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Can Sophisticated Mathematical Models Help Police Fight Crime?

Is it possible to predict crimes from studying human behavior? A new paper from researchers at the University of California shows how mathematical modeling may soon lead to truly predictive police work.

BY TYGHE TRIMBLE

If television crime shows and Hollywood thrillers are to be believed, criminals are intelligent, complex people. It takes a crack team to catch these masterminds who usually elude the authorities time and again.

But common lawbreakers do not fit this picture. Most crime—including burglary, drug-use and homicide—is predictable and even avoidable. Steer clear of the bad side of the neighborhood or move to the nicer part of town and you can get away from much crime. But this simple fact doesn't help police prevent crime from spreading—even if they know where it's happening, it's hard to stop it from happening again nearby. It is these circumstances, a group of researchers from University of California, Los Angeles (UCLA) believe, in which mathematical models can come to the aid of law enforcement.

Most crime happens somewhere familiar to the criminal. Burglars return to the scenes of a crime to replicate the success or exploit vulnerabilities identified during previous offenses, according to Andrea Bertozzi, a professor at UCLA and one of the authors of *Dissipation and Displacement of Hotspots in Reaction-Diffusion Models of Crime*, which will appear in the March 2, 2010 issue of the *Proceedings of the National Academy of Sciences*.

Using data from the Los Angeles Police Department (LAPD), Bertozzi and her colleagues created mathematical models to predict how crimes spread and react to police intervention over time. In the models, they found two kinds of "hotspots"—patterns of concentrated criminal activity. One hotspot, which they labeled supercritical, showed crime naturally forming out of an area where there was little or no previous crime. This area, which could also dissipate on its own, would likely represent a rise in burglary and car theft. The other spot, called subcritical, showed crime that feeds on itself, continuously building without intervention. These areas may represent drug markets or gang-related

crime.

When the researchers dispatched police in the models, they found that when fighting the supercritical hotspots, the officers did not stop the crime—it would simply move to an adjacent area. The subcritical crime areas, on the other hand, tend to be stopped permanently.

These conclusions may not be extraordinarily surprising—taking down a drug ring, after all, is more likely to stop repeat crime than chasing areas where there were burglaries. But the findings are valuable to police departments who map crimes but have no analytical tools, says Jeffrey Brantingham, a sociologist and also an author of the study. It is difficult for departments to recognize that, for instance, there is more than one kind of hotspot of crime when looking at simple maps.

For now, though, "this research is not predictive in nature," Brantingham says. "The direction of our research is towards something the [National] Institute of Justice can use for predictive policing," he says. Before that goal is reached, there are still some kinks to work out.

For example, while supercritical hotspots predicted in the models continually move and are very difficult to banish, when law enforcement and criminologists have done experiments in the field, complete criminal suppression is a much more common outcome than displacement. "Part of the explanation for that is that most of the hotspots out there might be subcritical hotspots," Brantingham says. "And even if these are the kind of supercritical hotspots that do reoccur, the adjacent area might have a physical barrier or a different culture" that is unfavorable to repeat crime.

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