Geospatial Technology Working Group Meeting Report on Predictive Policing

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Introduction

The purpose of this report is to provide input from the Geospatial Technical Working Group (TWG) regarding their thoughts and perspectives about predictive policing. It was specifically written in preparation for the Predictive Policing Symposium jointly hosted by the National Institute of Justice (NIJ) and the Bureau of Justice Assistance (BJA).

The Geospatial TWG is supported and organized by NIJ. This TWG works closely with NIJ's Mapping and Analysis for Public Safety (MAPS) Center to help determine grant-funding priorities, identify emerging needs and concerns in the field, and review progress on existing grants. As part of their semi-annual meeting, the TWG devoted several hours to the topic of predictive policing.

The discussion was framed around what predictive policing means in the context of geographical analysis with regard to, but not limited to, the tools, techniques or methods that might used; impacts on privacy; accuracy of forecasts; and the use of forecasting that is place, organization, group or person based. This discussion was captured in the meeting minutes and expanded upon and formatted by the authors of this report.

As the discussion progressed, it was clear that the geographical aspect of predictive policing could not be decoupled from the broader idea of predictive policing. As such, there are ideas in this report that apply more generally to predictive policing and that incorporate the experience of practitioners, academics and applied researchers serving on the TWG.

IT IS IMPORTANT TO NOTE THAT THIS REPORT IS NOT MEANT TO BE READ AS A COMPLETE DOCUMENT OR AN EXHAUSTIVE ENUMERATION OF TOPICS DISCUSSED DURING THE SESSION. This report represents an initial dialogue. In some instances, topics or ideas are not fully fleshed-out, are disjointed, or represent participant conjectures not cited with evidence. Many of the ideas in this report are based on the knowledge, research and experience of the person who stated them. And, of course, what follows does not fully encompass all of the examples and ideas from the larger law enforcement community. The reader is expected to use this report to think more about what was said and to spur on additional ideas not considered here.

What Is Predictive Policing?

Discussion first focused on the meaning of the term, *predictive policing*. In a practical sense, prediction was seen as being common, either implicitly or explicitly, in the day-to-day work of many of the TWG members and activities in their organizations. For crime analysts, it was seen as something routinely applied through regular analysis, prevention and problem solving. For others, it was seen as a key component of theory and research, particularly when such activities are informed by theory and empirical evidence.

The group grappled with the question, What does "predictive policing" really mean? How is it different than what is already being done? Particularly, to what degree is it similar to or different from other emerging analytic strategies such as intelligence-led policing, data-driven policing, risk-based policing or evidence-guided practice?

It was suggested that the term *predictive* could be open to interpretation and might overstate the current level of precision possible when forecasting crime and assessing risk. However, the term seems to be engrained in the mind of professionals and overlaps conceptually with alternately named strategies cited in the last question above.

Predictive policing evokes a sense of risk-based assessment of potential future activity. The question immediately arises, "With regard to the risk of 'what'?" Some members asserted it is risk with regard to crime. However, others argued that there are all sorts of crime. The concept of risk assessment takes on practical meaning when considering particular types of crime that extend to contextual factors, including those based on particular offender types or places (e.g., downtown business district vs. residential bedroom community). As such, an effort should be made to not just define what predictive policing means but also to address the breadth and depth and its meaning in a specific context. For instance, examining factors that are predictive of burglary rates may be a valid area of inquiry. However, more specific questions — e.g., what factors contribute to residential burglary risks in neighborhoods experiencing high rates of home foreclosures — are likely more useful and more amenable to prevention, intervention and problem-solving strategies.

It was suggested that *forecasting* may be a more appropriate term to use because the word *predicting* has connotations that lead to potential civil liberty and liability issues based on the people, groups, programs, institutions and places to which the term is applied. These may come with political ramifications as well.

Prediction as applied to crime is likely a two-dimensional temporal activity. It is a forward-looking endeavor with regard to assessing risk of broader long-term trends and narrower short-term activities/factors that lead to the emergence of crime. Either of these approaches lends itself to the assessment of resource distribution and an anticipation of certain expected impacts. Predictive policing should therefore encompass the development of analytic tools and methods used to identify crime prevention tactics/strategies and benefits gained in their deployment. The focus seems to be on the

reduction of crime, which implies ongoing assessment similar to the assessment phase of the SARA problem-solving approaches. Recognizing that predictive policing's popularity and market value will be highest with respect to violent and serious property crime, the analytic techniques and prediction methods should be applied to other areas for which police are responsible, ranging from traffic management to crowd control to enhancing citizen participation.

