THE SEQUENCE OF ANALYSIS IN SOLVING PROBLEMS

by

Deborah Lamm Weisel

North Carolina State University

Abstract: *Traditional crime analysis has limited utility for police problem solving. Such analysis usually involves summary reports and aggregated statistics, primarily of Part 1 crimes, providing little insight into most crime problems. Although technology and techniques such as Geographic Information Systems are increasingly used to address crime and disorder and identify trends and patterns, such methods, which focus exclusively on temporal and spatial relationships, typically lack the rich contextual variables that offer us the potential for understanding problems. These methods are useful for enumerating, establishing prevalence and identifying subsets of problems to be examined. Analysis for problem solving requires an iterative process of developing and testing provisional hypotheses, often through the collection of primary data about community problems.*

Meaningful analysis in problem solving requires a fundamentally different approach than the secondary analyses that dominate crime analysis functions in American police agencies. Indeed, effective analysis of crime and disorder is a major impediment for many police agencies attempting to address community problems.

Traditional crime analysis has limited utility for problem solving. Traditional analysis usually involves summary reports and aggregated statistics, primarily of Uniform Crime Reports Part 1 crimes, providing little insight into most crime problems. Although technology and techniques such as Geographic Information Systems (GIS) are increasingly used to address crime and disorder and identify trends and patterns, such methods, which focus exclusively on tem-

Crime Prevention Studies, vol. 15 (2003), pp. 115-146.

poral and spatial relationships, typically lack the rich contextual variables that offer us the potential for understanding problems. In terms of problem solving, much of what passes as analysis might well be considered as equivalent to scanning — the preliminary selection and confirmation of the existence of a problem (Eck and Spelman, 1987). This paper explores analysis-related functions and practices that can extend and enhance the contribution of crime analysis to solving problems, including the expansion of primary data-collection methods. Regardless of what organizational unit is responsible for analysis of problems, more attention should be given to the *process* of analysis.

For many, the use of the term "analysis" in addressing community problems is misleading. In practical terms, analysis is the systematic collection of knowledge about a particular problem *and* the drawing of inferences from that information. Analysis of problems is often confused with the largely descriptive summary functions resident in many police crime analysis units.

To improve analysis of problems, there does need to be some substantial improvement of structure and access in data collection: police records are not collected for purposes of research and hence suffer from major research limitations. It is widely acknowledged that further expansion of problem solving as a practice would "require a substantial upgrading of the information production and processing capacity of the police" (Mastrofski, 1998:175). That task necessitates devoting resources to research and development (Goldstein, 1990; Reiss, 1992; Mastrofski, 1998).

Within current resources, however, effective analysis requires more thinking and wider participation in primary data collection by crime analysts and others in police agencies. This paper sets forth an analytic approach for systematically examining problems, a process that will enhance our ability to draw inferences from data and inform the development of appropriate responses to problems of crime, disorder and public safety.

GUIDANCE ON ANALYSIS

In principle, analyzing problems is simple and common-sensical (Read and Tilley, 2000; Bynum, 2001).[1] In practice, key analytical tasks necessary for problem solving have not been clearly articulated and sequenced, making analysis an ambiguous process in which objectives are unclear, data are often weak and incomplete, and the process is often compressed and artificially truncated. While there are established practices for social science research, which inform

analysis for problem solving, these processes do not closely fit the *practical* requirements for police in examining problems.

To date, insufficient attention has been given to analysis in problem-oriented policing, and it is a process that police often overlook or address superficially (Sampson and Scott, 2000; Scott, 2000; Bynum, 2001; Clarke, 1998). Indeed, Scott (2000) points out that additional guidance on analysis is necessary. For such guidance, one can turn to the extensive analysis guide in Eck and Spelman (1987); the crime triangle (described in Bynum, 2001 and Scott, 2000) which focuses researchers on offenders, victims and locations; or, a recent contribution, Bynum's (2001) guidebook on analysis.

But what exactly do we mean by the term "analysis" in the context of solving problems? Goldstein (1990) says analysis is an in-depth probe about the factors that contribute to a problem. Moore (1992) calls this "thoughtfulness" about problems; Sampson and Scott (2000) also describe analysis as a "thoughtful, in-depth" process. Sherman et al. (1998) says problem-oriented policing is "essentially about insight, imagination and creativity." Bynum (2001) says analysis requires creativity and innovation. Goldstein (1990:36-37) elaborates that analysis is:

> An in-depth probe of all the characteristics of a problem and the factors that contribute to it — acquiring detailed information about, for example, offenders, victims, and others who may be involved; the time of occurrence, locations and other particulars about the physical environment; the history of the problem; the motivations, gains and losses of all involved parties; the apparent (and not so apparent) causes and competing interests; and the result of current responses.

These descriptions of analysis for problem solving are suggestive of a process that may be extremely intimidating for many police practitioners.

Based on published descriptions of problem-solving efforts, we know little about how problem solvers go about analyzing problems. We are, however, keenly aware of the limited contribution of problem analysis in many cases. Part of this absence is attributable to the rational reconstruction of problem-solving efforts. Descriptions of most problem-solving efforts focus on the responses implemented — and results achieved — rather than a retrospective retelling of how they got there. Even more rare are descriptions from practitioners of failed attempts at analysis. Rosenthal (1979) calls this the "file drawer problem," popularizing a term for our tendency to record efforts that show a substantial impact and relegating those without impact to the filing cabinet. Whether we discuss the absence of prac-

tical significance or statistical significance related to "failed" analysis, the effect is the same: to reduce by some level the number of problem-solving efforts, hence analytical processes, available for examination. (Read and Tilley [2000], examined problem-solving failures; however their descriptions of the efforts were rudimentary and did not illuminate analytical processes undertaken.) Thus, positive outlooks on problem solving may be due to a process of selective reporting, in which failures are rarely included (Moore, 1992). It is not so much that failures are included or excluded from the problem-solving literature; much of the narrative about analysis in problem solving presents data that do not appear to further our understanding of problems. Not all analyses in problem solving are constructive; however, their blanket inclusion in descriptions becomes a red herring to those who might read problem-solving descriptions for instruction.

Our knowledge of problem solving in written descriptions is also limited by the narrative construction of authors, who exercise selectivity in presenting details of problem-solving practices. It is human nature to report behavior based on positive decision outcomes, which distorts our perspective on the problem-solving process. What are the missteps and wrong turns that successful problem solvers took in analysis?[2] Was the process linear, or as creative and thoughtful, as has been suggested is necessary? The presentation of key facts and information about problem analysis is a rational reconstruction of an inherently untidy process. But the steps of problem analysis can be sorted out somewhat and logically sequenced to provide a model for problem solving. The remainder of this paper makes a preliminary attempt to do just that.

KEY STEPS FOR PROBLEM ANALYSIS

There are three major stages of problem analysis through which most problems will proceed in a somewhat sequential nature. The first phase involves documentation of the problem — justification for undertaking a detailed analysis of the specific problem and determining the appropriate scale or scope of the problem and its investigation. This phase is virtually synonymous with the scanning function described by Eck and Spelman (1987). Police, however, have often been troubled by the distinction between scanning and analysis, including the point at which one ends and the other commences; indeed, the distinctions between the two stages of problem solving may be virtually indistinguishable, one fading into the other by matter of degree. Nonetheless, the tasks of scanning are distinctive and critical

to moving forward with analysis. The major steps include parsing, enumeration and establishing prevalence.

