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Power Law Distribution and Solving the Crime Problem

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The recession has forced law enforcement agencies to take a hard look at their operations to determine where they can cut expenses. As part of that examination, agencies are trying to decide how to use their resources more efficiently and effectively. The critical factor in this process should be the agency's mission: what it proclaims to undertake for the community it serves. The author believes that the principal mission of any law enforcement agency is to prevent crime, and this article is directed primarily at those agencies that share this belief. If the mission is to prevent crime, then how can law enforcement agencies accomplish it in today's environment with smaller budgets and fewer officers? Perhaps one way is to regard the problem of crime and examine its characteristics as a problem.

Power Law Distribution

Author Malcolm Gladwell points out that problems are often assumed to have the normal distribution of a bell curve, where the bulk of the problem is confined to the middle of the curve with the extremes on either end. He believes that the "bell-curve assumption has become so much a part of our mental architecture that we tend to use it to organize experience automatically."¹ Gladwell examined several diverse problems—the Los Angeles, California, Police Department Rampart scandal from the late 1980s and early 1990s, homelessness, and vehicle pollution—and found that none exhibited the characteristics of a bell curve. Rather, each was found to have a power law distribution where all the activity creating the problem lies at one extreme, making it look more like a hockey stick with the activity sloping upward steeply to the left. This type of distribution is also referred to as a J-curve.²

A closer examination of power law distribution shows that not only does it apply to a variety of problems, but it also is "practically a universal law" when it comes to phenomena in general.

John E. Eck, Ronald V. Clarke, and Rob T. Guerette explain:

A small portion of the earth's surface holds a majority of life on earth. Only a small proportion of earthquakes cause most of the earthquake damage. A small portion of the population holds most of the wealth. A small proportion of police officers produce most of the arrests resulting in prosecution.³ In more popular terms, this kind of distribution is commonly referred to as the 80-20 rule; 20 percent of some things are responsible for 80 percent of the outcomes.⁴ In practice, it is seldom exactly 80-20, but it is always a small percentage of some group involved in a large percentage of some result.⁵

Crime is also a phenomenon that displays a power law distribution, both in the people who commit it and in the places where it is committed.

Prolific Criminal Offenders

Power law theory, as it applies to offenders, has been well documented for the past several decades. In the Philadelphia Cohort Study, which followed 9,945 subjects from childhood to adulthood, only 6.3 percent of offenders labeled "chronic" were responsible for 52 percent of the crimes committed by all the study's participants.⁶ A United Kingdom Home Office study, which focused on a group of 51,441 children born in Great Britain in 1953, found that 7 percent of the study group accounted for 65 percent of the criminal convictions for the entire study group.⁷ Of the most significance to this discussion of power law and prolific offenders are two separate studies conducted on two different continents, 25 years apart: the Cambridge Study in Delinquent Development and the Pittsburgh Youth Study.

The Cambridge Study in Delinquent Development was a prospective longitudinal study of 411 males in a working-class area of North London in the United Kingdom that covered a period of more than 20 years, with solid data available for 395 subjects out of the total original sample.⁸ It is important to note that this study focused on actual conviction data for offenses "synonymous with 'serious' or 'criminal' offenses . . . no convictions for traffic offenses were included, nor convictions for offenses regarded as minor."⁹ The results of the Cambridge study showed that one-third of the subjects in the sample were convicted at least once, with the maximum number of convictions at 14 by two subjects.¹⁰ Just 22 of the subjects were responsible for half of the crimes committed by the entire study group.¹¹ In addition, the study showed that there was only a 10 percent chance that the frequent offenders were likely to end their criminal careers, while there was a 33 percent chance that the occasional offenders would stop committing crimes after a conviction.¹² Will Cook et al. note that a power law relationship describes both the data for the entire sample and the data that excludes the two-thirds of the subjects with no convictions.¹³ In other words, for the entire sample, a small percentage of those subjects were responsible for most of the convictions, and a small percentage of those subjects were responsible for most of the convictions, and a small percentage of those subjects that received convictions were responsible for a large percentage of the total number of convictions.

