates a high incidence of crime in a particular area.

The result of this mapping technique is a grid map. The color of each grid cell varies based on the cell's score. Cells with high numbers of points may be shaded bright red, to indicate high crime rates while areas with lower levels of crime may be shaded cooler colors.

Using Statistical Tests to Find Hot Spots

When analysts want to create and examine a crime map, they must make a judgment call about the size of the geographical area portrayed on the map. Once analysts have created a map, spatial data analysis software can be used to apply statistical tests that help identify areas with high levels of crime and analyze crime data. Statistical tests can help find where crime is clustered in certain places or areas on the map compared with crime that occurs randomly.

Software for hot spot analysis. Two software packages that can be used for hot spot analysis are CrimeStat and GeoDa.[4] Both software packages are free and can be downloaded online.

CrimeStat is used to analyze crime incidents or other types of point patterns. CrimeStat uses point data on a map to produce statistics that indicate clustering, or to what extent crimes cluster in specific areas. A number of statistical tests can provide a single statistic, or number, which describes how much clustering occurs across the map. Statistical tests available in CrimeStat include the Nearest Neighbor Index (NNI), Moran's I, and Geary's C statistic.

CrimeStat and GeoDa use another type of statistics to compare and analyze clustering in more localized parts of a map, for example, finding several adjacent clusters of high or low rates of crime, or finding an area with low crime rates that is adjacent to several crime hot spots. These statistics are called Local Indicators of Spatial Autocorrelation (LISA) statistics. Analysts can also create LISA maps to show where clustering is occurring.

More information on density mapping and spatial statistical approaches for identifying and analyzing crime hot spots is available in a 2005 publication from the National Institute of Justice entitled *Mapping Crime: Understanding Hot Spots.* Information on using CrimeStat, links to the GeoDa web site, and information on training opportunities can be found at www.ojp.usdoj.gov/nij/maps.

Conclusion

Spatial data analysis software has advanced in recent years, giving researchers the ability to perform a more sophisticated analysis of crime hot spots. Being able to identify these hot spots and hot places, and direct policing efforts and crime prevention measures to them, has become a promising way to reduce crime.

Effective crime reduction, however, also requires law enforcement agencies to hire crime analysts. Analysts should be encouraged to learn more advanced analysis techniques to better identify crime hot spots and to understand the underlying factors that influence hot spot patterns.

References

Eck, J.E., S. Chainey, J.G. Cameron, M. Leitner, and R.E. Wilson. *Mapping Crime: Understanding Hot Spots.* Washington, D.C.: U.S. Department of Justice, National Institute of Justice, 2005. NCJ 209393.

Sampson, R.J., S.W. Raudenbush, and F. Earls. "Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy," *Science*, 227(1997): 918–924.

Shaw, C.R., and H.D. McKay. *Social Factors in Juvenile Delinquency*, Vol. 2, No. 13. Washington, D.C.: U.S. Government Printing Office, 1931.

Notes

1. Directed patrols are police units that respond to incidents or places that need special attention.

2. ArcView Spatial Analyst can be found online at www.esri.com/software/arcview.

3. CrimeStat was developed by Ned Levine and Associates, through a grant from the National Institute of Justice. CrimeStat can be found online at www.icpsr.umich.edu/NACJD/crimestat.html.

4. GeoDa was developed by Luc Anselin and other researchers at the Spatial Analysis Laboratory (SAL) at University of Illinois, Urbana-Champaign. GeoDa can be found online at www.geoda.uiuc.edu.

Data sources:

Map data comes from the D.C. GIS, which is run by the District of Columbia Government's Office of the Chief Technology Officer (OCTO). http://dcatlas.dcgis.dc.gov

Crime incident data comes from the Citywide Data Warehouse program of the D.C. Office of the Chief Technology Officer (OCTO) and the Metropolitan Police Department (MPD). http://data.octo.dc.gov/Metadata.aspx?id=3

Disclaimers:

"The data made available here have been modified for use from the original source, which is the Government of the District of Columbia. Neither the District of Columbia Government nor the Office of the Chief Technology Officer (OCTO) makes any claims as to the completeness, accuracy, or content of any data contained in this application; makes any representation of any kind, including, but not limited to, warranty of the accuracy, or fitness for a particular use; nor are any such warranties to be implied or inferred with respect to the information or data furnished herein. The data are subject to change as modifications and updates are complete. It is understood that the information contained in the dataset is being used at one's own risk."