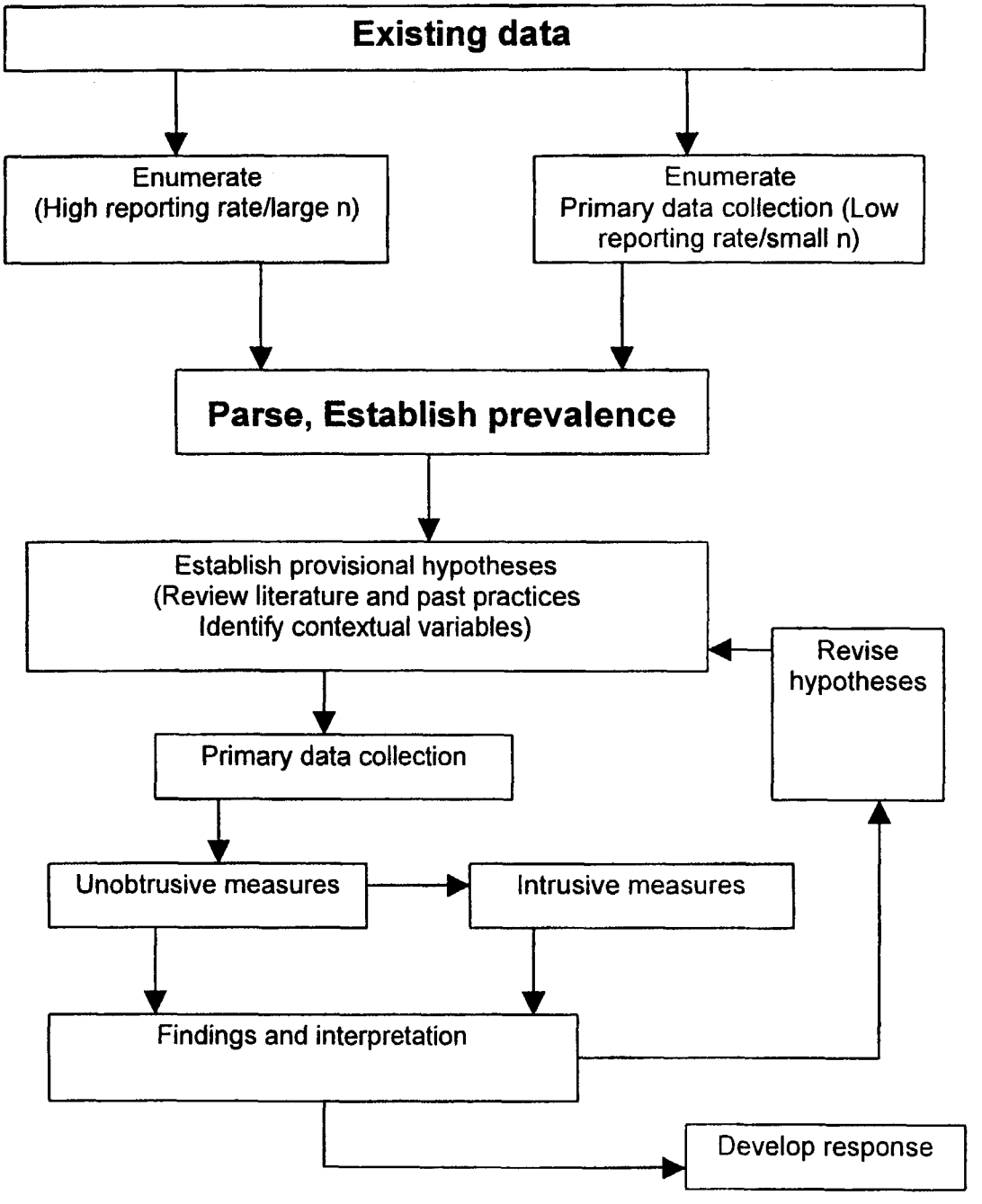
The second phase of problem analysis is data collection — typically primary data collection, as it will be quite rare to find that existing data are sufficient to develop an effective response to a problem of substantial size or duration. The last phase involves analysis and interpretation of findings. The stages of analysis are subsequently described and visually displayed in Figure 1.

Parsing of Problems

Clarke and Goldstein (2002) suggest that the "classic pattern" of problem-oriented policing is to address a subset of an original problem: to reduce the problem from its first conception to a manageable subset. This task of data reduction or parsing may involve selecting the largest subset of an identified problem. In their paper, the chosen subset consisted of the theft of appliances from construction sites — an identifiable subset of the larger problem of theft from construction sites, which also included the theft of tools, heavy equipment, supplies and so forth. Each was a subset of the more generalized crime-recorded problem of commercial burglary. The type of property stolen was the key variable upon which existing police data were sorted, and thus it was used as a criterion for parsing.

In many cases, spatial — or temporal — parsing has been established as a primary method of data reduction. The need for parsing varies, often depending on the size of or presumed heterogeneity within the problem. Large scale problems — as reflected by a large volume of calls, incidents or complaints — typically contain variations which can be disentangled. (Although smaller scale problems may also contain variations, the small volume may not permit meaningful disaggregation.) Parsing may precede or follow enumeration. Parsing of problems from existing data is often a practical necessity, and should not be tedious given the widespread prevalence of automated data systems. But, parsing will not always be possible and may in fact suggest difficulty with problem selection if problems are inherently "too small." Clarke (1998) notes that police frequently undertake problems that are too small, and thus are inconsistent with the definition of problem-oriented policing. In this case, police should aggregate up — reverse parsing — to determine if isolated incidents fit some larger pattern of problems. Is the case under investigation an isolated example, or does it reflect a larger pattern?

Figure 1: The Sequence of Analysis



In contrast to small problems, analysis of large problems is complicated by complexities associated with heterogeneity. For ex-

ample, analysis of a residential burglary problem — among the most numerous of crimes reported to police — may include a range of housing types: apartments, condominiums, public housing, duplexes and single-family housing. Determining, for example, the type of property stolen or the point of entry may bias the analysis toward the housing type that dominates burglaries. If break-ins occur mostly at apartments, sliding glass doors will appear as the most common entry point; if break-ins occur mostly at single-family houses, front doors may be kicked through in a residential version of smash-and-grab. Or contrarily, property stolen from apartments may consist primarily of highly portable goods, such as jewelry and cash, while property taken from houses may include larger electronic equipment, the former being accomplished quite easily on foot with the latter — typically — requiring private transportation.

Parsing the problem into different housing types — or different types of property stolen — permits an independent analysis of the characteristics of burglaries in quite different dwelling types. Since housing types may not be easily extracted in many police data sets, justifying the extra effort of collecting additional data for parsing may take some convincing of practitioners. As Tilley (2002) notes: "Patterns identified at a higher level will be checked out for their relevance at a lower level." The opposite, of course, will apply as we can aggregate — or replicate and validate — lower levels of analysis to build an accurate picture of larger-scale problems in jurisdictions.

Determining where and how to parse a problem is part art, part science. Sometimes natural break points will occur in data, suggesting natural subtypes. Parsing should be sensible. While one can typically easily combine problems at later stages in analysis if the level of parsing is too fine, delaying the desegregation of problems may mask important distinctions within data.

Enumeration

The use of recorded police data is the starting point for analysis for many problems. The routine collection of data by police about problems — recorded crime problems — provides valuable and historic baseline information often over multi-year periods. Based on existing data, we can rather reliably determine how many reported offenses of a single type occurred during any given time period. When engaging in problem solving, police tend to examine crime problems rather than problems related to disorder or public safety (Rojek, 2001). Indeed, the availability of recorded and automated crime data has likely contributed to a predilection of police to undertake problem-solving initiatives about recorded crime problems. It is easiest to

examine that which is at hand.[3] For most police agencies, these data on hand include incidents, calls-for-service and arrests. In some agencies, such data may also include field interviews and citizen complaints.

Police data, of course, suffer from many problems, including underreporting, generic classifications, and data entry errors or backlogs. For example, in Charlotte-Mecklenburg Police Department, an agency with a reputation for professionalism, more than half the annual incidents of appliance theft from construction sites were not recorded as such in the agency's records management system, necessitating a manual review of incident reports to compute the correct incidence of the problem (Clarke and Goldstein, 2002). Similarly, reports of graffiti to police in San Diego were recorded as vandalism, requiring an extensive effort to compute the reported incidence of graffiti (Police Executive Research Forum, 2001). In Memphis, TN, a project funded to examine the correlation between crime and crash locations was predicated upon the availability of automated crash data. After an extensive search for the data, the crash records were found — a two-foot pile of paper reports. Miscoding, missing or otherwise limited data are characteristic of police data, rather than being exceptions. For the most part, these limitations can be overcome through manual sorting, reading narrative reports, and supplementing with other data sources such as criss-cross directories and so forth; these steps are extraordinarily time consuming but quite necessary in analysis. Analysts in problem solving must learn to anticipate such data problems and be willing to invest the time and effort necessary to overcome data limitations.