Overall, the TWG felt it was particularly important to think of predictive policing as encompassing more than just crime incidents. Rather, it should be considered a comprehensive approach that deals with issues other than crime per se (e.g., traffic, community incivilities, and problems such as unlicensed businesses and the effects these have on crime). Consistent with tactics and strategies that derive from broken windows theory, prediction can be applied to many activities in policing beyond simply where crime may/may not emerge and who will/will not offend. There are many activities in which the police engage that can be evaluated with regard to their expected outcomes. For instance, outcome-based or predictive analysis could be considered when implementing new policies, practices or procedures that alter the way police deliver services in general, and enhance their ability to fight, control or prevent crime, in particular. Predictive policing could be applied to evaluating the effectiveness of new programs and assessing their impact on individuals, groups or places. Under the rubric of predictive policing, for example, police might examine the impact that the implementation of a Police Activity League (PAL) program has on school attendance, or to determine if an associated tutoring program has an effect on the grades of those participating. That is, does the program reduce the incentives to offend based on better performance in school?

Crime prevention, which seems to be the heart of predictive policing, is not routinely measured by local law enforcement. This is in part because it remains methodologically challenging to determine what might have happened, had a particular prevention strategy not been implemented. Obviously, any department choosing to engage in predictive Policing would benefit from including an evaluation component in their prevention efforts. The small number of studies that use such methodological rigor (e.g., David Weisburd's work in Jersey City) are promising; they suggest that scarce police resources focused on the most prolific crime places (e.g., street segments or hot spots) are even more effective than those that focus on the most prolific offenders. This underscores the need to pursue place-based strategies and evaluations that complement more traditional person-based approaches. Important work lies ahead in determining the generalizability of such findings, particularly in what geographic contexts these effects may be most pronounced, and in determining how place-based and person-based strategies might best be combined to provide the highest return on deployment of police resources.

Some may remain skeptical about the ability of academics and practitioners to "research our way out of crime." In the late 1990s, however, a series of meetings on "Measuring What Matters" resulted in an article, authored by Robert Langworthy, that discussed identifying the appropriate variables for crime prevention. Using a similar approach, there is no reason why crime prevention cannot be promoted and ultimately reach a level

of success. By adopting proven public health perspectives, crime researchers and analysts are making progress in developing contextualized evidence on what works in what context.

Many studies speak of using various indicators to predict juvenile crime. The TWG recognized that a variety of demographic and behavioral data can have predictive utility but also recognized that some data will have profiling ramifications. The relatively large body of work addressing the risk of recidivism has a clear nexus to predictive policing. For example, efforts to predict the likelihood of juvenile recidivism — given a juvenile program, its location and individual characteristics — fall under the rubric of predictive policing. In this case, for instance, it would be important to look in detail at statistical interaction effects and to include both risk and protective factors when using various units of analysis (e.g., individual, family, groups, neighborhood, school and community). Analytic techniques that incorporate and/or combine quantitative and qualitative approaches could be useful.

Practitioners think of predictive policing as a strategy by which we develop knowledge about what to expect. They view predictive policing, ideally, as a strategy by which uncertainties are minimized and expectations are maximized. Deploying resources emanates from the analyst using historical data to derive predictions, often place based, that require police attention. The police like many other organizations and endeavor to use data from the past to forecast the future. Forecasting calls for service and workload data to allocate human resources and to design schedules is routine in many agencies. However, there seems to be an overall lack of precision in this forecasting, which usually entails estimating workload demands for hour blocks (shifts) across days of the week in administratively defined geographic or aerial units (e.g., police beats, patrol areas) over a calendar or fiscal year. The fact is, much of the business that police are expected to handle varies across temporal and geographic scales. For example, we know that routine activities, days of the week, and weather changes can affect calls for service in the short-term in geographic areas of varying sizes.

Others matters come to police attention when their jurisdictions experience a phenomenon that diffuses across several areas. The mortgage-banking credit crisis started in more remote places but, after some yet-to-be-determined time lag (the Wall Street lag), manifestations of the crisis emerged in local jurisdictions in the form of housing foreclosures, shifting populations, reduced revenues and reduced vital services. Thus, developing and thriving neighborhoods that had been or were becoming community assets were propelled downward and became economic liabilities.