The Pittsburgh Youth Study began in 1986 with a total sample of 1,517 boys from three different grade levels in the Pittsburgh, Pennsylvania, public school system. Unlike the Cambridge study, which relied on actual convictions of its subjects, the Pittsburgh study analyzed "self-reported" acts of delinquency.¹⁴ Two-thirds of the subjects in the study reported no acts of delinquency, just as two-thirds of the subjects in the Cambridge study had no convictions, and of the subjects that did report acts of delinquency, 87 percent reported between one and twenty acts.¹⁵ Again, as with the Cambridge study, a power law relationship describes both the data from all the subjects and the data when the subjects with zero reported acts are removed.¹⁶ Cook et al. summarize the most relevant points of these two studies:

We therefore examine different aspects of criminal activity—convictions and self-reported acts of delinquency—over different timescales. The results are remarkably similar in the two separate studies. A power law relating the frequency to the rank of the number of convictions/reported criminal acts fits the overall samples well and better than the alternative hypothesis of an exponential relationship between the two. However, the exclusion of the frequency with which zero crimes are committed/reported improves the fit with both data sets. In other words, when the sample is restricted to those individuals who have actually committed a crime in the relevant time period, a power law describes the frequency distribution even better than when the whole sample is used.¹⁷

Consider these findings for a moment. Two different studies on two different continents, separated by 25 years, with different methods of recording data, and yet the results are nearly identical. Power law distribution clearly applies to those who commit crime. A vast majority of the population commits little to no crime, with only a small percentage of the population committing any crime. Moreover, an even smaller percentage of the criminal population commits most of the crime. Similar results are found when examining the places in which crime is committed.

Prolific Crime Places

A Seattle, Washington, study that spanned 14 years found that 4 percent to 5 percent of the city's blocks accounted for 50 percent of the reported crime, while 84 percent of the blocks maintained stable levels of reported crime over the entire length of the study.¹⁸ Braga studied shootings in Boston over a 30-year period and found that the 7,359 total incidents occurred in only 11.5 percent of the city; in other words, 88.5 percent of the city experienced no shooting incidents at all.¹⁹ In a Minneapolis, Minnesota, study, a mere 3 percent of the addresses in the city accounted for 50 percent of all calls for service to the police during a one-year period.²⁰ Sherman notes that "this concentration was even greater for the predatory crimes of robbery, criminal sexual conduct, and auto theft: only 5 percent of the 115,000 street addresses and intersections in the city produced 100 percent of the calls for those usually stranger-perpetrated crimes."²¹ Sherman further examines this concentration:

One cause of that concentration, of course, is the small number of those crimes relative to the large number of places. Even without any repeat locations, for example, all of the robberies could only have occurred at 3.6 percent of all places. But the fact is that with repeat occurrences, they occurred at only 2.2 percent of the places—a 40 percent reduction from the hypothetical number of places if there were no repeat locations. Domestic violence is even more concentrated by place of occurrence than robbery. While 21 percent of the places in Minneapolis could have had a domestic disturbance call without repeats, only 8.6 percent actually did—a 59 percent reduction.²²

Sherman concludes by comparing the Minneapolis data with the Philadelphia Cohort Study, showing that the concentration of crime in relation to places is six times greater than in relation to persons.

In one of the most comprehensive examinations, John Eck et al. clearly demonstrate the power law relationship between places and crime in a review of "risky facilities."²³ Thirty-seven studies were identified that included data about variations in the risks of crime, disorder, or misconduct in facilities such as banks, bars, schools, sports facilities, and parking structures. From a review of these studies, "it appears that crime in any population of similar facilities in a geographic area and time period will be highly concentrated in a few facilities, while most of the facilities will have relatively few or even no crimes."²⁴ For example, a study of bars located in Shawnee, Kansas,

