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Predicting future crimes in Philadelphia

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By Nicholas Vadala / contributor

The term "crime prediction" often evokes the pop culture memory of Steven Spielberg's 2002 science fiction film *Minority Report*. In the popular movie, the government polices its citizens with the help of a trio of psychic beings that can predict who will commit a crime in the future.

Throughout the film, which was based on a 1956 short story by Philip K. Dick, future offenders are arrested before they actually commit the crimes they were predicted to perpetrate.

Ralph Taylor (http://www.rbtaylor.net/), a criminal justice professor and crime trend researcher at Temple University, was quick to dispel that connection in a recent interview with Technically Philly.

"With *Minority Report (http://www.imdb.com/title/tt0181689/)*, you have what is called, in techno-babble, an idiographic prediction," he says. "And what that means is that you can say this person is going to do this [crime], at this time, in this place."

In reality, "crime prediction" is more appropriately termed "crime forecasting" and is far less nefarious than its fictional, more clinical counterpart, researchers say.

In terms of social science, crime forecasting takes a nomothetic approach to the predictive analysis of crimes; essentially, the science looks at trends in a given area and extrapolates predictions of future developments based on the variables affecting those trends.

"One is clinical, the other is theoretical," Taylor adds. "We can be sure that those estimates will not be totally accurate."

Current endeavors into the fields of crime forecasting and mapping are largely based off the New York City Police Department's COMPSTAT (http://en.wikipedia.org/wiki/CompStat)—or Comparative Statistics—process, which originated in 1995 under the command of Commissioner William J. Bratton.

Beginning humbly as a series of pin-strewed maps marking crimes in given areas, COMPSTAT meetings essentially allowed department management to stay abreast of what crimes happened where and what district captains planned on doing about those crimes.

Not long after debuting with the NYPD, other police departments adopted the COMPSTAT process, including, in 1998, the Philadelphia Police Department.

With the advent of geographic information system (GIS) mapping, which combines statistical analysis with geographic information, the old pin board system has been long since abandoned in favor of more efficient electronic methods of mapping and prediction.

Ralph Taylor, a criminal justice professor and crime trend researcher at Temple University, sees crime forecasting as a way to free up police force resources that can go to community building activities. Photo by Nicholas Vadala.

“New technologies keep the leadership up to speed on what’s happening where, if not in real-time, than at least in a very recent time frame,” says Taylor. “It allows management to analyze, organize and respond in an efficient manner.”

The Philadelphia Police (http://technical.ly/philly/companies/philadelphia-police)'s primary foray into the electronic crime mapping and forecasting field began six years ago with their Crime Spike Detector, developed by Robert Cheetham, a University of Pennsylvania graduate and CEO of the Callowhill-based GIS firm Azavea (http://technical.ly/philly/companies/azavea).

Hired along with another Penn graduate to start a crime analysis unit with the Philadelphia police, Cheetham (http://technical.ly/philly/people/robert-cheetham) quickly saw the need for more efficient methods of mapping.

"We were serving almost 7,000 sworn officers and 1,000 civilians," Cheetham says. "So there was a tremendous premium on automating things."

At the time, Philadelphia police was documenting over 5,000 incidents a day, each of which would be assigned a "geocode" that described the nature of the incident along with its location. Cheetham saw the need to develop a program that could mine through that geocoded data, analyze it and then notify the appropriate people about what changed over time.

Under the direction of then-Deputy Commissioner Charles Brennan, Cheetham developed the prototype for what would eventually become the city's Crime Spike Detector, which is still in use today.

"They actually caught some bad guys with this prototype," Cheetham says. "Particularly because it found clusters of crime incidents that were split between districts."

Predictive analysis is also used to monitor criminals after they've been convicted.

In order to allocate resources in a sensible way, Philadelphia's Department of Probation and Parole began forecasting individuals who were likely to create a threat to public safety, says Richard Ber (http://www-stat.wharton.upenn.edu/~berkr/)k, a criminal justice professor who works in the Wharton School's statistics department at the University of Pennsylvania.

Agencies have typically relied on analysis methods used since the 1920s based on clinical evaluations, he says, which had a very low success rate.