Using ModelBuilder for Geographic Information System Tasks

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Crime analysis requires a Geographic Information System (GIS)—a software program for capturing, managing, and analyzing geographic and spatial data—to process data and create data products (e.g., printed maps, pamphlets) for a wide audience. Crime data can change daily, which makes producing maps and other products a daunting task for many analysts. Automating regular tasks will save time and allow for more sophisticated tools for analysis.

Crime analysts need a mapping program that allows them to regularly update data in a timely fashion. Environmental Systems Research Institute's (ESRI) ModelBuilder is a component of a type of GIS software called ArcMap[1] that allows for drag-and-drop development of complex geoprocessing tasks (e.g., placing points on the map based on addresses, summarizing data). It helps crime analysts expedite their daily geoprocessing tasks for map production.

Advancing Earlier Modeling Tools

ESRI's ModelBuilder is a drag-and-drop process modeling environment that comes standard with ArcMap version 9.x. ModelBuilder is an advancement of ArcView 3.x's Geoprocessing Wizard Extension. Where the Geoprocessing Wizard was limited to tasks like spatially joining, merging, and clipping data, ESRI introduces all of ArcMap's functional capabilities (e.g., spatial analysis, geoprocessing) into the Toolbox. A large number of different tools and tasks can be strung together in the literal sense of a systems technology: data go in, a process occurs, and data come out. The potential to string complex tasks together and automate them to run regularly makes ModelBuilder an attractive option for any Crime Analysis Unit.

Introducing the User Interface

Getting started.

Press the menu button to open ArcToolbox as a window in ArcMap. This window is similar to the Table of Contents window.

- Toolboxes can be expanded by clicking the [+] sign to the left of the toolbox symbol.
- Toolboxes are arranged by task subdivision (e.g., Geoprocessing), and by extension (e.g., Spatial Analyst). This arrangement allows users to expand levels of tools within this arrangement, and create customized toolboxes to contain frequently used tools.

Note that some toolboxes require users to license extensions. Check license availability with the Desktop License Manager, which can be found under the ArcGIS install directory.

Finding and using tools.

- The "Index" and "Search" tabs at the bottom of ArcToolbox help analysts locate tools. The "Index" tab lists tools by title, and the "Search" tab will find any word within the tool's title and description.
- Double-click tools to use them.
- When a tool is being used, a window interface will request input and output data locations[2] as well as parameters available for each tool. Input data can include raw data, layer files, and selections from the ArcMap project. Output data can be saved to shapefiles or feature classes in a geodatabase.
- To create a new toolbox, right-click at the top of the tool tree and select "new toolbox." This toolbox stores models, scripts, and tools within one ".tbx" file.

- Initially, the new toolbox will be placed in the "Documents and Settings" folder in the application data. Accessing or transferring these ".tbx" files is impossible without system administrator rights. However, a new feature to ArcMap version 9.2 lets a user create and store toolboxes in geodatabases.
- Name the new toolbox with a clear description and title.
- Create a new model by right-clicking on the new toolbox and selecting "New Model."
- Right-click and select "edit" to view the blank ModelBuilder stage.
- Drag tools from existing toolboxes onto the model window. Tools that are dragged onto the window will require blank input and output data locations. Double-clicking the tool within a model will bring up that tool's interface window. Users can establish data paths here.

The following section describes two ways to use ModelBuilder for crime analysis.

How to Geocode Data with a Composite 1.0 Geocoding Service

Crime data are constantly in a state of flux. Analysts must geocode data regularly to be able to work with timely data. As counties and cities grow more sophisticated in their use of GIS, using multiple mapping layers can ensure that the addresses given in a records system will help analysts find the most accurate location on the map. This example uses two layers, a street file and a geofile,[3] to order the automatic location selection process inherent in a composite address locator.[4]

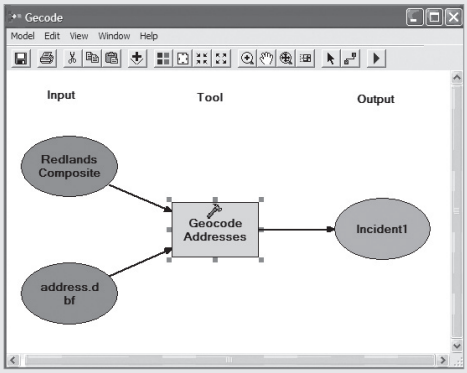
Before beginning the geocoding process.

