

Interactive Offender Profiling System (IOPS)

Name: Professor David Canter

Title: Executive Director

Organisation: International Centre for Investigative Psychology, UK

Name: Dr Donna Youngs

Title: Managing Director

Organisation: International Centre for Investigative Psychology, UK

Introduction

IOPS has its origins in the International Centre for Investigative Psychology (ICIP) studies of the behavioural and spatial patterns that can be identified within offenders' actions. Developed to support the next generation of software tools for police and law enforcement analysts, IOPS integrates large police databases at speed, drawing directly on research findings to:

- Link crimes;
- Prioritise suspects;
- Build catalogues of offenders' geo-behavioural profiles;
- Generate potential TIC's (that is, further offences that are 'taken into consideration');
- Explore co-offending networks;
- Indicate locations for intelligence gathering;
- Allow hotspot analysis ;
- Provide geo-coding capabilities ;
- Provide powerful mapping capabilities from its ArcGIS (or similar) platform.

The original vision of the IOPS system (Canter, 2004) emerged out of twenty years of research. The following illustrative operational scenario indicates one possible utilisation of that system:

A member of the public reports a burglary. The address and crime details are recorded from a scene of crime visit or other remote information source. This is integrated into existing databases and related to online detailed maps (and/or aerial photography) and made available to dedicated crime analysts in a local intelligence unit or specialist intelligence section.

The digitised geographical information is supported by crime data and a set of analysis functions that allows rapid comparative analysis, facilitated by interaction with the background. This enables the crime analyst to construct inferences concerning possible linked burglaries in the area and possible suspects. This leads to the proposal of a number of possible offenders and their likely residential locations. Information on known recipients of stolen goods and illegal drugs suppliers is also available.

By interrogating the system the analyst alerts a local police patrol to observe an area for the criminal and to pay particular attention to three most likely suspects with a note of where they are currently living.

An integrated operational system

The first version (IOPS 1.0) was developed for the UK's Metropolitan Police using software engineers at the Kelvin Institute of Strathclyde University. It draws on large police datasets and uses this to perform analysis using the geographical profiling software, Dragnet, to explore offending spatial behaviour and generate geographical profiles that are then integrated with Multidimensional Scaling-based visual models of offender modus operandi (MO's). These and other analyses are combined in different ways to address directly the operational questions analysts and detectives face in investigations. The system has the potential to assist many investigations of serial, violent and volume crime by,

- Helping to determine what aspects of the crime should be highlighted to guide the investigation.
- Providing the basis for generating inferences about the distinguishing characteristics of the offender.
- Assisting in the determination of which crimes are likely to be linked.
- Offering possibilities of which property crimes may be linked to each other or to violent crimes.
- Indicating geographical locations in which further intelligence may be forthcoming.
- Proposing geographical locations of particular significance to an offender.
- Generating priority rankings for suspects and other nominals using both geographical matching and MO matching - the system searches for known offenders and puts them in rank order on the basis of their location and also their 'modus operandi'.

IOPS has a number of key components that interact with each other. These are explained in the next sections.

Direct mapping of offences and offenders

ArcGIS is used to represent on a map all offences within any given offence type and period along with known relevant offenders within the police databases. The detective or analyst may interact with this map to select a subset of these offences according to various operational criteria. The actions committed within these crimes are drawn out from the police information system. These actions are then subject to subsequent analysis to create 'modus operandus', or MO 'Heat Maps'.

MO Heat Maps

MO Heat Maps are a development of Investigative Psychological studies identifying the key variations in offending style within crimes from burglary to serial rape (for a review of this work see Canter and Youngs 2003; 2008c). The MO Heat Maps consist of Smallest Space Analyses of offence activity in which the frequencies of each action are indicated by a colour code. This gives rise to regions of similar frequency having similar colours and therefore revealing the structure of the overall pattern of behaviours. Figure #.1 illustrates this.