Predictive policing must incorporate the actions and mechanisms of other components of the criminal justice system. Budget shortfalls are forcing some state corrections departments to implement early releases of inmates. Such measures are bound to increase the workload for police.

Thus, the idea that the past is most often used to predict the future is a key part of predictive policing. These approaches are limited, however, because the fallacy that

history repeats itself is adhered to as if it will play out the same way it did before. History seldom repeats itself exactly because it is subject to contextual changes across time. Also, anticipating events or changes may influence the trajectory of crime. Learning that a neighborhood will be the location of a new work-release center would give analysts reasons to revisit those crime projections that were based on simple, recursive time-series projections assuming that all factors stayed the same.

Compared with disciplines such as economics and public health, the uses of leading indicators for predicting crime are relatively few and far between. The TWG concluded that development of a robust and context-sensitive set of leading indicators should be a major focus of predictive policing strategies. More work needs to be done to find the combination of individuals, groups, organizations, programs and places that provides a context for the interactions among them, particularly those leading indicators that are geographically and situationally specific. Constant refinement of forecasting/prediction will be required. Development of risk assessment models and tools are, by definition, a recursive and iterative process.

Long-term goals must be clear despite short-term "blips." As an applied research endeavor, predictive policing efforts must grapple with real-world contingencies, or "externalities," that may adversely affect attempts to create "pure science" experimental research designs and are generally under the direct control of police/analysts/researchers. The following list identifies some of challenges identified by the TWG:

■ Budget and staffing constraints will affect an agency's ability to (1) collect relevant data, (2) effectively implement intervention/prevention strategies, (3) provide analysis, and (4) reach conclusions about effective responses.

■ As public agencies, police departments are required to be transparent. Politics and media do have at least a short-term effect on police programs and policy development. Political, media and public opinion may exert different pressures in different communities (e.g., the call for more or less "get tough" approaches, or greater or less reliance on community policing). Moreover, agencies will be pressed for quick results and "proven" strategies. This politically charged environment is not always conducive to more methodologically rigorous evaluation practices.

■ Calls for increased data sharing and continuing development of fusion centers provide both opportunities and challenges. Some departments may feel pressured to provide data in a format and with a level of consistency they have not previously achieved. If properly supported and incentivized, this may represent an opportunity to enhance data development and data sharing. If not supported and incentivized, frustrations in some agencies may undermine sharing efforts. Although prospects for net gains in data quality are promising, care must be taken that some agencies not get left behind.

■ New technologies and procedures are reshaping how police do business and what types of data are available for analysis. For instance, geographical information systems (GIS) and global positioning systems (GPS) implemented through automated

vehicle locators (AVL), license plate readers (LPR), offender-tracking GPS, and in-car cameras are providing data sources that feed data-driven policing strategies and improve their performance and effectiveness. Again, this may result in net benefits, but some agencies may be overwhelmed by
"data overload" and could benefit from support and technical assistance.

■ Data quality remains an issue. Analysts will need to remain vigilant about differences in data collection and business processes to understand how divergent reporting protocols may compromise models. One well-documented example of this data problem relates to various definitions of gang-motivated versus gang-related crime. Cross-jurisdictional research has been hampered because of the lack of uniformly applied definitions of gang crime. These definitional differences are affected by policies, practices and legal restrictions that differ greatly by locality and result in measurement artifacts. A better understanding of how definitional and operational differences between law enforcement agencies affect measurement and data sharing is vital.

■ Police departments and their activities do not exist in a vacuum. The concept of systems theory, developed decades ago, should be kept in mind. Context, prevention and interdependence with the entire criminal justice system affect prediction.

■ Similar to military tactics or those applied to emergency management, the approaches must be adaptable and responsive to changes in the operational environment, new policies/directives and community demographics. To some extent, this adaptive approach may be antithetical to the "we made our plan, are sticking to it, and are giving it time to gel" that sometimes takes hold in paramilitary bureaucracies such as law enforcement.

The TWG took some time to address the question, "What is not predictive policing?" First and foremost, the TWG agreed that the concept should not be oversold as a precise tool or an exact science. In a manner similar to hurricane models, there is a cone of uncertainty that widens as the predictive scope is extended in time. Predictive values are extrapolated, with more weight given to the data reflective of more recent events. The level of uncertainty rapidly grows, the further out in time that something is projected to occur. As tracking progresses, it is recognized that many events can occur that ultimately alter the pattern of the prediction. As such, the predictability of change — as time goes on and more consistent data are provided — must be an ongoing and iterative endeavor.