showed that 20 percent of the bars accounted for 62 percent of reported crime at all bars over a two-year period. In a study of stores in Danvers, Connecticut, 20 percent of the stores accounted for 85 percent of the reported shoplifting cases.²⁵ A Jacksonville, Florida, study examined apartment complexes with at least one reported crime, rather than looking at all apartment complexes, which turned out to be 269 apartment complexes, each with more than 50 units. In this data set, 20 percent of the complexes accounted for approximately 47 percent of the crime—a number that would be much higher if the apartment complexes with no calls to police were included.²⁶ In Chula Vista, California, 19 percent of the motels in the city accounted for 51 percent of the calls for service to police. Even when motels were separated by those locally owned versus those belonging to a national chain, the data remained virtually unchanged: 20 percent of locally owned motels accounted for 50 percent of the calls from all locally owned motels, and 20 percent of the national chain motels accounted for 54 percent of the calls from all national chain motels.²⁷ The power law relationship exists even when crime is categorized separately into violent and property crimes.²⁸

Eck et al. conclude that the power law relationship between facilities and crime is the rule rather than the exception, regardless of whether the facilities or the crimes are subdivided. The implications are obvious:

Focus on the high crime members of the facility set and, if one is successful at driving down crime at these locations, the overall crime level for all facilities in the set will decline. The flip side of this argument is just as obvious: focusing on all the facilities, and particularly the low crime facilities, will have little impact and will have greater costs per crime prevented than the recommended approach.²⁹

Based on the research, the same argument holds true for offenders as well. Focusing on the most prolific offenders will drive down crime committed by all offenders. Treating all offenders equally will not.

Implications

On the one hand, the power law characteristics of crime represent good news for law enforcement. As Gladwell notes, “When a problem is that concentrated, you can wrap your arms around it and think about solving it.”³⁰ On the other hand, there is some bad news as well. Foremost is that repeat offenders and high-crime places are not likely to respond to the standard model of policing, which is characterized by “random patrol, rapid uniformed response, deployment of officers to crime investigation once an offense has been detected, and reliance on law enforcement and the legal system as the primary means of trying to reduce crime.”³¹ The bad news, however, is not that bad, as solid research over the last 10–15 years has identified effective policing strategies that address the relationship between power law distribution and crime, particularly repeat offender programs and hot-spot policing for high-crime places.³² These strategies work because they reject the false premise that crime is committed by a large number of individuals over a widespread area; instead, they acknowledge the reality of the problem by attacking those relative few who commit most of the crime, and those small number of places where high concentrations of crime are committed.

With all this said, it is important to point out that the author is not advocating the sole use of enforcement action in addressing the crime problem. True gains in crime reduction may not be fully realized without at least some form of problem-oriented policing, such as what Anthony A. Braga and David Weisburd call “shallow” problem solving.³³ Like repeat-offender programs and hot-spot policing, problem-oriented policing has been shown over time to work in reducing crime.³⁴ In fact, Jerry Ratcliffe’s definition of intelligence-led policing, which focuses on “prolific and serious” offenders, acknowledges the effectiveness of problem-oriented policing and its role in the strategic management component of intelligence-led policing.³⁵ The first step,

however, is still to accept the concentrated nature of crime, and only then can law enforcement begin to change policing to meet this challenge.

In the end, the current economic environment facing law enforcement could be a blessing in disguise. As agencies are forced to examine how they police—particularly those with a crime reduction mission—they may discover that their current strategies are not effective in actually reducing crime. Understanding the power law characteristics of the crime problem is one way to begin solving the problem of crime, and through focusing their resources on targeting repeat criminal offenders and prolific crime places, police agencies actually *can do* more with less. Saving money and reducing crime is a proposition that law enforcement agencies can no longer afford to ignore. ■

Notes:

¹Malcolm Gladwell, *What the Dog Saw: And Other Adventures* (New York: Little, Brown and Company, 2009), 181.

