Using Agent-Based Models to Inform Policing Decisions in Crime Clusters

Verity Tether[*1], Alison Heppenstall[†1, 2], Nick Malleson[‡1, 2] and Daniel Birks[§1, 2]

[1]School of Geography, University of Leeds
[2]Alan Turing Institute

10th January 2019

Introduction and Rationale

The study of the relationship between crime and space has been studied for centuries, and certain spatial features have been found to lead to geographical clusters of crime. Analysis of these clusters by Brantingham and Brantingham (1995) and Clarke and Eck (2003) led to the identification of differing underlying causal mechanisms, thus distinguishing three different types of clusters; **crime generators** (which bring in large numbers of people, creating targets for an opportunistic criminal, e.g. parks (Groff and McCord, 2012)), **attractors** (which lure motivated offenders with the possibility of criminal opportunity, e.g. red-light districts (Brantingham and Brantingham, 1995)), and **enablers** (which experience minimal regulation of criminal behaviour due to poor management practices, such as a car park with no attendant (Clarke and Eck, 2005, 2003)).

Clarke and Eck (2003, 2005) proposed that it is possible that an area can transition between each of these types of cluster over time, suggesting that these mechanisms may experience further complexity than was initially identified. However, understanding and uncovering these mechanisms poses a challenge to researchers, as does understanding their impacts for the future, due to issues well-known to contemporary quantitative criminology such as fuzzy theories, insufficient data, and the complexity of systems being examined (Johnson and Groff, 2014). Agent-based models (ABMs) are, however, a valuable tool for work of this nature. Characterised by the presence of autonomous agents in an environment, which are interactive, reactive and proactive (Wooldridge and Jennings, 1995, cited by Bandini et al., 2009), ABMs tend not to examine the individual behaviours of the agents, instead focusing on the macro-level patterns which emerge from the interactions of the agents and the environment (Johnson and Groff, 2014). Consequently, an ABM is capable of testing criminological theories by investigating whether a model is able to produce their expected outcomes (*ibid.*), and are thus well-suited to this analysis.

Case Study

Red-light districts, and particularly those areas which see a concentration of street sex workers, are notoriously associated with the presence of a variety of crime (Hubbard, 1997; Weitzer, 2005). These areas have traditionally been considered crime attractors by the above definition, but the introduction of a novel policing strategy in Leeds in 2014 may render this untrue in this case; from 1st October 2014, sex workers were able to sell their services between 7pm and 7am, without being apprehended by the police (Longman and Hatchard, 2016) in a certain area of the city. The subsequent increase in police presence led to diminished criminal opportunity, thus calling into question its suitability as a crime attractor.

It is believed that improved understanding of these spaces will lead to a reduction in crime rates. As

---

[*] gy11valt@leeds.ac.uk
[†] a.j.heppenstall@leeds.ac.uk
[‡] n.s.malleson@leeds.ac.uk
[§] d.birks@leeds.ac.uk

each sort of cluster requires a different policing approach, enhanced cognizance of the underlying mechanisms which lead to these sorts of crime clusters will enable more tailored policing strategies. Moreover, systematic testing of the differences in the mechanisms between each cluster type will inform on the possibility of the existence of a spectrum, permitting further understanding of these spaces in a hitherto under-researched area.

Aims

The aim of this work is twofold. Firstly, ABMs shall be used to create and abstract data on crime found at crime generators, attractors and enablers, in order to investigate the differences caused by each of these mechanisms, and the possible existence of a spectrum. Secondly, this data will subsequently be applied to a case study of the red-light district of Leeds as an empirical example, to assess whether the patterns demonstrated here are aligned with what would be expected if the red-light district formed a traditional crime attractor.

Methodology

For this analysis, five different ABMs will be created, to simulate each of the following:

1. A control model
2. A traditional crime generator
3. A traditional crime attractor
4. A traditional crime enabler
5. The Managed Area of Leeds

To satisfy the first aim of this work, the crime patterns which emerge as a result of each of the first four models will be compared, identifying the differences and similarities which occur. Experiments shall be undertaken to identify the degree to which the mechanisms must be changed to move from one classification to another, thus investigating the possibility of the existence of a spectrum. The second aim of this work shall build on these models, comparing them with for the Managed Area, analysing its suitability to be considered a crime attractor.

References

Bandini, S., Manzoni, S., Vizzari, G., 2009. Agent Based Modeling and Simulation: An Informatics Perspective. Ournal Artif. Soc. Soc. Simul. 12.

Brantingham, P., Brantingham, P., 1995. Criminality of Place: Crime Attractors and Crime Generators. Eur. J. Crim. Policy Res. 3, 5–26.

Clarke, R., Eck, J., 2003. Become a Problem Solving Crime Analyst in 55 Small Steps. Jill Dando Institute of Crime Science, London.

Clarke, R., Eck, J., 2005. Crime Analysis for Problem Solvers in 60 Small Steps. Center for Problem Oriented Policing.

Groff, E., McCord, E.S., 2012. The role of neighborhood parks as crime generators. Secur. J. 25, 1–24. https://doi.org/10.1057/sj.2011.1

Hubbard, P., 1997. Red-light districts and Toleration Zones: geographies of female street prostitution in England and Wales. Area 29, 129–140.

Johnson, S.D., Groff, E.R., 2014. Strengthening Theoretical Testing in Criminology Using Agent-based Modeling. J. Res. Crime Delinquency 51, 509–525. https://doi.org/10.1177/0022427814531490

Longman, J., Hatchard, S., 2016. The city that allows women to sell sex. BBC News.

Weitzer, R., 2005. New directions in research on prostitution. Crime Law Soc. Change 43, 211–235.