Of course, many problems of concern to police are not sufficiently counted to provide a baseline measure of incidence. While it may be widely recognized that there are problems with speeding, graffiti, loitering, homelessness, bullying, underage drinking, gang-related problems and the like, there is typically no reliable data source about the incidence of these problems. Thus, methods must be established and data collected to enumerate many problems. Enumeration is typically a greater challenge for problems not routinely reported to and recorded by the police.

Analysis of official data about problems often distorts findings in ways we cannot usually detect. Most types of reported crime are substantially underreported: only about 36% of felony crimes are reported in the United States (Walker, 2001), and about half of all crime is reported in Great Britain (Laycock, 2001). For example, residential burglaries are typically reported in about half of all offenses, and underreporting is most common where the offense is attempted but not completed. In what other ways is underreporting distorted?

Burglary victims are less likely to report subsequent offenses if they are revictimized than they are to report the first or initial offense. Thus, examining only data for offenses that are reported may clearly skew our thinking about specific problems; unfortunately, it distorts our thinking in ways that we cannot clearly determine. Similarly with arrest data, because few offenses are cleared up through arrest. For example, 17% of arsons and 19% of larceny-thefts are cleared through arrest in the United States (U.S. Federal Bureau of Investigation, 2000). Are these offenders representative of all offenders for that crime type?

What is the importance — and the contribution to analysis — of offenses that are unreported to the police?[4] Is it possible to enumerate unreported problems? Of course, some enumeration can be achieved through simple counts. In Newport News (VA), officers documented the number of prostitutes in a two-mile area through field interviews, noting that prostitutes were easy to identify through suggestive clothing, congregation in specific areas at certain times, and excessive friendliness (Eck and Spelman, 1987). The investigating officer used field interviews to identify the prostitutes by name and monitored their presence over several months. Other problems require more effort to enumerate. Surveys are routinely used to enumerate the incidence of crime problems. Occasionally, proxies may be used when data are not available for enumeration. For example, motor vehicle crashes may be a proxy for speeding.

The contribution of enumeration in the problem-solving process is easily ascertained; documentation of baseline levels of problems provides a convenient pre-post design — the type missing in many problem-solving efforts.[5] For example, in Newport News, the number of prostitutes working a four-block area dropped from 28 to 6. (Of course, the remaining prostitutes may have been especially prolific; Eck and Spelman failed to estimate the amount of business generated by the prostitutes, the number of hours on the street or Other empirical measures of their activity.) However, the decline in the number of prostitutes on the street provided a useful measure of police effectiveness in addressing problems in the area. And there are many other examples in which enumeration provides both baseline and impact measures for problem solving.

Despite the presumptive nature of enumeration, counting of a problem is an inherently critical first step in problem solving: it reveals the scope or scale of the problem. Thus, it may reveal that there are too few instances of a problem to invest a substantial effort, or such a large-scale problem that additional resources should be identified, or that the problem boundaries should be recast and scaled down to be consistent with available resources.

Establishing Prevalence

A recent newspaper article decried underage drinking in bars in Montgomery County (MD). Nearly 100 incidents of underage drinking had been detected in undercover stings in the preceding three years (Becker, 2002). Was that a lot or was it a little? How did that amount compare to prior years, surrounding jurisdictions, or to anything comparable? Simple counts of problems in specific locations often do not provide a sufficient basis for examination of a problem, particularly in drawing comparisons between similar problems in different locations. (Of course, this example is also inadequate because it is a police activity measure not an incidence measure.)

The work of Clarke and Goldstein (2002) suggests that enumerations are not of great value unless an accurate denominator can be determined. (For example, the number of tricks by the prostitutes described previously.) In that article, Clarke and Goldstein needed to know the number of dwellings under construction to use as a denominator for number of thefts. That number could be obtained relatively easily through a review of certificates of occupancy, a government-issued permit. Similarly, for thefts of and from cars in commercial parking lots, the number of parking spaces is useful (see Clarke and Goldstein in this book) — information that may be obtained from parking companies or undertaken through visual assessments. For speeding problems, one must determine the volume of traffic in an area to determine the proportion of speeders.

For some crime and disorder problems, determining a denominator is a challenging task. For example, in examining stops-and-searches — or racial profiling — researchers and policy makers have extensively debated the selection of an appropriate denominator. There is consensus on the numerator — the ethnicity of drivers stopped and/or searched by police. For the denominator, however, should one use the ethnic composition of the resident population of an area, of licensed drivers, of the license-eligible population of an area, of persons engaged in motor vehicle crashes, or the driving population (that is, the persons who actually use the roadways under question)? Of course, each denominator has drawbacks. The ethnic composition of residential populations is relatively easy to determine, even for relatively small areas, using census data. Licensed drivers can be determined spatially; however, the holding of a license may have no relationship to presence on the roadways. Even driving populations — those persons available to be stopped — vary substantially by time of day, and even on roadways quite close to one another. Determining racial characteristics of drivers through observations is very difficult. In other words, determining an appropriate

denominator — and collecting data about it — may be a cumbersome task. How necessary is this step? In many cases, it provides critical information about the proportions of the problem. For example, the detection of repeat victimization has little meaning without comparison to those victimized once only and those never victimized. Determining an accurate denominator has the potential to greatly illuminate a problem and point to directions for intervention.

COLLECTION OF DATA

Once the major tasks of documenting, delimiting and verifying a problem have occurred, the analysis process will typically turn to collection of data. This is not a task that should be undertaken without direction. I recall interviewing officers from the Baltimore County (MD) Citizen Oriented Police Enforcement (COPE) unit in the late 1980s (Taft, 1986), who described how they would immediately conduct a standard community survey once a problem was identified. In general, rote data collection tasks will not provide the most precise information about problems. Instead, data collection protocols must be designed for each problem-solving effort; while such efforts should make use of prior data collection efforts, each should flow from the problem being examined.

Testable Hypotheses

The practice of social science research relies on specifying hypotheses and collecting data to test them. Laycock (2000) says we need practitioners to help develop testable hypotheses. In police parlance, these hypotheses may be considered "hunches" about what factors contribute to a problem. Once articulated, a series of working or provisional hypotheses can be examined and empirical data collected to either confirm or falsify the hunches. This process is consistent with social science methods, although in analyzing problems great effort should be made to identify multiple hypotheses, and to revise and re-articulate hypotheses during collection of empirical data.[6] This search for explanation thus consists of the raising and discarding of ideas about the problem.

In this way, problem-solving research is more complex — or adaptive — than much social science research and more consistent with the "grounded theory" described by Glaser and Straus (1967). Grounded theory employs a process of progressive elaboration in which a design "builds up" from substantive facts to a set of theories, which can be subject to testing and verification with empirical methods. Thus, the articulation of testable hypotheses in problem solving

will typically follow the processes of parsing, enumeration, establishing prevalence, and preliminary trend or pattern analysis — the exploratory and descriptive methods of research. Once we have established the parameters of the problem under consideration, we can undertake the next phase of analysis, the search for explanation.

A testable hypothesis should be explanatory in nature and conjecture primarily about the "why" of a problem. It should be well understood that testable hypotheses are preliminary in nature. Through primary data collection, the hypotheses will be tested and refined, elaborated or discarded. Only when the preliminary hypotheses are articulated can one identify the appropriate tools for data collection.

Provisional or working hypotheses are not about establishing causality beyond any doubt; instead, the hypothesis should illuminate or add insight to the process of causation. And it is of critical importance that the hypotheses examined are those that are amenable to intervention. Occasionally, the construction of such hypotheses may be quite obvious, but criminal justice researchers have been soundly criticized in the past for ignoring the obvious, and identifying intervention points which cannot be realistically addressed — such as racism, poverty and other deeply rooted social dynamics. This objective of analysis — finding an appropriate intervention — has been called the "pinch point" by Read and Tilley (2000), the "points of intervention" in Bynum (2001), and the "entry point" (Toch and Grant, 1991). Toch and Grant (1991) note that a complex problem may have multiple entry points, while the number of entry points for a simple problem may be singular. Indeed, the search for interventions will likely prioritize possible pinch points based on responses or interventions that are the least expensive and the least coercive.

