Spatial analysis of crime displacement and diffusion of crime control benefits in central London's Lower Super Output Areas

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Summary

This paper investigates the impact of a crime deterring initiative called *MetTrace* rolled out by the Metropolitan Police Service and SmartWater Technology Ltd, and if this has led to *spatial displacement* or *diffusion of crime control benefits*. A combination of spatial analytical methods, including differential local Moran's I and Weighted Displacement Quotient, are employed to assess the tendency of displacement of burglaries around areas SmartWater was rolled out, covering the period before and after the implementation of the scheme. The results support the recent literature in that applying situational crime prevention measures does not necessarily trigger a significant crime displacement.

KEYWORDS: crime displacement, crime prevention, hotspots

1. Introduction

When the notion of crime displacement was introduced, crime reduction efforts were considered to trigger a direct and clear pattern of the relocation of crime, and that it would seriously undermine our ability to reduce crime (Reppetto, 1976). However, recent studies suggest that taking a focused geographic approach to crime problems can in fact improve the effectiveness of policing and may also yield a spill-over effect called *diffusion of crime control benefits* (Braga *et al*., 1999; Weisburd and Green, 2005; Weisburd *et al*., 2006; Bowers, *et al*., 2011; Telep, *et al*., 2014)). Yet the impact of crime reduction efforts is still under-investigated, mainly due to a shortage of opportunities to evaluate crime displacement at a small geographic scale, and lack of suitable methodology for measuring the extent of displacement (Bowers and Johnson, 2003; Ratcliffe, 2005; Nakaya and Yano, 2010). Understanding how crime displacement unfolds after problem-oriented interventions marks an important step towards effective policing and crime reduction.

Several situational crime prevention efforts have been implemented in recent years, focusing on crime reduction by altering the host environment to increase the risk and effort for criminals. One such example is an on-going operation of a burglary deterring initiative called *MetTrace* currently being rolled out across London by the Metropolitan Police Service (MPS) and SmartWater Technology Ltd. SmartWater is a traceable liquid with a

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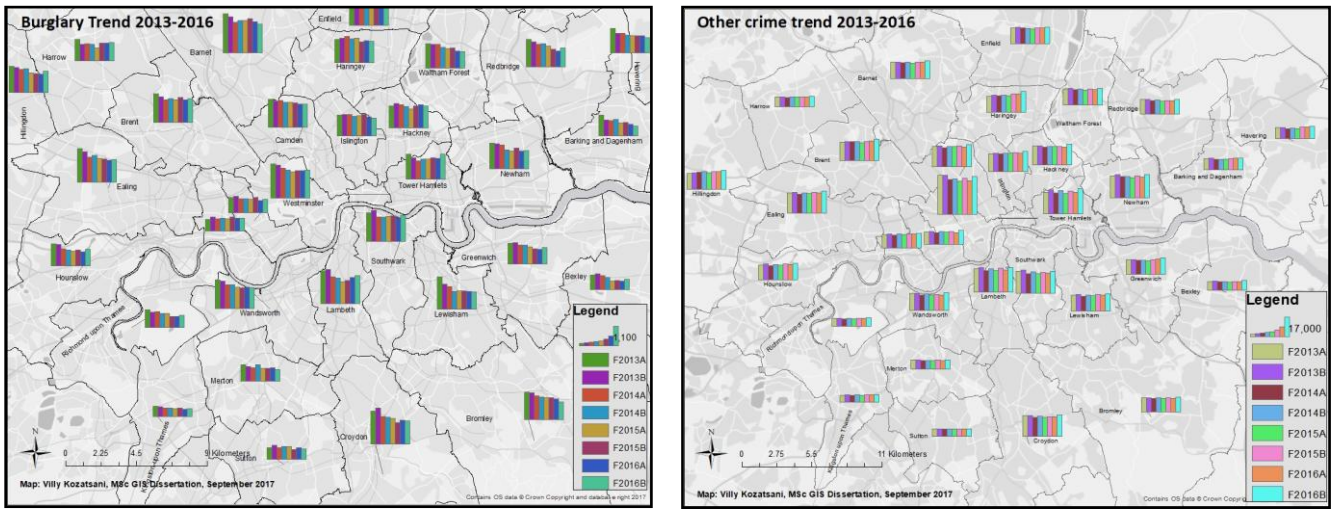
unique chemical composition and forensic asset marking system applied to valuable items with the purpose of deterring thefts and linking offenders to a specific crime scene. Its deployment is considered to change the household environment and discourage burglars from breaking in, thus reducing the inherent vulnerability of these premises. This paper aims to investigate the impact of their operation, and to see if it has led to spatial displacement of burglaries or diffusion of benefit.