- Have the necessary geocoding layers available and entered as address locators.
- Keep all geocoding layers and address locator services in one geodatabase.
- Store this model in the geocoding geodatabase while storing output data in an alternate database. This will help reduce schema locks[5] on the geocoding geodatabase while viewing the geocoded incident file. It will also promote a general organization system for geocoded data.

After the toolbox is added to the geodatabase, the folder structure will resemble the following image:

Geocoding data.

- Right-click the geocoding geodatabase and select New>Toolbox.
- Right-click the Toolbox and select New>Model.
- Right-click the newly created model and select edit to see the empty ModelBuilder stage.
- From ArcToolbox, find the Geocode Addresses tool from Geocode Toolbox and drag that onto the model stage.
- Double-click the model and enter the following required parameters by finding or saving them in your working directory:
  - Input Table
  - Input Address Locator
  - Input Address Fields
  - Output Feature Class
- Alternatively, drag the data elements onto the stage from the Table of Contents and connect them to the tool by clicking the Add Connection Tool. The following image depicts what your model stage should resemble, with the systems concepts labeled as Input, Tool, and Output.
- Push the Run button. This model will produce a new geocoded feature class called "Incident1."

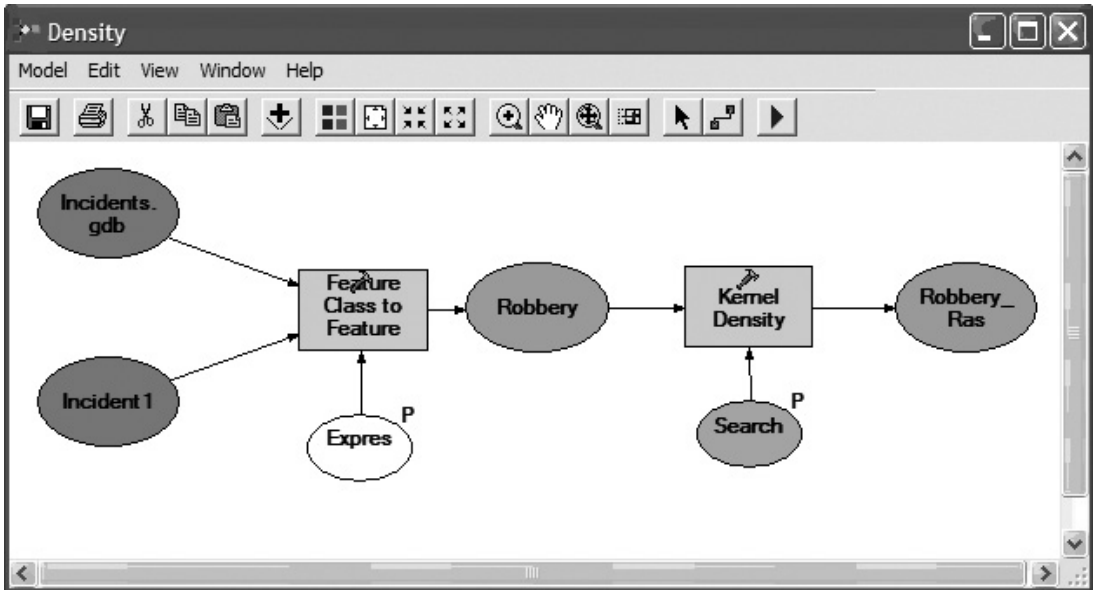


Creating Kernel Densities for Hot Spot Mapping

This section describes a model that will automate the query and hot spot routine that analysts are commonly asked to complete. Specifically, this model will query the newly geocoded Feature Class with a Structured Query Language[6] (SQL) query and then run a Kernel Density[7] tool from Spatial Analyst. The model is assembled in a similar fashion to the geocoding model described above.

This section discusses using the Feature Class to Feature Class tool to create a new feature class from a query. In this case, the tool should break down the full Incident1 feature class into an individual crime type and deliver the Kernel Density output to the Incident geodatabase after the model is run.