In this way, analysis for problem solving inherently involves both applied *and* basic research; the first seeks to identify an opportunity for intervention in order to reduce a problem, the latter seeks to measure and understand the problem. Thus, problem-solving research is an "empirical investigation that describes and explains how things behave and how that behavior can be changed" (Reiss, 1992:86).

Identifying Contextual Variables

The articulation of testable hypotheses relies on generating a range of variables that are presumed to be associated with the problem. These contextual variables are factors that have the potential to shed new light on the causal sequencing of the problem being examined. The identification of key contextual variables is not necessarily intuitive, although prior research, expert knowledge of settings, and

other factors may point one to important variables that may suggest intervention points.

A review of some recent problem-solving efforts demonstrates the value of identifying key contextual variables:

- *Security practices.* In Charlotte-Mecklenburg, key variables about appliance theft from construction sites included identifying the stage of construction, builder, and security practices employed (Clarke and Goldstein, 2002). In San Diego, a review of management and leasing practices in a self-storage warehouse were the key to a response (Sampson and Scott, 2000).
- *Apartment building size.* In a study of drug dealing locations in San Diego, smaller apartment buildings were used more often by drug dealers than the larger buildings, because the former typically had fewer resources to control behaviors (Eck, 1995).
- *Placement of cash registers.* In the Gainesville, FL convenience store study, stores which had interiors not clearly visible from outside and those with fewer employees had a higher risk of robbery. Robbery risks were also higher when a store's cash register — often by virtue of its placement — was obscured from exterior view (Clifton, 1987).
- *Coin-operated gas meters.* Coin-operated gas meters in public housing in Kirkholt, England, were the frequent targets of residential burglaries. The pay-as-you-go meters provided a pre-set amount of gas for heating and cooking. Although emptied periodically, the meters could hold a large amount of money. Removing them contributed to a 40% decline in burglaries in the first year and a sustained decline over the next three years (Forrester et al., 1988, 1990).
- *Width of aisles in stores.* In a study in England, narrow aisles in shopping markets were found to facilitate purse snatching, as offenders bumped patrons. Consequently, the aisles of the markets were widened and reported thefts declined 44% (Poyner and Webb, 1992).
- *Traffic volume and flow.* Street closings and rerouting of traffic have had a major effect on a wide variety of crimes, according to the review in Sherman et al. (1997). Such changes in traffic patterns have reduced prostitution, drive-by shootings, homicides, violent crime and burglary.
- *Duration of visibility.* Studies of graffiti have shown that decreasing its duration reduces its prevalence. Left to fester, graffiti acts like a magnet for other graffiti. Quick removal of

graffiti denies vandals the pleasure of having the graffiti seen. Of course, one can't easily measure the duration of graffiti unless it has been carefully enumerated (Sloan-Howitt and Kelling, 1990).

- *Placement of gas islands.* In Kansas City, MO, the placement of gas station islands influenced the ability of employees to monitor drive-offs and employee theft (Police Executive Research Forum, 2001).

Of course, one wants to identify these key variables as early as possible in the analysis process. To do so early saves time, money and energy. In some cases, the routine examination of recorded crime data may point to key variables. For example, such a routine examination will include point of break in, type of property stolen, proximity to schools, bars or other crime generators, time of day of offense and so forth.

In most cases, a review of the literature is a necessary step for identifying possible variables of interest. Such an examination, for example, for residential burglary would unearth variables such as the presence of an alley, corner location, typical occupancy patterns, traffic ingress and egress, proximity to pedestrian paths, proximity to neighbors, and a host of other variables that have been associated with burglary (Weisel, 2002).

Sequencing Research Steps

The ordering of data collection matters, for both practical reasons and for shedding light on problems. It matters how one proceeds with research. The idea is not to throw out a huge net and reel in whatever gets caught up in the net. Instead, a strategic analytic process will involve sequencing research steps. The general process is to move from the broad to the specific, and do so in a way that information collected and examined in one stage, informs the questions in the next. (The research steps and sequencing are laid out in Figure 1.)

Both Bynum (2001) and Clarke (1998) suggest that analysis be organized to answer the questions of who, what, where, why, when and how? In practical terms, the sequence should consist of what (problem) occurs when (time of day or other temporal dimension) and where (geographic location) and affects whom (victims or offenders)? This examination should also illuminate exactly *how* the problem occurs, but the ultimate objective of analysis is to understand *why* a problem recurs at a particular time and place in the way that it does. In general, we can expect what, when, where and who to be identified

through existing databases, and to be examined in preliminary analyses.

Systematic analyses should begin with an examination of existing data: the incident reports, arrests and call data mentioned previously. There are practical reasons for this: the data are available and, since they are largely automated, they are available quickly and can be downloaded to personal computers for examination. For problems that are numerous and are well represented in police data — burglaries, robberies, homicides and the like — this data source is sufficient for enumeration. The data are used to confirm the presence of the problem and begin a preliminary examination for trends within the data. By sorting and classifying the data, we can examine and detect initial patterns of space, time, premises, property taken, offenders' addresses and a host of other variables identified in the data set.

Successful problem solving suggests that analytic tasks cannot occur all at once. A complete examination of secondary data — records of calls, incidents, arrests and other data — should be the first step of analysis. This examination of existing data should be a fairly rigorous examination, in which trends, classifications and explanatory patterns are sought — while recognizing the limitations of the data source. These existing data sources reflect a single perspective (law enforcement), and historic patterns of information-gathering (calls) and police activity (arrests). Thus, these data omit offenses that are unreported, and other key points of view from interest groups such as citizens or businesses, and they reflect the biases associated with arrest patterns. In other words, existing data represents a sample of some unknown population. Despite these limitations, existing data may point problem solvers in the direction to ask key questions about the problem, and will likely suggest ways of prioritizing primary data collection.

For problems which are few in number or otherwise not well-represented in the police data base — domestic violence, graffiti, prostitution, problems with the homeless or mentally ill, and the like — efforts must be made to document or approximate the extent of the problem. This task of enumeration will likely involve primary data collection. The primary method of enumeration includes observation (e.g., of speeders, loiterers, prostitutes or customers in drug markets) or close substitutes such as surveillance, video surveillance, traffic counters and the like. The goal is to approximate what existing data — if available — would demonstrate about the problem: what, where, when, who and how questions. While some problem-solving efforts may be inclined to conduct surveys at this point or engage other

high-resource tasks, these are better deferred until more is known about the parameters of the problem.[7]

Upon completion of trend analyses, before much effort has been expended in analysis, problem solvers should parse the problem, usually scaling back the problem under investigation. This parsing will often involve geography — e.g., alcohol consumption in a park (or group of parks), speeding through school zones, gas drive-offs at convenience stores, and the like. But parsing may reflect other subcategories of existing problems: e.g., homosexual prostitution, motor vehicle theft for parts, or burglary by juveniles. Once the parameters of the problem are established, every effort should be made to establish the prevalence of the problem by determining an accurate denominator.

A review of literature on the problem should occur at this point, as well as a review of past practices to address the problem. The reviews should carefully identify contextual variables that were key elements in other work, in research or prior experience. Clear identification of these variables allows the analysis to determine if the local problem is consistent with other studies or whether variations exist.

And now comes the creative part of analysis: primary data collection. Primary data collection tends to be overlooked and is likely disregarded for a variety of reasons. First, as Caulkins (2000) notes: "We tend to measure what is easy to measure, not just what is important." Primary data collection requires the most resources of any analytic process employed thus far. It can be quite time consuming, and requires careful construction of data collection instruments — sometimes employing outside experts; establishment of sample procedures to be followed; and administration or actual collection of the data. If not well-designed, primary data collection is subject to much criticism.