²John E. Eck et al., "Risky Facilities: Crime Concentration in Homogeneous Sets of Establishments and Facilities," *Crime Prevention Studies* 21 (2007): 228, http://www.popcenter.org/tools/risky_facilities/PDFs/Eck_etal_press.pdf (accessed November 5, 2010).

³Eck et al., "Risky Facilities," citing, Brian Forst et al., *Arrest Convictability as a Measure of Police Performance* (Washington, D.C.: U.S. Department of Justice, National Institute of Justice, 1982); and citing, Brian Forst et al., *What Happens after Arrest?* (Washington, D.C.: Institute for Law and Social Research, 1977).

⁴Eck et al., "Risky Facilities," citing, Richard Koch, *The 80/20 Principle: The Secret to Achieving More with Less* (New York: Doubleday, 1999).

⁵Eck et al., "Risky Facilities."

⁶Jery Ratcliffe, *Intelligence-Led Policing* (Portland, Ore.: Willan, 2008), 54.

⁷*Ibid.*, 54–55.

⁸Will Cook et al., "Scaling Behaviour in the Number of Criminal Acts Committed by Individuals," *Journal of Statistical Mechanics: Theory and Experiment* (July 2004): 4–5.

⁹*Ibid.*, 5.

¹⁰*Ibid.*, 6.

¹¹Paul Omrod et al., *Non-linear Modeling of Burglary and Violent Crime in the UK* (London, England: Volterra, 2002), 33.

¹²Ratcliffe, *Intelligence-Led Policing*, 54.

¹³Cook et al., "Scaling Behaviour in the Number of Criminal Acts Committed by Individuals," 9.

¹⁴*Ibid.*, 3.

¹⁵*Ibid.*, 10.

¹⁶*Ibid.*, 11–12.

¹⁷*Ibid.*, 15.

¹⁸Ratcliffe, *Intelligence-Led Policing*, 50.

¹⁹Anthony A. Braga, "Understanding and Preventing Serious Violence in Boston," (presentation, FBI National Academy Associates 2010 Annual Training Conference, Boston, Mass., July 27, 2010).

²⁰Ratcliffe, *Intelligence-Led Policing*, 50.

²¹Lawrence W. Sherman, "Hot Spots of Crime and Criminal Careers of Places," in *Crime Prevention Studies*, ed. John E. Eck and David Weisburd, vol. 4 (1995), 36.

²²*Ibid.*, 36.

²³Eck et al., "Risky Facilities," 225–264.

²⁴*Ibid.*, 229.

²⁵*Ibid.*, 229–230.

²⁶*Ibid.*, 230.

²⁷*Ibid.*, 231.

²⁸*Ibid.*, 230.

²⁹*Ibid.*, 246.

³⁰Gladwell, *What the Dog Saw*, 186.

³¹Ratcliffe, *Intelligence-Led Policing*, 65.

³²Lawrence W. Sherman et al., *Preventing Crime: What Works, What Doesn't, What's Promising* (Washington, D.C.: National Institute of Justice, 1998), <http://www.ncjrs.gov/works> (accessed November 5, 2010); and Brandon C. Walsh, "Evidence-Based Policing and Crime Prevention," in *Police Innovation: Contrasting Perspectives*, ed. David Weisburd and Anthony A. Braga (New York: Cambridge Press, 2006), 305–321.

³³Anthony A. Braga and David Weisburd, "Problem-Oriented Policing: The Disconnect between Principles and Practice," in *Police Innovation: Contrasting Perspectives*, ed. David Weisburd and Anthony A. Braga (New York: Cambridge Press, 2006), 133–152.

³⁴Sherman et al., *Preventing Crime: What Works, What Doesn't, What's Promising*; and Walsh, "Evidence-Based Policing and Crime Prevention," 305–321.

³⁵Jerry Ratcliffe, "Intelligence-Led Policing: Anticipating Risks and Influencing Actions," in *Intelligence 2010: Revising the Basic Elements*, ed. Marilyn B. Peterson, Bob Morehouse, and Richard Wright (IALEIA, in press).

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