Members of the TWG commented about the uniqueness of statistical uncertainty as it applies to geospatial data. Geographically, uncertainty is more multidimensional than, for instance, time-series forecasts in that a spatial opportunity structure is introduced, whether in physical space or across networks. Underscoring comments previously made regarding realistic expectations, it may be best to think of predictive policing as a collection of tools to reduce uncertainty and improve efficiency rather than overselling it as a way to achieve certainty and develop precise solutions and fixed policy prescriptions.

There was relatively little discussion on the underlying theories supporting or framing predictive policing. However, it seems that it would be based on the phenomenon to be predicted. This does not mean that any theory is mutually exclusive to a unit of analysis; depending on which unit is used, several theories will overlap and contribute. This means that there will be an interaction of one theory with another, with the outcome ultimately leading to prevention. Fortunately, this reflects the eclectic and theoretically ecumenical approach with which many crime analysts, intelligence analysts and data-centric law enforcement leaders are already adept and capable of executing.

Units of Analysis

In moving forward with predictive policing, units of analysis need to be identified in clear and precise ways. Individual, group and place have been initially identified as the broader headings, but more clearly articulated subcategories must be developed. The TWG recognized, for instance, that there is an overlap in victim and offender populations, particularly in the context of gang crimes and drug markets. Examples of subtyping or disaggregation — such as Baltimore County, Maryland's, practice of filtering out "indefensible burglaries" — must be developed to a greater extent. The TWG recognized that programs and institutions can also be units of analysis in predicting of their success/failure and effectiveness/ineffectiveness. Crimes against persons and property crimes could also be units of analysis. The issue of the various units of analysis will need further exploration, refinement and standardization under the predictive policing paradigm.

The Role of Context in Predictive Policing

The TWG also concluded that one-size-fits-all approaches are seldom applicable. Effectiveness measurements and expectations of results will vary across departments as well as sectors or neighborhoods in larger jurisdictions. For instance, some types of crime and disorder may be reduced by increasing the police presence, but others may not. Expectations and results may also vary geographically or by other contexts, such as types of community. What applies in gentrifying urban areas, for instance, may not apply in a new suburban development or an urban area that is plagued with home foreclosures.

A relatively extensive body of literature exists regarding person-based risk, and new research is emerging around place-based risk. Much of the risk-based research focuses at the individual level of analysis and is applied to persons already formally involved in the criminal justice system. Risks of bail violation and of recidivism for those on probation, parole or released from prison have been developed through collaborations between practitioners and academics, and these are all areas in which considerable applied research has been developed.

Some of these risk-matrix and scoring methods involve assessment across units of analysis (e.g., family support, or available resources in the release neighborhood). In recent years, police have been increasingly involved with these populations, in part through federal support of various grants in the area of re-entry into the community. In

addition, a growing number of departments have been involved with local programs patterned after Boston's successful Cease Fire program; a common element across them all is some type of risk assessment. To varying degrees of sophistication, these programs use risk assessment to determine which offenders are most likely to re-offend and/or benefit from intense carrot-and-stick intervention. At minimum, these programs attempt to identify the most chronic, habitual or egregious offenders on the premise that past behavior is the best predictor of future behavior. These processes are often based on qualitative data and police or probation officer knowledge, but some also rely on quantitative approaches, including the use of police/court records and more elaborate risk-assessment protocols.

Of particular relevance are programs that are based on leading indicators or targeted at specific at-risk groups. Some law enforcement agencies are involved in programs that implicitly or explicitly target at-risk groups — including programs such as DARE, G.R.E.A.T., or Police Activity League (PAL) programs. Although programs such as tutoring or specialized day camps directed at high-risk populations are common within policing, little systematic research has been conducted regarding their effectiveness or ineffectiveness for particular target groups or individuals.