The creative dimension of primary data collection involves determining the research questions about the problem that remain unanswered through other data, and determining the best way to get answers to these questions. Perhaps a single tool can be used to answer the remaining questions. If multiple tools will be used, it is best to plan these to follow sequentially. For example, interviews with police officers could precede interviews with building managers; interviews with building managers should precede environmental surveys; and environmental surveys should precede a community survey. In this way, resources and interim findings can inform each successive data collection effort. The police surveys may reveal the role of nonresidents in a drug problem in an apartment complex. The building owner-manager may reveal management practices that control ingress to properties. An environmental survey may reveal the contri-

bution of lighting or traffic patterns to a contained neighborhood. Thus, the data collected in each wave of data collection are evaluated to determine, and offer questions of greater specificity to be included in, the subsequent data collection tool. This sequencing of data collection and analysis — collect, analyze, revise hypothesis; collect, analyze, revise hypothesis — is intuitive for experienced researchers. However, it needs to be made explicit to offer guidance for problem solvers with less experience.

There are two major types of primary data collection: unobtrusive and intrusive measures. Unobtrusive measures primarily include observation and surveillance; these methods are somewhat broader, however, and may include traffic counters, CCTV, environmental surveys and other devices. Intrusive data collection measures include surveys, interviews, and focus groups — measures that involve face-to-face interaction. If more than one primary data collection instrument is to be used, it is often best to employ non-intrusive measures first, and obtrusive measures last. The practical reason for this is that it is difficult to revise a survey after it has been completed, and it is difficult to reschedule and carry out focus groups and the like. Typically, non-intrusive measures are less expensive and can be replicated, and even expanded; surveys, more complex and much more expensive, are typically a one-shot deal. Just as we favor the least intrusive and least expensive responses, so to do we prioritize analysis tasks, avoiding large investments of time and resources when quicker and cheaper options will answer the same questions.

These latter analysis measures are sometimes more complex and more labor intensive than the preceding tasks and every effort should be made to craft instruments and data collection processes that will answer any remaining questions about a problems. This is sort of the last gig, so it needs to be good. The most technical part of this type of data collection may involve the use of sampling, and this is an element that requires a modest level of expertise. (Of course, if the complete population will be surveyed — all burglary victims, all motel owner-managers, all the residents or businesses around a prostitution problem — then there is no sampling involved.)

Lastly, of course, we examine the overall picture provided by data and draw inferences from it. The goal should be to develop a coherent story about the problem, identifying the key constructions that contribute to its existence as a problem. This should determine the most viable pinch point or point of intervention. All of the data collected will not fit into or contribute to the story about the problem.

Increasing Use of Qualitative Methods

We have described how analysis of problems involves articulating working hypotheses, the search for alternative explanations, ruling out rival hypotheses, and recasting hypotheses. As a result of this iterative process of elucidation and explanation, research on problems is inherently multi-method. Thus, the progression towards "identification of proximal cause" is developmental. Such an approach is consistent with qualitative research designs, which can be employed for primary data collection.

When police think of data, they tend to think of quantitative data. But important qualitative data can be collected about problems, using empirical methods to operationalize and enumerate key constructs. As Schmerler and Velasco (2002) note, police or crime analysts must collect primary data, including qualitative data, to shed light on problems. Such data can illuminate the inherently flawed official records about crime and crime-related problems.

Although data gained through these qualitative methods may be viewed as unscientific, there are established practices that sufficiently increase the validity of collected data. In particular, primary data collection can and should be conducted systematically; for example, observations should be conducted at specific times, and interviews should use established questionnaires. Qualitative research methods can overcome limitations of data availability and resolve some issues related to bias since existing or quantitative data about problems are based primarily on official sources and records such as recorded calls-for-service, reported crime, arrest reports, field interviews and citizen complaints.

Qualitative research has often been viewed as subjective, non-scientific research that is laden with the researcher's own values. Its historical beginnings may have contributed to the stereotype that "anything goes" in qualitative research, stereotyping the social science method as inferior and unscientific. This view of qualitative research continues today. The primary criticisms of qualitative methods include its subjectivity or inherent bias, the absence of sufficient rigor (contributing to weak validity), the inability of the method to establish causality, its inherent unsuitability for answering empirical questions, and limited generalizability. Increasingly, however, most qualitative researchers emphasize the importance of objectivity. Of course, all research methods are vulnerable to bias because there are judgment calls inherent in selecting issues to study, questions to include and subjects to study (Kuhn, 1962; Cook and Campbell, 1979.)

Quantitative studies, especially experimental or quasi-experimental designs, were developed for their capacity to reduce the

uncertainty associated with making causal claims. In general, quantitative researchers use Popper's (1959) concept of falsification, "proceed [ing] less by seeking to confirm theoretical predictions about causal connections than by seeking to falsify them." In contrast, qualitative studies aim to develop "the very theoretical constructs which the quantitative research seeks to falsify" (Cook and Campbell, 1979). In other words, one method develops, one method disproves; the former by finding examples, the latter by finding the exceptions. The former involves continuous revisions of classification schemes as additional data are collected, and thus the use of "provisional hypotheses" to suggest lines of investigation. This approach is essential for the conduct of analysis for problem solving.

It is widely accepted that qualitative methods cannot be used to establish causality — but they can inform causal sequencing. Qualitative studies also can be rigorous and rule out numerous threats to validity through a series of verification tactics. Internal validity can be increased by insuring data reliability through a triangulation process of: repeated verification using different kinds of measures of the same phenomenon; corroborating or seeking contradiction of findings from informants; making comparisons between data sets; examining the meaning of outliers, searching for rival explanations and negative evidence; ruling out spurious relationships; and replicating findings.

The rigor of qualitative studies can also be enhanced through the use of systematic processes for data collection, recording and coding of data - generating categories, themes and patterns; data reduction and interpretation; testing the emerging hypotheses against the data; and searching for alternative explanations. Techniques such as pattern matching, comparative studies and cross-site case studies can be structured to collect quantitative data, and thus answer many empirical questions (Glaser and Straus, 1967; Marshall and Rossman, 1995; Miles and Huberman, 1984; Hedrick, 1994; Kirk and Miller, 1986).

Much qualitative data can be converted into quantitative information through coding and counting, permitting the statistical testing of data gathered through qualitative methods. This analysis produces greater explanatory power and greater generalizability. Glaser and Straus claim random sampling is not necessary to discover relationships and is important only if the researcher wishes to describe "magnitude of relationship within a particular group." Indeed, random sampling is not always possible because of our inability to determine the parameters of many populations of interest. Sampling limitations limit statistical validity, but Glaser and Straus (1967:228) point out that data can be verified through the "aggregation and comparison of evidence of different kinds and from different sources."

ANALYTIC TECHNIQUES

In most social science research, we are concerned with the validity of our data: Do the data accurately reflect the phenomenon we intended to measure? Design sensitivity, data measurement and quality are important issues, which are beyond the scope of this paper. But these issues have important implications for analysis — hence evaluation — of problem-solving efforts. For example, the scale of the problem-solving effort has major implications for the type of analyses that may be undertaken. To detect results, problems of sufficient size are necessary to detect effects (see Weisburd, 1993, for a detailed description of this issue) and quantitative data are inherently necessary to measure the magnitude of problem reduction.

The preceding section of this paper describes systematically collecting data about problems. The process of analysis in problem solving, however, is about more than collection of data. To be useful, the data must be interpreted or evaluated in some way to make sense of them. In a 52-page guide for law enforcement published by the U.S. Department of Justice about the analysis of problems, Bynum (2001) dedicates a single paragraph — actually a single sentence — to the actual analysis of data. He suggests that data be analyzed with descriptive univariate statistics (frequency distributions), and two-by-two cross-tabulations of multivariate statistics. Other studies compare prevalence between locations and consist of correlational studies. These are not complex procedures.

Is this an adequate analytical rigor given the extensive efforts in which we have engaged to enumerate and examine the problem? It is true that we can't make statistical inferences from most data collected for problem solving. In many cases, convenience or purposive samples are drawn from populations that do not have established parameters (Maltz, 1994).

