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Los Angeles to Test Simulation Model That Predicts Criminals' Reactions to Increased Policing

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Hot-spot policing, in which officers increase patrols in areas identified as having a disproportionate amount of crime is used by law enforcement agencies to proactively protect communities. But use of the technique has triggered questions about whether it eliminates crime, or simply pushes criminals into other areas.

Now researchers from the University of California, Los Angeles (UCLA) have developed a computer simulation model that answers those questions -- and it could help police departments target their crime-fighting resources more effectively.

"It's been known for decades, probably at least since the 1930s, that crime shows very strong spatial and temporal patterning, meaning it forms hot spots," said Jeffrey Brantingham, an associate professor of anthropology at UCLA. "Beginning in about the 1970s, criminologists and law enforcement officials started to say, 'Well, since crime patterns in this way, wouldn't it be reasonable to put extra policing and crime-prevention strategies and direct them right at those hot spots?'"

Many assumed hot spot policing would just cause the criminals to relocate. However, Brantingham said there actually are only a few instances where crime displacement has been observed.

About four years ago, UCLA researchers created a mathematical computer simulation model of crime pattern formation. The model led them to identify two types of crime hot spots that react differently to increased policing - one that relocates and another that dissolves.

"Once we noticed these large-scale patterns forming in the simulation model, we started working on a theory to explain them," said Andrea Bertozzi, a professor of mathematics and director of applied mathematics at UCLA. The researchers published their analysis in February.

Different Outcomes, Same Intervention

Using the mathematical analysis, the researchers can predict how a crime hot spot will respond to increased policing. "It provides that mechanistic model that says these are exactly the conditions under which you should get hot spots forming," Brantingham said. "So it provides boundaries on what sorts of conditions produce hot spots."

That's how the researchers arrived at a "surprising conclusion," he said. The model suggested that

there were at least two different types of hot spots - known as super-critical and subcritical - that form under different circumstances. Small spikes in crime form super-critical hot spots. "Little crime events that individually don't seem to be all that significant or all that big, nucleate into a hot spot," Brantingham said. The second type, subcritical, forms during a large, significant spike in crime. The two may appear similar to the public's eye, but they respond differently to intensified policing.

Using 10 years of data from the Los Angeles and Long Beach police departments, the researchers tested the model with information from burglaries. "We did the mathematical equivalent of experiments to test what would happen if you went in and tried to suppress these different types of hot spots," he said. "And lo and behold, you get the two characteristic behaviors that we observed in real experiments of hot spot policing."

The model revealed that when given additional policing, super-critical hot spots displace and form in adjacent regions because they're developed from small crime spikes. "You can't just go and suppress all those small spikes in crime; you're going to suppress the big hot spot," Brantingham said. "The small spikes in crime that are out there in the environment are ready to nucleate into a new one." However, the larger, subcritical hot spots do not re-emerge after increased policing.

Although researchers used burglary data to test the simulation, Bertozzi said the model can apply to other crimes like gang violence or improvised explosive devices in the Middle East.

"Ideally from the technological and crime-prevention strategy perspective, we're pointing in the direction of saying, ‘OK, we need to be aware of the different types of hot spots out there, and we need to develop procedures for predicting what type of hot spot we're looking at, then tailor policing strategies in appropriate ways,'" Brantingham said. "I would say we're cautiously optimistic, but there's a long way to go before that's a reality."

And that's where the Los Angeles Police Department (LAPD) comes into the picture.

Real-World Impacts

Policing through the use of crime statistics and mapping is nothing new to the LAPD. The department has used the CompStat crime control model -- first implemented in the mid-'90s in New York City to analyze crime statistics and plot them electronically to determine patterns -- for many years as a way to reduce crime by focusing on problem areas. Through the years, Los Angeles, the nation's second most populous city, has seen a measurable decrease in crime. "Last year we had 314 homicides in the city, and I think our top year was 1,092 in 1992," said Lt. Sean Malinowski, assistant commanding officer of the LAPD's Regional Crime Center and the officer in charge of CompStat.

Now the city wants to use predictive policing to bring those numbers down even more. "We need much more fine-tuned instruments to do that," Malinowski said. "You can't just look at a historical crime map and be that accurate."

Using CompStat, the police department compares the most recent 28 days of data against the 28 days prior, and then compares those two periods to the same times during the previous year to decide where to deploy officers. "The commanders are doing kind of a predictive model in their heads, but the stuff

I am excited about at UCLA will do a much better and more specific forecast -- that's our hope anyway," Malinowski said.

The LAPD is working with UCLA and Craig Uchida, president of the consulting firm Justice & Security Strategies Inc., to test the predictive crime simulation model in the field. They're developing an experimental design that's composed of a test site and a control site, which could consist of two similar areas in L.A., Malinowski said. Predictions will be made for both areas and policing would be increased in one area to evaluate the accuracy of the predictions.

The LAPD received a $200,000 planning grant from the National Institute of Justice to work with Uchida and UCLA on the project, and it's applying for a larger grant in August to start the experiment. The department expects the grants to be awarded in early 2011. Malinowski said scientific experiments are rare in policing because departments tend to be eager to start using new concepts.

"This is the tradeoff; usually in policing we don't have time to wait until January. So frankly, what's happening is people are doing grass-roots efforts to try to test things, and we'll probably buy some off-the-shelf software and test it," he said. "But I want to commit to doing this scientific experiment because the federal government and a lot of agencies are looking to invest in this concept of predictive policing."