Moving forward, the TWG recommends that predictive policing focus on improving processes for developing typologies, topographies and other methods of segmenting units of analysis (persons, communities, etc.) to enable more contextualized data analysis and prediction. The general question "What works?" must be supplemented with greater attention to "What works (or does not work) with which population groups, under which circumstances, and in which geographic contexts?" This is analogous to public health prevention campaigns that are sensitive to and responsive to the culture, mores, values, behaviors and resources available to the various demographic groups and geographic areas. Local religious and cultural practices, for instance, would need to be considered when implementing programs to reduce sexually transmitted diseases. It may be necessary to consider the effect of similar contextual factors when using predictive policing approaches.

The bottom line is that a complex host of factors are in play; predictive policing must account for more than just the historical data.

Examples of Predictive Policing

The current predictive policing activities in many law enforcement agencies seem to revolve around identifying trends to react to. As discussed, this needs to be understood in the geographic context. Capitalizing on the previous experience of practitioners serving on the Geospatial TWG, individuals provided responses to the question, "What does predictive policing mean from the perspective of your agency?"

A common thread identified by many of the following jurisdictions is that predictive policing is initially or primarily place based.

Charlotte-Mecklenburg (NC) Police Department

The CMPD uses historical data primarily from about 6,000 neighborhoods to perform regression analysis to assess crime risk on the basis of a set of independent variables describing the demographic and ecologic characteristics of a neighborhood. The unit of analysis is the small neighborhood — similar to using a block group or census tract — with corresponding data. For example, several indexes were developed by the geography department at the University of North Carolina, Charlotte, to identify the state of neighborhoods on the basis of physical, economic, social and crime conditions. These indexes are used to gauge change in neighborhoods and determine where the resources need to go. Based on the CMPD work and through use of indices similar to the CDI, the TWG sees the expansion of community or neighborhood-based risk-indicator data as a key component of predictive policing.

Dallas (TX) Police Department

The Dallas PD looks at the impact of technology in two important ways. Technology will create new opportunities for crime, but it also allows the police to establish connections and actionable intelligence, particularly in the area of financial crimes. The Dallas PD is interested in predicting where future financial crimes will occur as well as the type of attacks that will arise in the future as a result of evolving technology.

For example, in the case of credit card theft, the bank typically ends up being the only victim to suffer financial loss, as they reimburse customers from whom the money was stolen.

One approach adopted by the Dallas PD was to identify the processes and criminal networks through which financial crimes are perpetrated. Education of business owners and citizens about the methods by which these crimes occur is a primary prevention tactic. Losses can be minimized by identifying the highest risk individuals (e.g., vulnerable youth, and technology-challenged adults), activities (e.g., Internet purchases and websites), and places (credit cards used at particular businesses). This departs somewhat from the usual approach used for combating street crime. Street-crime investigation focuses on establishing where the crime occurred, who committed it, and to whom it occurred. Internet financial crimes are more complex: Crime activity flows between places and so it requires a diffusion study. However, a distinction needs to be made between what the police can do on their own, and what can be done by all the parties involved. The victim-target types are typically well-known in these types of crimes and may include banks and financial centers, noting that the unit of analysis is the organization in this case. Using predictive policing techniques, probabilities can be assigned to each location and type of attack.

Several additional yet unique components of financial crime were cited. First, solving financial crimes requires specially trained people who can stay a step ahead of the criminals and criminal innovations. Investigations of financial crimes and cybercrimes are distinct from those for street crimes. Second, law enforcement is forced to recognize that a substantial proportion of financial crimes occur outside their geographic jurisdiction and, indeed, outside this country. Hence, financial crime is difficult to fully

investigate and predict because of its geographically diffuse nature. In addition, it is easy for agencies to dismiss responsibility for these crimes, declaring, "It's not *our* job!"

To the extent that these types of crimes could be anticipated, departments such as the Dallas PD could control the offenders' access to the most likely targets as well as educating the targets so they avoid the types of activities most likely to result in victimization. This effort is predicated on the realization that, although banks do not want to be regulated nor inform law enforcement when financial crimes occur, the citizens are the victims, who need to be better protected.

Predicting cybercrimes requires the collection of very specific data. For example, when an identity theft occurs, citizens often do not know whom to call about the incident. An Internet Crime Complaint Center handles these calls, but they estimate that only about 1 in 4 crimes are reported to them. Furthermore, some rural police departments do not know how to collect data on e-crimes or even how to initiate investigations.