The analytic methods employed in recorded problem-solving efforts have varied. In descriptions of the six Herman Goldstein award winners in 2000 at the annual Problem-Oriented Policing conference, no sophisticated statistical analyses were used (Police Executive Research Forum, 2001). The primary method of analysis consisted of reporting frequency distributions. Perhaps the most complex analysis was an examination of gas thefts in Kansas City, MO that compared frequency distributions of offenses between police patrol divisions, and detected the concentration of offenses at three addresses within the patrol division of interest. This analytic task — searching for patterns of temporal and spatial clustering — is a recurring phenomenon in analysis; indeed, classification and sorting of data are the major analytic processes used in problem solving.

To increase reliability and validity of data, most analytic procedures for problem solving — however rudimentary — should include triangulation, to verify and confirm Findings, and rule out rival hypotheses or contradictory findings. But how much analysis is necessary? This will depend upon the scope and severity of the problem, but in general analysis should be sufficient to tell a coherent story about a problem.

The level of analytical skills necessary need not be daunting. For example, in Clarke and Goldstein (2002), several analytic processes were undertaken to examine a problem for which there were 109 incidents in the baseline year. The scale of the problem was not huge, and in fact it may be a fairly typical-sized problem-solving effort. The major analytic tasks included the following:

- Collection of reported crime data on theft from construction sites; determination of number involving appliances.
- Identification of low clearance rate for crimes.
- Review of property stolen: type and brand of appliance, plug-in versus hard-wire installation.
- Identification of builders.
- Determination of median loss per break-in.
- Calculation of break-in risks by builder, based on number of occupancy certificates.
- Review of builder security practices.

The list of analytic tasks proceeds more or less chronologically, demonstrating how successful analysis moves systematically in three key ways:

- From an examination of existing data (reported crime) to primary data collection;
- From the broad to the narrow; and
- Building analytic tasks one upon another, suggesting that thought follows each major analytic task.

Thus, although the analytical techniques employed are not statistically sophisticated, the process of concatenation — the coupled sequencing of the analytical process — provided insight into the problem being examined. This sequencing — moving down a cone of resolution — is a key element of analyzing problems.

One of the biggest problems with primary data collection appears to be the absence of a coherent plan for data collection tasks. Based on case studies, there is some evidence that primary data collection

efforts of police are highly unfocused.[8] Consider for example, the winner of the 2000 Herman Goldstein award (Police Executive Research Forum, 2001). The case study of addressing a graffiti problem identified a list of major analytic tasks undertaken, included the following in what appears to be the temporal sequencing employed:

- A community meeting in which the graffiti problem was voiced.
- A mapping survey of graffiti, determining the type, location, and offenders (gangs, crews of individuals responsible for tags).
- Research of expenditures on graffiti removal.
- A focus group of 10 convicted taggers, exploring motives.
- Calls-for-service, arrests, type, suspect age, proximity of tagging to suspects' residences.
- A survey of 25 taggers in custody, exploring motives.
- Examination of prior responses, including police response and dispositions.
- Examination of responses by other jurisdictions.

While their data collection efforts were extensive, there is no indication that any analytic task — and its findings — led to any other analytic task. Reading the case study leaves the reader — at least this one! — confused as to the sequencing of the tasks, their thoroughness, and even their purpose.[9] For example, the officers undertook a mapping survey of a two-square mile area, counting more than 300 incidents of graffiti. (This task would be consistent with the practice of enumeration recommended earlier in this paper.) The case study reported that the officers stopped counting at 300, suggesting that the enumeration was not complete and there were more than 300 instances of graffiti. Did this number represent most of the graffiti in the four-square mile police division being examined or a small portion? There is no indication of how the survey was carried out: were major streets, or "hot" graffiti locations sampled or any systematic method of data collection followed? The absence of information about this critical analytic step is suggestive that the data collection occurred haphazardly.

Despite weaknesses in the method of data collection, the data were used as if they were reliable. For example, police examined the relationship between tagging locations, and the routes to and from school of the homes of taggers (presumably homes of the 10 convicted taggers who were part of a focus group). Elsewhere in the case

study, police stated "70% of graffiti tags were reported," presumably relating 218 calls-for-service in 1998 to the 300 counted incidents of graffiti, concluding that graffiti is underreported.[10]

Similarly, the report states that 265 of the graffiti incidents appeared at rental housing, while 35 occurred at single-family houses. The counted graffiti on these two building types totals the claimed 300 incidents, but the narrative goes on to describe the prevalence of graffiti at business corridors, in alleys, on dumpsters, poles and boxes, and school walls. It is unclear whether the graffiti on these surfaces and buildings went uncounted and, if so, why?

Importantly, the case study claimed a 90% in reduction of graffiti after a series of responses were implemented. Although not stated, the presumption is that the 300 incidents were used as a baseline measure; the post-intervention measure was described as "an inspection of the neighborhood." The reader might presume that this inspection followed the same data collection path as was used in the original mapping survey, but I suspect such a presumption gives credit where it is not due.

This case study of graffiti efforts was noteworthy: the officers carried out a great deal of investigative work, were wide-ranging in their efforts to collect information, and involved some other agencies in development of their response. They were well-intentioned, committed and showed a sustained commitment to the project over time. They were innovative, and did not leap immediately to an enforcement-based response as often occurs. The judges who selected the project as the Goldstein award winner stated that the "project was exemplary," citing the "dramatically positive" effect of the response (presumably that 90% reduction in graffiti).

Perhaps the most noteworthy aspect of this case study is that it had the *potential* to be an exemplar of problem solving. There was a large problem, high levels of concern, and a high level of commitment from the officers who worked hard on the project. If this is true, what went wrong with this project? The biggest weakness in the case seems to be analysis and the unsystematic manner in which a series of analyses were undertaken. Based on the written narrative, the police undertook the mapping survey fairly soon after a community meeting in which graffiti was voiced as a concern. The mapping survey was used to "quantify the extent of the problem," or validate the concerns expressed by citizens. In hindsight, the officers may have been better served to first review existing data (arrests, calls-for-service and such) about graffiti, and put more development effort into the design of the mapping survey (actually an environmental survey), even tapping the expertise of experts such as crime analysts. The "pinch point" of the analysis was this mapping survey, and its devel-

opment and administration should probably have shared the rigor often associated with development and administration of a community survey.

The study may also have suffered from a predisposition to focus on active and potential taggers. For example, an analytical task that appeared to have occurred early in the project involved a focus group of 10 taggers, in which a psychologist "counseled" taggers for three months to uncover their motivations and reasons for tagging.

Perhaps the most sophisticated statistical methods to be commonly employed in analysis for problem solving involve community surveys or other data collection methods, which usually involve sampling, and thus inferential statistics. The development of sophisticated data collection instruments also requires a level of expertise in developing neutral questions, determining an appropriate sample, and administering the survey. If the survey is to be administered to a sample, sample selection and size determination is a task in which most practitioners would have little experience.

FUTURE OF ANALYSIS

The future of analysis in solving persistent community problems will involve the dramatic expansion of data collection methods and a rising interest in data-driven decisions. Accountability of police and their relative effectiveness — including cost-effectiveness — are likely to have a strong influence on policy making and police practice in the future. Since problem-oriented policing is dependent on good quality information, knowledge and expertise, the future of problem solving in policing will be dependent upon the "collection, processing, analysis and dissemination of information" (Brodeur, 1998:50). Indeed, the increased availability of computerized data has already transformed decision making in police agencies (Reiss, 1992). Increasingly in the 2000s, new technologies can expand data collection and analysis methods and contribute to our understanding of problems.

A wide variety of technologies are changing the ability of police to collect information about crime and public safety problems. For example, tools such as CCTV, used to monitor traffic conditions and misbehaviors, can also be used as baseline measuring devices of volume, demographics, and road use behaviors. Other technologies may be used to gather information:

- With its Fast Fax program, the Fairfax County Police Department (Virginia) can send important information to hundreds of local businesses in a matter of minutes. A fax might detail a recent robbery and describe the suspect or notify business

owners of the next scheduled crime prevention meeting (Waggoner, 1997). This communication may also work for notification of police.