- Assume that the model should be flexible and that a user needs the ability to change some of the tool parameters when opening the model.
- Right-click the Feature Class to Feature model and hover over Make Variable>From Parameter. This will bring up a list of parameters that a user would usually enter when double-clicking the tool.
- By selecting parameters here, those parameters become a separate piece of the model.



- Right-click the new floating model component and select Model Parameter. The parameters normally entered for individual tools become parameters for an entire model. The model is then used as a geoprocessing tool. Change the incident's SQL query expression and the search radius in the same window.
- When running kernel densities for hot spots of multiple types of crime, copy and paste the existing model into the model stage. This will create multiple strings of tools.
- The Feature Class to Feature Class tool can set the SQL query expression for each crime type queried, and the Kernel Density tool will produce raster (i.e., pixel-based) densities for each incident feature class a user creates.

Notes

1. More information can be found at www.esri.com.
2. Input and output data locations are the file paths where GIS data can be entered into the geoprocessing tool or where the geoprocessing tool saves created data.
3. Street files and geofiles are two types of geolocating databases. When used in mapping, a geofile places each address in the center of the dominant building on that parcel of land. If there is no entry for that address in the geofile, it will reference the street file system.
4. This document assumes that readers are familiar with address locators and geocoding tabular data.
5. Schema locks prevent an analyst from using and editing data from a different GIS task.
6. Structured Query Language is the common format for database querying. Incidents can be queried by time, date, or any other data related to the incident.
7. Kernel Density is the standard tool used for creating hot spots. An analyst decides what the search radius should be and how the raster produced should be symbolized.

Highlight: California University of Pennsylvania Opens Crime Mapping Center

Tom Mueller, Ph.D.
Assistant Professor, California University of Pennsylvania
Director, Peter J. Daley Geographic Technology Center

With funding from a 2004 grant from the U.S. Department of Justice, the California University of Pennsylvania's Earth Science Department was able to open a Crime Mapping Center that has helped local police departments identify trends while helping students interested in law enforcement build their careers.

The Crime Mapping Center is equipped with Geographic Information System (GIS) technology that allows students to complete weekly and monthly crime-mapping reports for rural police departments. Students have been working during the past several years for the Uniontown, Brownsville, Johnstown, and Bethel Park police departments in southwest Pennsylvania. The students download call-for-service data and process them with GIS software for display on electronic maps. Students then analyze the crime data and show law enforcement officers the spatial patterns of crimes (either all crimes in the area or specific crimes, such as assault or criminal mischief). These maps help police monitor crime in their jurisdictions.

One example of using such data was the creation of a map of criminal mischief complaints that occurred near abandoned buildings. This hot spot map enabled police to track these incidents and look for trends. Students also created maps of the "mean center" (or spatial average) of robbery incidents for three separate months. This allowed the police to examine if robberies were moving in a particular direction and discuss what underlying reasons might be causing the geographical shift. The reports are also used to support applications for federal grants.

Back Row. California University President Angelo Armenti, Brad Clemenson, Mayor Norma Ryan of Brownsville **Front.** Tom Mueller, Chief Stephen Cooper of Connellsville

Many metropolitan police forces have units that concentrate solely on crime mapping, but police departments in this region of Pennsylvania do not have the funding for such units. The partnership with California University of Pennsylvania provides these police departments with important services they could not otherwise afford.

The center benefits students as well. It is staffed by student volunteers interested in applying what they learn in the classroom to real problems facing police. The center is run by the university's Earth Science Planning Club, but any student from the university is welcome once he or she receives training. Working at the center has opened career doors for these students, many of whom have gone on to become professional crime analysts. As analysts, they apply the skills and experience they gained to problems of resource deployment, directed patrols, checkpoint locations, traffic accident avoidance, and community mobilization. They also help their departments address the elements that lead to crime and the demand for police services.

California University of Pennsylvania's Earth Science Department hopes that it will be able to expand its crime-mapping services to more police departments in the future.

New Jersey Report Highlights City's Crime Hot Spots

Crime mapping has helped officers analyze crime patterns in Jersey City, New Jersey. A series of news reports published the week of October 15, 2007 drew attention to the city's crime problem and discussed recent initiatives to stop crime.

Crime is reported every 3 hours in Jersey City. Theft and robbery are the most commonly reported incidents. When crime analysts used a computer mapping program to map recorded incidents, they found four areas in the city with the highest levels of crime—the Martin Luther King Drive corridor, the Central Avenue corridor in the Heights, the Newark Avenue strip, and the Montgomery Gardens public housing complex. Additionally, the city's Newport Centre Mall had the highest crime rate of any single address.

