Man versus machine
The case of geographic profiling

Geographic profiling is a police deci-sion-making task that requires a prediction to be made about the home location of an at-large serial offender, based on informa-tion about where that offender has commit-ted his or her crimes. The most publicized solution to this task involves using compu-ter systems to produce a probability map that shows the likelihood of an offender re-siding at various locations around the area where their crimes were committed *-see probability map (diagram one).*

Based on decades of offender spatial behaviour research, these computer sys-tems utilize mathematical functions (de-rived from large data sets) that reflect the distribution of distances between offender home and crime locations.

What is surprising about these com-plex and, until recently, costly actuarial systems however, is that they have been implemented around the world without any evidence that they outperform human judgments. We have been conducting ex-periments over the past three years to de-termine how people perform on geo-graphic profiling tasks and the sorts of strategies they employ when making such predictions and can now report four ma-jor conclusions.

1. *People use simple cognitive strategies to make accurate predictions.*

Please examine diagram two and pre-dict, by marking an X on the map, where you think the serial offender is living (the black dots represent crime locations).

If you are like one of our participants, you probably used one of two simple cognitive strategies. Prior to being instructed on how best to make such predictions, you may have used either the Equidistant heuristic (you predicted that the offender lives roughly in the centre of all the crimes) or the Cluster heuristic (you predicted that the offender lives close to the majority of crimes). In either case, you would have made a reasonably accurate prediction.

We discovered that people using one of these two strategies made accurate predictions because these strategies exploit the empirical regularities associated with offender spatial behaviour. In other words, a strategy that in-volves predicting that the home location of an offender will be in the centre of their crime locations matches the empirical regularity that serial offenders often live central to their area of criminal activity.

Of particular interest to the police practi-tioner is our finding that, before training, po-lice officers who used one of the two strate-gies above made predictions that were as ac-curate as those produced by one commonly used geographic profiling system.

2. *It is possible to train people to improve their predictions.*

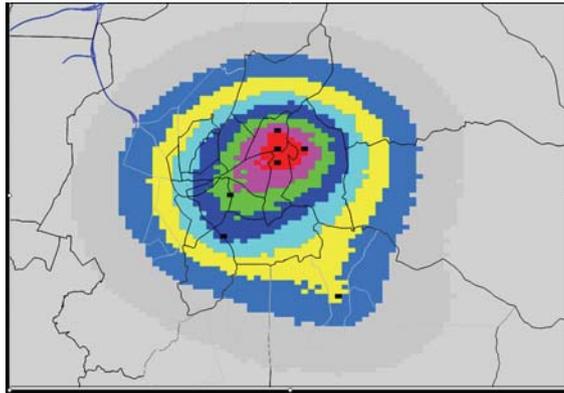Although some used inappropriate strate-gies to make predictions, we have found that
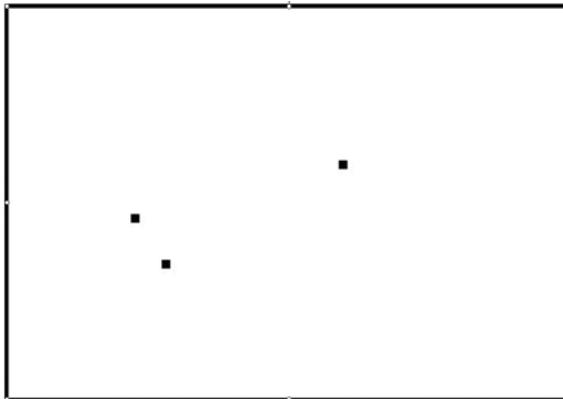

Diagram 1

Diagram 2

it is possible to teach them to apply more ef-fective strategies through a 10-minute train-ing session. We have trained groups of partici-pants to use one of two simple strategies that we knew beforehand would exploit the empiri-cal regularities associated with offender spa-tial behaviour.

The two strategies are the Circle heuris-tic (serial offenders often live within a circu-lar area with the diameter defined as the dis-tance between the two furthest crimes in a series) and the Decay heuristic (serial offend-ers often do not travel far from home). We found that introducing one of these heuris-tics resulted in improved predictive accuracy. Again, perhaps most important to the police practitioner, is our finding that it is possible to train groups of police officers to make heu-ristic-led predictions that are as accurate as those made by one commonly used geo-graphic profiling system.

3. *Simple strategies perform as well as more complex strategies.*

Geographic profilers have access to a rep-ertoire of strategies for predicting a serial of-fender's home location. These range in com-plexity – some involve more calculations to implement than others – and the assumption often made is that more complex strategies (e.g., negative exponential function) will out-perform simpler (e.g., mean centre) strategies.

We tested this assumed relationship between the complexity and accuracy of 11 strategies and showed that strategy complexity wasn't positively related to accuracy. In other words, when used to make geographic profiling predictions, simpler strategies were often more accu-rate than complex strategies. Simpler methods were also found to perform as well as complex strategies across profil-ing tasks that ranged in complexity, where complexity was defined by the number of crimes included in an offender's crime series (i.e., increasing number of crimes equates to increasing complexity).

From this evidence we offer the fol-lowing advice: Geographic profiling ex-perts who rely on complex geographic profiling systems may be providing noth-ing more than what could be achieved by applying one of the two strategies de-scribed above.

4. *Increasing task complexity does not have an effect on human predictive ac-curacy.*

It has been contended that actuarial systems might outperform human judges when the geographic profiling task be-comes more complex (i.e., when there is more information to consider).

In our most recent research, we tested this notion by varying the number of crimes that our participant's had to con-sider when making their predictions and by providing some of our participants with topographic information. We found that human predictive accuracy wasn't affected by the inclusion of either of these factors, thus human judges appear capable of making ac-curate profiling predictions under a range of conditions.

Our findings may surprise those who be-lieve it is necessary to use computerised geo-graphic profiling methods that require exten-sive training. In terms of operational support, our findings suggest that police officers can make highly accurate predictions when using only simple strategies. Furthermore, in terms of training, the findings indicate that police forces may be able to suffice with a quick and inexpensive training exercise that teaches their officers simple decision rules.

The significance of this implication in-creases with smaller police agencies that may be limited in their technological capabilities. These forces will likely find low-cost, easy-to-implement alternatives to geographic pro-filing systems particularly beneficial.