- In some Chicago neighborhoods, community policing officers carry beepers to help them respond to the concerns of local business owners. To divert nonemergency calls from an overburdened 911 system, shopkeepers report such incidents as loitering, shoplifting, panhandling, parking problems, and suspicious activity (Waggoner, 1997). Such data — if recorded and analyzed — provide valuable information to police.
- In Baltimore, nearly 60% of the calls received by the 911 emergency system during 1995 were not emergency calls. During the first year of operation of a 311 non-emergency number, 911 calls for police service declined 24.7%, and the number of calls dispatched declined by 6.6%. Citizen satisfaction rate for request-for-service calls to the 311 center was 98.4%. Although early evaluation data suggested the 311 concept could enhance the police department's community policing goals (Baltimore Police Department, 1997), later studies unfortunately showed that referral data were not tracked (Mazzerole et al., 2002). Data available from 311 systems provide a wealth of information about neighborhood problems that are often difficult to discern from emergency calls.
- Police patrol vehicles are increasingly equipped with cameras. Cameras provide a rich source of information for addressing underlying questions of minority trust and confidence in the police. Thousands of traffic stops are videotaped — and held for up to a year. The tapes provide a rich data source for examining the ways in which law enforcement and those stopped respond to these stressful encounters.
- Video surveillance of drug or other illegal markets can document the way markets operate. In Charlotte-Mecklenburg, center city cameras were able to zoom in and identify a previously unidentified drug market. One of the main sellers would open the hood of his car and fake working on it, to alert buyers that the business was open. This is inherently a qualitative measure. Video surveillance as an unobtrusive measure has potential to further enrich our limited understanding of drug markets and other illegal markets.
- Community surveys have become a routine method for police to gather information from citizens. According to the U.S. Justice Department, 62% of law enforcement agencies con-

duct citizen surveys to inform police regarding problems of crime and disorder (Reaves and Holt, 2000). Such surveys can be tailored to elaborate citizen perceptions about specific problems, providing a valuable source of information to police and a basis of comparison in different areas.

- Mapping of crime and public safety information is a useful way to sort and represent data, and present information in a way that is easily understood. The increased availability of PC-based mapping software enables most police agencies to engage in mapping crime and disorder, facilitating an examination of problems by time and geography. According to the Justice Department, 68% of law enforcement agencies in the U.S. use computerized geocoded and mapping data (Reaves and Holt, 2000). This includes mapping of arrests, incidents and calls-for-service — with arrest data mapped the least often and incidents the most often.

- The National Incident Based Reporting System (NIBRS) — a system designed to collect more information about crime incidents than UCR — provides a wealth of additional information about crime-related problems, especially victims. According to the Justice Department, 56% of law enforcement agencies in the U.S. are NIBRS-compliant (Reaves and Holt, 2000).

Not since the Uniform Crime Reports were established in the 1930s in the United States have we had such a windfall of information about crime. The locus for much of the increased availability of information will not be crime analysis units as currently configured. Although such units exist in two-thirds of police agencies in the United States (Reaves and Goldberg, 1999), crime analysis units are inherently organizationally decoupled from the police agency. Indeed, 15 years ago Eck and Spelman (1987) criticized the dependence on crime analysis units for problem solving because of the analysts' reliance on existing police records. A core component of problem-oriented policing is research, yet few police departments, if any, have research and development units; instead, the loci for information about crime — crime analysis units — choose to focus on descriptive, aggregate statistics.

In practical terms, analysis should not be relegated to crime analysis units, which may suffer from rudimentary dependence on existing data, are often decoupled from the police agency and its officers, and detached from communities. Nor should analysis be resident among patrol officers, with their penchant for enforcement responses and reluctance to invest the necessary time for careful research. Nor should analysis be entrusted to the hands of academics,

who may try to impose excessive rigor, be overly time-consuming (Bynum, 2001), miss the obvious and otherwise provide research that is not relevant for practitioners (Duffee et al., 2000; Laycock, 2000). A former chief of the San Diego Police Department suggested that analysis is best left to the "homework squad" — people who both care and have the capacity to do research. But this too has weaknesses — those who could contribute most and benefit most from the research, are left out of the process (Toch and Grant, 1991). In practice, effective problem solving will invariably involve some combination of these actors, interacting in ways such that each may substantially contribute to developing both an understanding of a particular problem and developing the solution that will be most effective.

Address correspondence to: Deborah Lamm Weisel, North Carolina State University, Department of Political Science and Public Administration, 1307 Glenwood Avenue, Suite 157, Raleigh, North Carolina 27605. E-mail: <dlweisel@social.chass.ncsu.edu>.

REFERENCES

Baltimore Police Department (1997). "Baltimore Police Department Communications Division 3-1-1 Non-emergency Telephone Number First Annual Program Evaluation (October 1996/September 1997)." Baltimore, MD: author.

Becker, J. (2002). "Montgomery Called Lax on Alcohol." *Washington Post*, p.B1 (Feb. 12).

Brodeur, J.P. (1998). *How to Recognize Good Policing.* Thousand Oaks, CA: Sage Publications.

Bynum, T.S. (2001). *Using Analysis for Problem Solving: A Guide for Law Enforcement.* Washington, DC: U.S. Office of Community Oriented Policing Services, Department of Justice.

Caulkins, J.P. (2000). "Measurement and Analysis of Drug Problems and Drug Control Efforts." In: *Measurement and Analysis of Crime and Justice.* (Criminal Justice 2000 series, vol. 4.) Washington, DC: Office of Justice Programs, National Institute of Justice.

Clarke, R.V. (1998). "Defining Police Strategies: Problem-Solving, Problem-Oriented Policing and Community Oriented Policing." In: T.O. Shelley and A.C. Grant (eds.), *Problem-Oriented Policing: Crime Spe-*

cific Problems, Critical Issues and Making POP Work. Washington, DC: Police Executive Research Forum.

——and H. Goldstein (2002). "Reducing Theft at Construction Sites: Lessons From a Problem-Oriented Project." In: N. Tilley (ed.), *Analysis for Crime Prevention.* (Crime Prevention Studies, vol. 13.) Monsey, NY: Criminal Justice Press.

Clifton, W. (1987). "Convenience Store Robberies in Gainesville, FL: An Intervention Strategy by the Gainesville Police Department." Gainesville, FL: Gainesville Police Department (photocopy).

Cook, T.D. and D.T. Campbell (1979). *Quasi-Bxperimentation: Design and Analysis Issues for Field Settings.* Boston, MA: Hough ton Mifflin.

Duffee, D., D. McDowall, L.G. Mazerolle and S.D. Mastroski (2000). "Measurement and Analysis of Crime and Justice: An Introductory Essay." (Criminal Justice 2000 series, vol. 4.) Washington DC: National Institute of Justice, U.S. Department of Justice.

Eck, J.E. (1995). "A General Model of the Geography of Illicit Retail Marketplaces." In: J.E. Eck and D. Weisburd (eds.), *Crime and Place.* (Crime Prevention Studies vol. 4.) Monsey, NY: Criminal Justice Press.

——and W. Spelman (1987). "Who Ya' Gonna Call? The Police as Problem Busters." *Crime & Delinquency* 33(l):31-52.

——and W. Spelman (1987). *Problem-Solving; Problem-Oriented Policing in Newport News.* Washington, DC: Police Executive Research Forum.

Forrester, D.I., S. Frenz, M. O'Connell and K. Pease (1990). *The Kirkholt Burglary Prevention Project: Phase II.* (Crime Prevention Unit Paper no. 23.) London, UK: Home Office.

——M.R. Chatterton and K. Pease (1988). *The Kirkholt Burglary Prevention Demonstration Project, Rochdale.* (Crime Prevention Unit Paper no. 13.) London, UK: Home Office.

Glaser, B. and A.L. Straus (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research.* Chicago, IL: Aldine.

Goldstein, H. (1990). *Problem-Oriented Policing.* New York: McGraw Hill.

Hedrick, T. (1994). "Possibilities for Integration." In: C.S. Reichardt and S.F. Rallis (eds.), *The Qualitative-Quantitative Debate: New Perspectives.* San Francisco, CA: Jossey-Bass Publishers.

Hunter, R.D. (1999). "Convenience Store Robbery Revisited: A Review of Prevention Results." *Journal of Security Administration* 22(1): 1-14.

Kirk, J. and M.L. Miller (1986). *Reliability and Validity in Qualitative Research.* Beverly Hills, CA: Sage Publications.