As previously stated, the banks will not report these losses, so the activity continues, with little incentive for victims to report and little deterrence for criminals to desist. Because the citizen does not ultimately suffer a loss, he or she does little, or nothing, to reduce the chance of being victimized again. It must be understood that the nature of these crimes has changed. Predictive policing must include a focus on crimes other than Part I crimes that are of a more physically harmful nature.

It is worth noting, however, that there is often a link between cybercrimes and Part I crimes. Studying the linkages might provide the opportunity for more focus on electronic/cybercrime. Drug users often break into cars as part of an organized group to steal credit cards and commit fraud. These credit cards are the means to many types of theft. If predictive policing can be used to identify these groups and specify who and where their most likely targets are, it can prevent them from obtaining the cards. The crime network and chain of events can be examined to look for points at which predictions can emerge.

Knox County (TN) Sheriff's Office

Lt. Bobby Hubbs spoke to the ease of stealing some "hot products" and the difficulty in stealing others. For instance, he said, GPS units are a target, but satellite radios are not. This is because GPS units are portable and easily passed from one user to another, whereas satellite radios are installed in the vehicle and programmed to work in only that particular vehicle. It should be noted that newer and more expensive GPS units have security codes built into them, thus beginning the "hardening of the target" for thieves in terms of selling or trading the stolen merchandise. Satellite radios also require a subscription for use, for which the identifying serial numbers must be reported. This deters the theft of such systems. Lt. Hubbs noted that it takes a while to incorporate antitheft aspects to technology and that, often, the vendors of easily stolen and sold products (such as GPS units) do not care about the ease of theft of the items because, ultimately, if they are stolen, more GPS units are sold to replace them.

Lexington (KY) Police Department

One area in which the Lexington PD uses predictive policing approaches revolves around planning and how future urban development can have an impact on crime. Neighborhoods and surrounding areas are monitored. Quality of life indicators are observed, recorded and factored into any analysis. It is understood that part of crime prevention in any neighborhood is the reliance on at least a minimum level of safety and a quality of everyday life that is relatively free of danger or crime. Disseminating the solutions among groups becomes a key factor in what works and what does not. Thus, the Lexington PD is prevention oriented. Crime prevention requires qualitative/quantitative analysis that relies on geographical analysis, which is folded into the preplanning stages for urban development.

Lakewood (CO) Police Department

In Lakewood, Colorado, light rail is about to be constructed. They are looking at other areas around Denver that have railways to understand their potential effects on Lakewood and prepare for the potential emergence of crime. They want to know what the best practices are, and what other jurisdictions have done to prevent typical problems, such as graffiti or car burglary associated with light rail. Primarily, they are quantifying crime and calls for service in the railway areas over time, and conducting an analysis that includes property values and any crime impacts on geographic area to guide their officer deployments and other efforts.

Changing Markets/Products and Their Effect on Crime

New technology and consumer products are introduced daily, and this always has consequences. Researchers and practitioners need to understand the risks of the new technology, using that knowledge to better predict how it can or will be used for criminal activity, and determining how popular new technology products can become targets of theft. They need to know what products the market is producing and which of those products are becoming the most popular or desired. For example, the Apple iPhone® was introduced in the U.S. several months before it was released in the U.K. Realizing this, the Home Office in the U.K. requested data from analysts in the U.S. about thefts of these devices to anticipate the potential for robberies and thefts in the U.K. that involve these devices.

Lt. Hubbs, of the Knoxville (TN) Sheriff's Department, noted that calendar events, such as paydays and food stamp distribution, have predictive utility. The socio-demographic factors operating at a neighborhood level can vary and be predictive.

The larger point is that changes in technology and consumer items (e.g., the iPod) have a profound and sometimes immediate effect on criminal opportunities and modus operandi. Some criminals — particularly those engaged in criminal enterprise networks — are

technologically savvy and highly adaptive. Police and analysts must be continually informed about technology changes and be at least as agile as offenders.