Each of these crime hot spots has its own crime problems. For instance, the Martin Luther King Drive corridor, which encompasses several neighborhoods in the city, has high drug activity. The downtown Newark Avenue area has problems with car break-ins. The Newport Centre Mall deals mostly with theft and shoplifting.

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How Can Jersey City Reduce Crime in Public Housing Complexes?

Within the city's top 10 crime hot spots are three public housing complexes, including the Montgomery Gardens public housing complex, suggesting that officers must find ways to regulate crime in these area. New Jersey Housing Authority Director Maria Maio, as quoted in the *Hudson County Now,* suggests the high crime rates may have to do with the way the buildings are laid out. She said, "These are dense, open areas where everybody has access, creating a lot of traffic and activity. At Booker T. Washington (housing complex), there is a vast no-man's land at the basketball courts, and that's where a lot of the crime happens."

Experts hope that housing demolition and renovation efforts can be used to reduce crimes in these complexes. The city has put in progress a plan called Hope VI that will demolish these buildings and replace them with smaller housing units and a mixture of low- and moderate- income homes.

Police Use COMSTAT to Combat Crime

In their effort to target criminal activity, the Jersey City police reintroduced the COMSTAT program in March 2006. COMSTAT is similar to the New York Police Department's famous crime-reducing initiative CompStat. Using COMSTAT, top officers to meet twice a month to review crime statistics and maps to find crime patterns and trends. This information is used to decide the best way to distribute law enforcement and combat crime. Additionally, the COMSTAT program holds officers accountable for crime in their jurisdictions. Public officials say COMSTAT has reduced violent crime by 8 percent, and nonviolent crime by 13 percent.

But changes in policing and public housing are only part of Jersey City's initiative to target crime hot spots. Other initiatives may include building taller downtown buildings to drive up real estate prices, funding better street lighting, and working toward a greater police presence. Crime mapping has helped the city understand where to start.

For more information, see: www.nj.com/hudsoncountynow/index.

How to Understand Crime "Blobs" on a Map

Crime maps are created when analysts use software to mark each reported crime in a given area over a certain period of time. They place a grid over the map and measure the crime density within each square on the grid. With a little bit of number crunching and the use of specialized software, they can show where in a given area crime rates are highest, and where crime is not a problem. An article by Rob Gebeloff in Newark's *Star-Ledger* describes how to understand mapping data for crime observed in Newark, New Jersey over the past 2½ years using a map with 34,000 points.

For more information, see: http://blog.nj.com/statattack/2007/10/whats_the_deal_with_those_crim.html.

New Jersey Makes Crime Maps Available to the Public

Newark's *Star-Ledger* and the *Jersey Journal* have placed crime maps and incident information on the web and made them available to the general public. Data cover crime that occurred in Jersey City between January 1, 2006 and July 23, 2007 and crime in Newark between January 1, 2005 and August 1, 2007.

For more information, see: www.nj.com/news bythenumbers.

News Bites

- The Chicago Police Department's Citizen and Law Enforcement Analysis and Reporting (CLEAR) system won Harvard University's 2007 Innovations in American Government Award. The CLEAR system provides real-time crime data and allows police agencies to share criminal data.
- Police in Fargo, North Dakota, have been using a new crime mapping system to examine crime patterns and target criminal activity. The system has already proved its efficacy, helping police solve a string of burglaries committed in 2005 by a robber nicknamed "Shoe Boy."
- Chicago gang crime expert Phil Cline may be putting his expertise to work in the suburbs. Cline will use his computerized mapping system to identify crime patterns and hot spots in suburbs surrounding the Chicago area.
- Oakland, California, has produced an interactive crime map of the city. The tool is expected to help educate the general public on crime patterns and trends. Find it at oakland.crimespotting.org.
- San Jose, California has created a crime mapping web site in conjunction with crimereports.com. The system lets users report crimes and provides the police with easy mapping for dispatch.

COPS Grant Information at your fingertips

The Response Center provides information on:

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Crime News Events 2008

Dealing with crime problems in a local law enforcement agency sometimes means reaching out to other local agencies (e.g., city planning) to come up with a solution. The events listed here are good opportunities to learn what mapping professionals and those in related areas are doing, get new ideas, and present your work.