Kuhn, T.S. (1962). *The Structure of Scientific Revolutions.* Chicago, IL: University of Chicago Press.

Laycock, G. (2001). "Scientists or Politicians: Who Has the Answer to Crime." Lecture, Jill Dando Institute of Crime Science, University College, London, April 26.

——(2000). "Becoming More Assertive About Good Research: What Police Practitioners Should Ask of the Academic Community." *Subject to Debate* 14(7): 1-4.

Maltz, M.D. (1994). "Deviating From the Mean: The Declining Significance of Significance." *Journal of Research in Crime and Delinquency* 31(4):434-463.

Marshall, C. and G.B. Rossman (1995). *Designing Qualitative Research.* Newbury Park, CA: Sage Publications.

Mastrofski, S.D. (1998). "Community Policing and Organization Structure." In: J.P. Brodeur (ed.), *How to Recognize Good Policing: Problems and Issues,* Washington, DC: Police Executive Research Forum, and Sage Publications.

Mazzerole, L., D. Rogan, J. Frank, C. Famega and J.E. Eck (2002). "Managing Citizen Calls to Police: An Assessment of Non-Emergency Call Systems." *Criminology and Public Policy* 2(1):97-123.

Miles, M.B. and A.M. Huberman (1984). *Qualitative Data Analysis: A Sourcebook of New Methods.* Newbury Park, CA: Sage Publications.

Moore, M.H. (1992). "Problem-solving and Community Policing." In: M. Tonry and N. Morris (eds.), *Modern Policing.* (Crime and Justice series, vol. 15.) Chicago, IL: University of Chicago Press.

Police Executive Research Forum (2001). *Excellence in Problem-Oriented Policing: Winners of the 2000 Herman Goldstein Award for Excellence in Policing.* Washington, DC: PERF and the Office of Community Oriented Policing Services, U.S. Department of Justice.

Popper, K.R. (1959). *The Logic of Scientific Discovery.* New York, NY: Basic Books.

Poyner, B. and B. Webb (1992). "Reducing Theft from Shopping Bags in City Center Markets." In: R.V. Clarke (ed.), *Situational Crime Prevention: Successful Case Studies.* New York, NY: Harrow and Heston.

Read, T. and N. Tilley (2000). *Not Rocket Science? Problem-Solving and Crime Reduction.* (Crime Reduction Research Series, Paper No. 6.) London, UK: Police Research Group, Home Office.

Reaves, B.A. and A.L. Goldberg (1999). *Law Enforcement Management and Administrative Statistics.* Washington, DC: U.S. Bureau of Justice Statistics.

——and T.C. Holt (2000). *Law Enforcement Management and Administrative Statistics, 1999: Data for Individual State and Local Agencies with 100 or More Officers.* Washington, DC: Bureau of Justice Statistics, U.S. Department of Justice.

Reiss, A.J. (1992). "Police Organization in the 20th Century." In M. Tonry and N. Morris (eds.), *Modern Policing.* (Crime and Justice series, vol. 15.) Chicago, IL: University of Chicago Press.

Rojek, J. (2001). "A Decade of Excellence in Problem-Oriented Policing: Characteristics of the Goldstein Award Winners." Presentation at the Academy of Criminal Justice Sciences annual meeting, Washington, DC (April 6).

Rosenthal, R. (1979). "The 'File Drawer Problem' and Tolerance for Null Results." *Psychological Bulletin* 86(3):638-641.

Sampson, R. and M.S. Scott (2000). *Tackling Crime and Other Public Safety Problems: Case Studies in Problem Solving.* Washington, DC: Office of Community Oriented Policing Services, U.S. Department of Justice.

Schmerler, K. and M. Velasco (2002). "Primary Data Collection: A Problem-Solving Necessity." *Crime Mapping News* 4(2):4-8.

Scott, M.S. (2000). *Problem-Oriented Policing: Reflections on the First 20 Years.* Washington, DC: Office of Community Oriented Policing Services, U.S. Department of Justice.

Sherman, L.W., D. Gottfredson, D. MacKenzie, J. Eck, P. Reuter and S. Bushway (1998). *Preventing Crime: What Works, What Doesn't, What's Promising: A Report to the U.S. Congress.* Washington, DC: U.S. National Institute of Justice.

Sloan-Howitt, M. and G. Kelling (1990). "Subway Graffiti in New York City: 'Getting' Up vs. 'Meaning It and Cleaning It.'" *Security Journal* 1:131-136.

Taft, P.B. (1986). *Fighting Fear: The Baltimore County COPE Project.* Washington, DC: Police Executive Research Forum.

Tilley, N. (2002). "Introduction: Analysis for Crime Prevention." In: N. Tilley (ed.), *Analysis for Crime Prevention.* (Crime Prevention Studies, vol. 13.) Monsey, NY: Criminal Justice Press.

Toch, H. and J.D. Grant (1991). *Police as Problem Solvers.* New York, NY: Plenum Press.

U.S. Federal Bureau of Investigation (2000). *Crime in the United States.* Washington, DC: U.S. Department of Justice.

Waggoner, K. (1997). "Creative Solutions to Traditional Problems." *FBI Law Enforcement Bulletin* 66 (8): 8-12.

Walker, S. (2001). *Sense and Nonsense About Drugs and Crime* (5th ed.). Belmont, CA: Wadsworth.

Weatheritt, M. (1986). *Innovations in Policing.* London, UK: Croom Helm.

Weisel, D.L. (2002). *Burglary of Single-Family Houses.* (Problem-Oriented Guides for Police Series.) Washington, DC: Office of Community Oriented Policing Services, U.S. Department of Justice.

Weisburd, D. (1993). "Design Sensitivity in Criminal Justice Experiments." In: M. Tonry (ed.), *Crime and Justice: A Review of Research*, vol. 17. Chicago, IL: University of Chicago Press.

NOTES

1. Some authors, such as Weatheritt (1986), suggest that even simple problems may require complex analyses.

2. Clarke and Goldstein (2002) describe two missteps in their analysis of thefts from construction sites: the use of building permits rather than the more precise certificates of occupancy, and problems with a survey of security practices among builders that needed to be revised mid-way in the survey process. Both missteps were corrected.

3. This issue is further characterized by the ongoing debate regarding the proactive versus reactive orientation of police. The availability of recorded crime data rests, of course, on the willingness or ability of people to call the police (Goldstein, 1990); hence police responses to these problems are considered reactive. The extent to which police organizations are proactive has relied primarily on units such as traffic, narcotics, vice, and organized crime because recorded data about the problems addressed by such units is not reliable or representative: it represents convenience samples, changing interests, visibility and other factors.

4. In many ways, the matter of our interest in unreported crime is a practical and an ethical issue. To what extent is unreported crime a concern to police? One concern is that increased efforts result in increased crime, as reported crime tends to increase. Both the British Crime Survey and U.S. National Crime Victims Survey suggest that the proportion of crime reported to police has increased in recent years in the U.S. and Great Britain. Despite protestations to the contrary, we measure much of police effectiveness (or ineffectiveness) by declines (or increases) in reported crime.

5. Sherman et al. (1998) note that the inclusion of a pre- and post-test would strengthen many research designs. The inclusion of a matched comparison group is also made possible through enumeration, and would further strengthen research designs.

6. Much social science research focuses on the testing of a single hypothesis or two, and may exclude alternative or rival hypotheses.

7. Bynum (2001) suggests surveys should be conducted very early in the analysis process since they tend to be time consuming; however, given limited resources and the difficulty in repeating a survey once more is

known about a problem, I advise waiting until secondary analyses have been completed, and non-intrusive and/or inexpensive data collection has occurred, and findings established. One can easily repeat these steps if necessary, but surveys are difficult to revise or repeat.

8. This appearance may in fact be an artifact of police writing about their problem-solving efforts.

9. The review of this case study of graffiti is not intended to criticize the officers who engaged in an extensive amount of work. It is used as an example because it was the *winner* of the Goldstein award, presumably an exemplary effort, yet suffers from major analytic weaknesses.

10. In most places, 70% reporting would not be considered to be a large amount of underreporting.