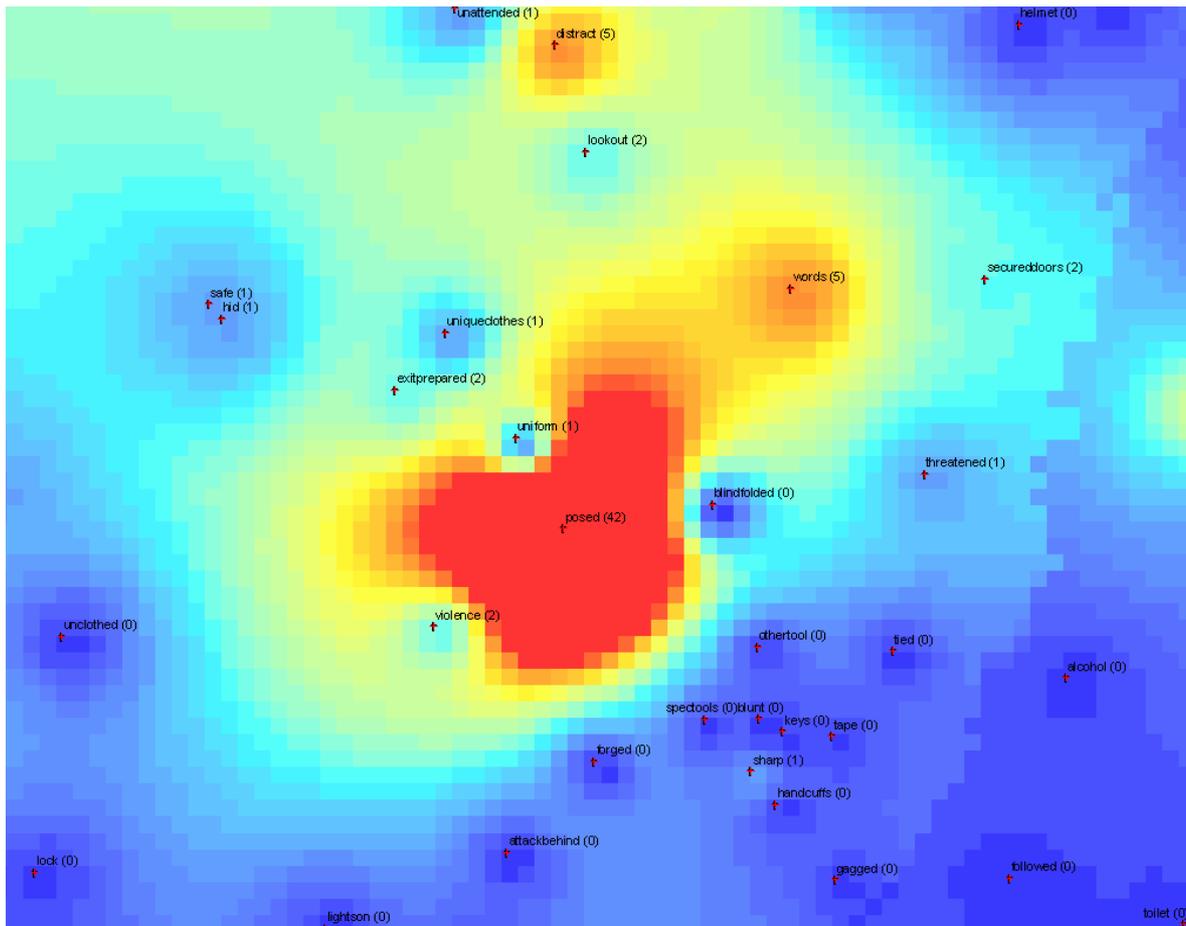


Figure #.1. An MO Heat Map. The points in this illustration are criminal actions. The closer together the actions, the more likely they are to co-occur in any crime.

Comparative Case Analysis

On the basis of the interactive selection of actions from the MO Heat Maps, it is possible to compare a subset of offences selected from the original set of offences and represent these as points in a space such that the closer the points representing the offence, the more similar the offences in terms of the originally selected actions (see figure #.2). This configuration is open to interactive use such that crimes that are similar can be identified on the screen and then portrayed on a map for further geographical analysis.