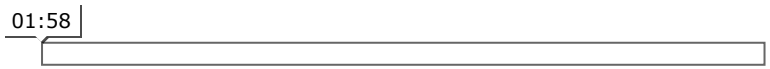
With improved statistical analysis that has resulted from new algorithms developed only in the last ten years, Berk says that agencies are able to better predict individuals who are most likely to commit a crime.

"What do you do with someone on probation or parole? How do you know who to release? That's a decision that parole boards make every day," he says.

But with machine learning, statistical extractions can be made from hundreds of thousands of cases, similar to how NetFlix or Amazon make customer recommendations. Potential predictors, like a person's prior record are taken into account. And unlike clinical evaluations,

determinants like IQ are taken out of the models.

Of course, Berk says that these models do make mistakes. “These forecasts are not perfect. Sometimes, they can claim a person is high-risk who is not, sometimes they miss a high-risk candidate. You have to weigh the cost of those two mistakes; how much worse is it not to find a bad guy?” he says. “That’s a policy decision.”



There’s been plenty of funding for projects on that analyze broad, geographic-based crime trends.

With a grant from the National Science Foundation, Cheetham began to develop that prototype further at Azavea. “Over the last three years we’ve been working with that funding to go beyond that initial proof of concept,” he said. Resulting in more advanced space-time analysis, visualization and forecasting tools, that work has come in the form of Azavea’s GIS crime mapping and forecasting utility, Hunchlab, which, in Cheetham’s estimation, could increase the effectiveness of law enforcement officials.

“Being able to adapt deployment of officers to crime in the city is, over the long term, going to result in lower levels of crime,” Cheetham says.

With an output that looks like a weather map of crime across the city, Hunchlab (http://www.azavea.com/products/hunchlab/) allows users to investigate and forecast crime data for any category of crime in any area of the city. By extension, that allows techniques such as observing data from a known gang territory and watching specific areas for certain crimes—an aspect that finds its basis in Temple University criminal justice professor Jerry Ratcliffe’s Near Repeat Pattern of Analysis.

“You can kind of think of crime as a disease. If a crime happens, we can see how it affects the likelihood that another incident is going to happen within a certain area in a certain amount of time after that,” says Hunchlab Product Manager Jeremy Heffner.

Essentially, the idea is that if one crime—like a residential burglary—happens, the chances that another will happen increase as a result of the first crime, much like a contained outbreak of disease in a given area.

Azavea CEO Robert Cheetham developed the Philadelphia Police Department’s Crime Spike Detector six years ago, a piece of software that is still in use to this day. Photo by Nicholas Vadala.

"What we get is a risk map that shows where there are elevations of risk for tomorrow," explains Heffner.

Hunchlab, however, is not Azavea's only entry into the world of crime mapping and forecasting. The company is currently partnering with Taylor and Ratcliffe at Temple University to develop a free tool that uses American Community Survey and current crime data to forecast crime levels based upon the various neighborhoods in Philadelphia.

Funded by the extraneously named Predictive Modeling Combining Short and Long Term Crime Risk Potential grant from the National Institute of Justice, the project should, in Taylor's explanation, allow for more accurate predictions because it will function based off various historical and current demographic and crime data sets.

"It's going to improve the way in which police departments put cops on dots," Taylor said.

For Taylor, though, that improvement goes beyond better allocating funds for cash-strapped police departments. It's more about opening up the police department to determine ways to institute long-term crime prevention—an aspect that could help to redefine the role of the police department in the communities that they serve.

"Citizens will only want to be eyes and ears of police if the police are people they know and trust," Taylor explained. "And if we can figure out how to take care of the crucial stuff with less officer hours, then that allows the department to determine their own goals."

"You've got the potential to allow the police to help build communities rather than just police them."

Technically Philly co-founder Brian James Kirk contributed to this report.

Organizations: Azavea, City of Philadelphia, National Science Foundation, Philadelphia Police, Philadelphia Police Department, Wharton School
People: Charles Brennan, Jerry Ratcliffe, Ralph Taylor, Robert Cheetham
Projects: Philadelphia Neighborhoods
Dev

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