2008 Indiana GIS Conference
February 19–20, 2008 in Indianapolis, Indiana
www.in.gov/igic

TuGIS 2008 (Annual Geographic Information Sciences Conference)
March 17–18, 2008 in Towson, Maryland
tugis.towson.edu

Southern Regional Science Association (SRSA) Annual Meeting
March 26–30, 2008 in Arlington, Virginia
www.srsa.org

URISA/NENA Addressing Conference (formerly GIPSC and URISA's Street Smart and Address Savvy Conference)
Cosponsored by the National Emergency Number Association and URISA.
April 7–10, 2008 in Portland, Oregon
www.urisa.org/conferences/Addressing/Info

IALEIA/LEIU Annual Conference
April 7–11, 2008 in Boston, Massachusetts
www.ialeia.org

2008 Annual Meeting of the Association of American Geographers (AAG)
April 15–19, 2008 in Boston, Massachusetts
www.aag.org/annualmeetings/2008/index.htm

California GIS Conference
April 23–25, 2008 in Modesto, California
www.calgis.org

Pennsylvania GIS Conference
May 14–15, 2008 in Camp Hill, Pennsylvania
cgis.hbg.psu.edu/conference/home.aspx

9th Annual International Conference on Digital Government Research
May 18–21, 2008 in Montreal, Quebec
www.dgo2008.org

2008 ESRI International User Conference
August 4–8, 2008 in San Diego, California
www.esri.com/events/uc/index.html

Tenth Crime Mapping Research Conference
September 17–20, 2008 in New Orleans
www.ojp.usdoj.gov/nij/maps

GIScience 2008
September 23–26, 2008 in Park City, Utah
www.ai_geostats.org/index.php?id=215

2008 California Crime and Intelligence Analysts Association (CCIAA)
September 23–26, 2008 in Pleasanton, California
www.crimeanalyst.org

Urban and Regional Information Systems Association (URISA) 46th Annual Conference
October 7–10, 2008 in New Orleans, Louisiana
www.urisa.org/conferences/aboutannual

The NIJ Conference 2008

July 21–23, 2008
Crystal Gateway Marriott
Arlington, Virginia

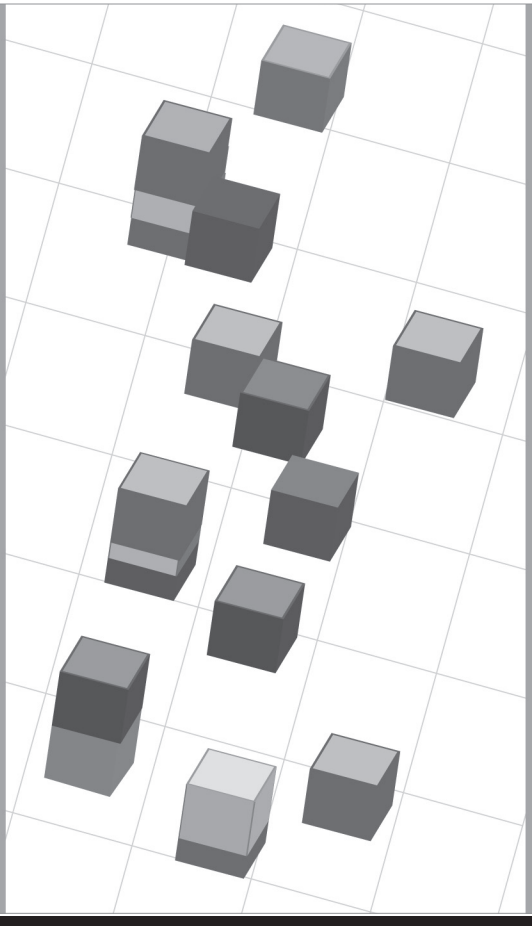
For more information, visit
www.ojp.usdoj.gov/nij/2008.htm

Featuring the plenary panel
"Making Smarter Decisions:
Connecting Crime Mapping with City Officials"

Mapping & Analysis for Public Safety (MAPS)

The Tenth Crime Mapping Research Conference:

Solving Problems With Geography and Technology



September 17–20, 2008
Sheraton New Orleans Hotel

National Institute of Justice
The Tenth
Crime Mapping Research Conference

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