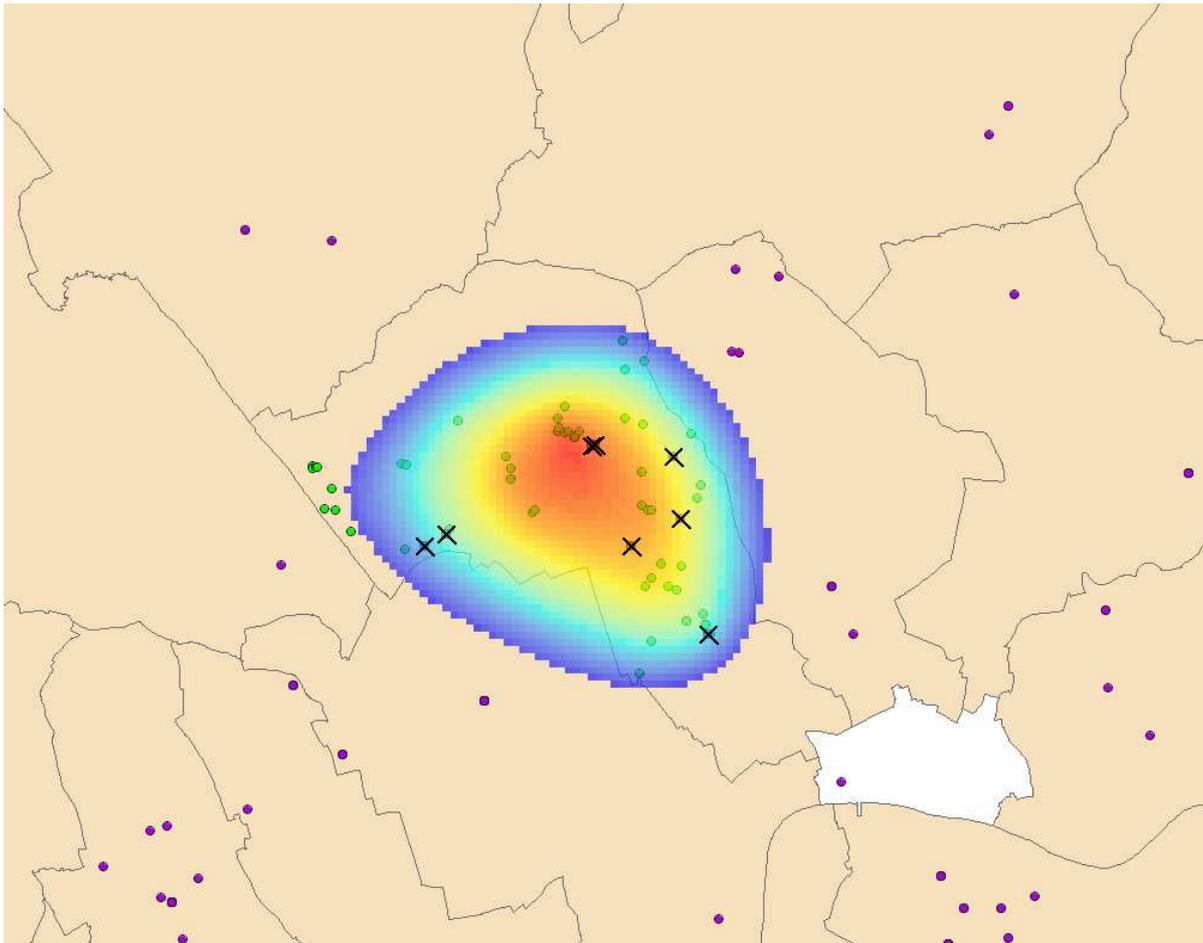


Figure #.3. A geographical profile of an offending series (the cross symbols), shown with possible suspects (the dot symbols).

Geographical and MO prioritisation

For any unsolved offence, IOPS then examines all known offenders in the system in terms of the closeness of match with the MO of the offence and the geographical profile. This is used to produce a suspect prioritisation table.

Social network analysis

A further capability of the system is the representation of known associations between offenders as links directly on a map, allowing additional analysis of other potentially linked crimes (see figure #.4)