The question arises: How does the supply/demand equation aid in predicting this type of crime? One TWG member commented that the specialized skills of electronic/cybercriminals allows them to exploit the market demand for certain fetishes spawned by society. Another example is in virtual space where human trafficking occurs. For instance, on Craig's List, escort/massage/exotic dancers/children advertised as being from other countries can be ordered from a particular location (city). These activities occur in cycles (e.g., Asian women and children may be sold more often than those from other regions; in another cycle, there may be a penchant for mail-order brides coming from Eastern Europe. These cycles are due to changes in buyer preferences, local economic and political conditions, marketing, and law enforcement successes. Certain geographical data components from these activities that might be useful ways to identify activity patterns that could lead to crime prevention through crime prediction. For example, phone numbers with area codes (including exchanges) and IP/locations of the posting parties can be used to identify the origins of posting and routing patterns of communication, all of which could be monitored if the number of false positives can be reduced. Organized crime groups are often behind human trafficking activity and their patterns can be reflected geographically in terms of both places and networks. Internet traffic can be monitored for hits, based on the nature or type of websites being used. Traditional organized crime organizations are increasingly using websites as fronts for making money, and new scams are continually being devised as technology evolves.

Policing financial and human trafficking cybercrimes requires a major change in current practices. These types of incidents significantly affect the public because the losses the banks incur are often recouped from the citizens through excessive bank fees and government bailouts. Variables leading to predictions could include the criminal outcomes of cybercrime. Predictability might start at the level of the end location of the crime. For instance, when a credit card is stolen, the theft needs to be reported quickly because the card is almost always used immediately to buy untraceable gift cards and other items easily sold and distributed. Wiring money is another outlet for credit card theft. Funds can be transferred to another location instantaneously, but most transactions are completed when a person travels to a specific place to pick up their ill-gotten gains. If the crime can be discovered, reported, and followed up quickly, perhaps the "pickup" person can be contacted before it is too late.

Law enforcement can take months, or even a year, to effectively respond to a given crime. Hence, there is some lag time before being able to do anything about the crimes that have occurred. Predictive policing would be effective in reducing this gap. Coupled with effective crime prevention techniques, predictive policing would be effective in reducing this time gap. Attention must be paid to these changes — whether technological, legal or societal — which continually reshape patterns of crime.

What Is in the Predictive Policing Toolbox?

What is in a predictive policing toolbox? It cannot be a black box or a glass box with a black cloud in it. It also cannot simply be a dashboard or an early warning system. Rather, several items contained in the toolbox would provide a flexible framework for each agency to develop its own methodology.

- Mechanisms that can bring people and variables together.
- Data from Fusion Centers.
- Context and thematic data clearing houses.
- Related data from other agencies (e.g., schools and hospitals) need to be identified and better utilized. (School attendance data may be useful: Truancy might be a leading indicator of daytime thefts or graffiti, particularly near areas where youth hang out. Increases in hospital admissions for certain types of trauma may indicate spikes in domestic violence.)
- Task forces.
- Memorandums of Understanding (MOUs).
- Software developed/enhanced in conjunction with predictive policing.
- Establishment of independent variables (risk, protective variables, and indicators).
- Data-integration techniques.
- Analytical framework.
- Qualitative and quantitative data.
- Guidelines on using predictive outcomes.
- Promotion and development of improved practices for collaborations across local, state, federal and international law enforcement agencies in light of cybercrime and geographically dispersed criminal enterprises operating at macro-geographic levels (regional to global).
- At similar regional and global levels, better coordination with private/corporate security and loss-prevention specialists is increasingly relevant.

Conclusion

Regardless of the level of sophistication at which analysis is conducted, predictive policing should be seen as a combination of short-term activities and long-term trends identifying the emergence of crime. A key focus should be on opportunities for prevention and the extrapolation of benefits from reducing crime, but it cannot stop there. Once an action is taken, recognize that the criminal activity will emerge elsewhere; changes in neighborhoods and market trends can be leading indicators of where the crime will emerge. Note that "where" is not always is a physical space; it can also occur in virtual or social space. A variety of available qualitative and quantitative data is available for monitoring these changes. Meanwhile, the policies and practices of crime prediction must be carried out while carefully considering the legal issues revolving primarily around the potential of breeching civil liberties and getting entangled in undesirable liability issues.

Although pursuit of pure, unadulterated science provides some guidance, predictive policing needs to be marketed and made it comprehensible to the executives, politicians, policymakers and ultimately the general public, all of whose support is necessary to implement the various strategies that fall under this rubric. A clear description of what predictive policing is (and is not) is necessary in order to influence organizations that are reluctant to act. The Los Angeles Police Department's Predictive Policing Symposium is a decisive and important event in pointing the way forward and building on the promising practices currently used in law enforcement agencies across the country. Although predictive policing may represent a definite paradigm shift, it must not only identify and refine existing practices but must also develop new techniques for interpreting massive volumes of data.