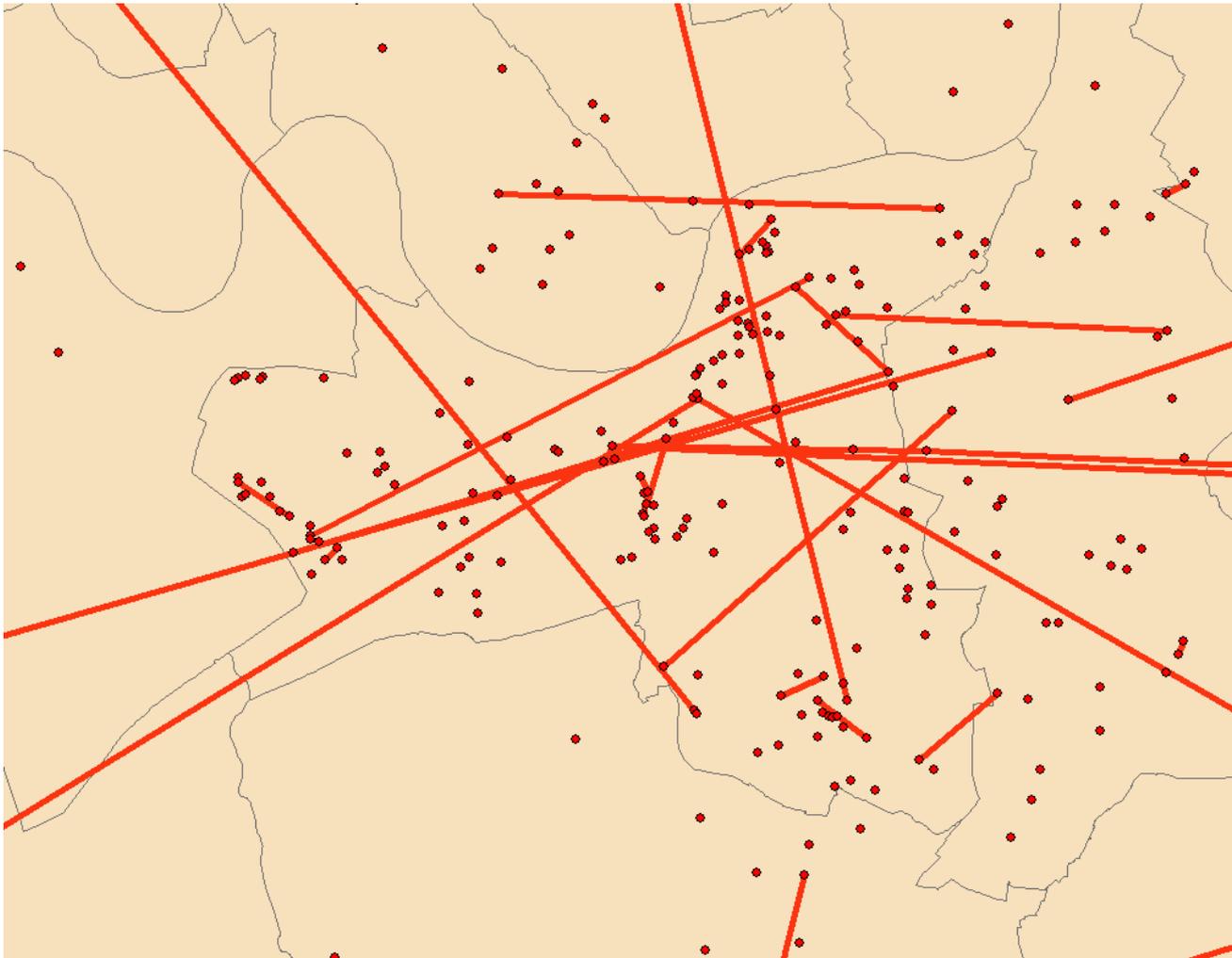


Figure #.4. This map shows linkages of known associations between offenders, helping to support additional analyses of their potentially linked crimes.

The potential of IOPS

Clear up rates for volume crime offences are remarkably low (e.g. ICIP studies indicate average clear up rates of 9.3% for street robbery and 9.7% for residential burglary). Significant improvements in the effectiveness of the police in crime detection (as well as reduction) are now potentially possible by exploiting recent advances in offender profiling and geographical profiling (Canter and Youngs 2008a) to develop crime investigation software that allows crime analysts and investigators in a systematic fashion, in real time and utilising the existing police databases, to:

- Produce a summary of characteristics of offenders who have committed similar crimes (an 'Offender Profile') on the basis of the MO.
- Identify the likely area of residence of a perpetrator based on the location of the offences, as well as the land use, environmental features and the aggregate crime patterns in an area (Advanced Geographical Profiling).
- Integrate the Offender Profile with the Geographical Profile to prioritise suspects within a subset of known offenders held within the police database (Geo-behavioural Profiling).
- Link further unsolved offences to a common offender (Comparative Case Analysis).
- Identify likely co-offenders and map out 'criminal networks'. (Geographical Social Network Analysis).

- Use time and sequence analysis of MO and geographical development to predict future activity.
- And from a crime reduction perspective, continually map ongoing changes in the geographical patterning of MOs, such that responsive, area-specific initiatives are possible to counter particular MOs and offender patterns.

The analysis of the geo-behavioural and social aspects of crimes in a real-time police environment also provides a powerful research context. The system therefore has the capability of continually learning in a research mode about criminal activity and feeding this back into operational use. IOPS thus grows out of, and feeds back into, the research environment of the International Centre for Investigative Psychology within which it has been developed.

References

Canter, D. (2004), *The System: Towards An Interactive Offending Profiling System*. Internal document, International Centre for Investigative Psychology.

Canter, D. and Youngs, D. (2003), *Beyond Offender Profiling: The Need for an Investigative Psychology*. In R. Bull, and D. Carson, *Handbook of Psychology in Legal Contexts*. Wiley, Chichester.

Canter, D. and Youngs, D. (2008a), *Principles of Geographical Offender Profiling*. Ashgate, Aldershot.

Canter, D. and Youngs, D. (2008b), *Applications of Geographical Offender Profiling*. Ashgate, Aldershot.

Canter, D. and Youngs, D. (2008c), *Investigative Psychology*. Chichester, Wiley.