2. Study Area, Methodology and Analysis

The study focuses on central London where SmartWater was rolled out in two waves in April 2015 and April 2016. Figures 1(a) and 1(b) collectively show the patterns of burglary and non-burglary crimes between 2013 and 2016, covering the period before and after SmartWater deployment. This study explores its impact in Camden and its surrounding boroughs of Barnet, Brent, Islington, Westminster, Lambeth and Southwark. While the number of incidents fluctuates from one period to another, there was a general reduction in the volume of burglary across these boroughs and across the Greater London region. The volume of non-burglary crime on the other hand, saw an increase during the same period.



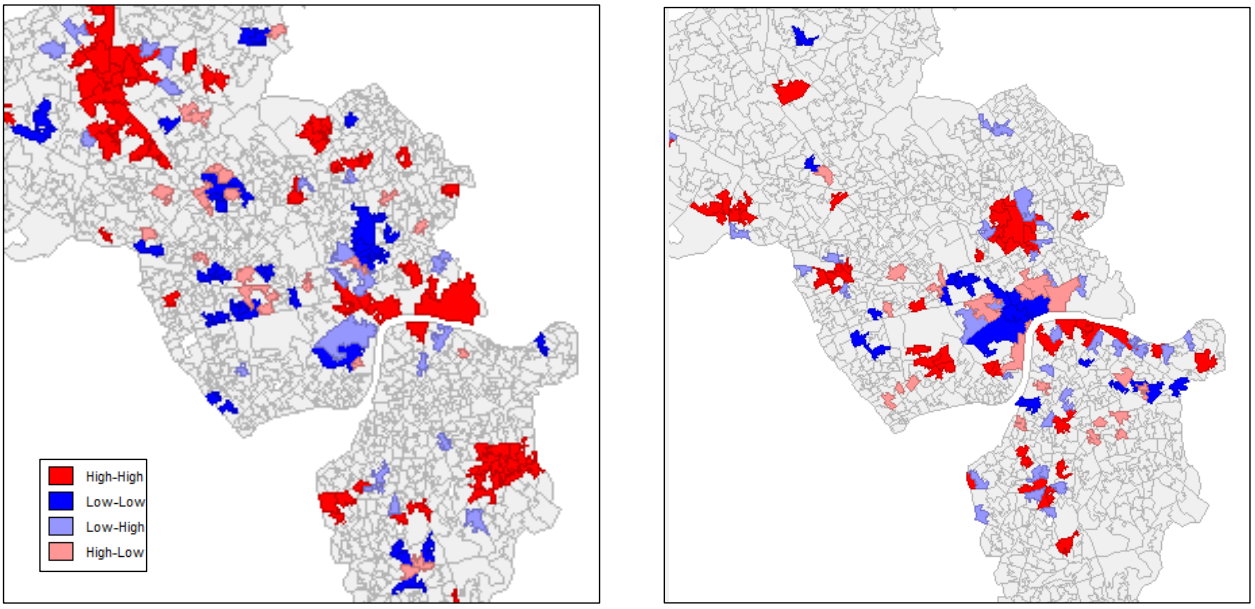
(a) (b)

Figure 1. Change in crime counts in central London: (a) burglary 2013-2016; (b) non-burglary 2013-2016.

The geographical distribution and the extent of spatial displacement of burglaries is measured using several methods including the differential local Moran's I test (GeoDa 2017), the Weighted Displacement Quotient (WDQ) analysis (Bowers and Johnson 2003) and correlation analysis. The differential local Moran's I measures the association of the magnitude of change in the number of events over time between an area (i.e. each LSOA in this case) and their surrounding area to detect areas that exhibit unusual tendency. The WDQ quantifies the extent of crime displacement or diffusion of benefit by comparing the number of incidents in the treated area and the buffer area surrounding the treated area before and after the intervention. The WDQ can be designated as WDQ = $(Bt_1 / Ct_1 – Bt_0 / Ct_0) / (At_1 / Ct_1 – At_0 / Ct_0)$, where Bt_1 is the crime count in the buffer area after the intervention, Bt_0 is the crime count in the buffer area before the intervention. Similarly, At_1 is the crime count in the treated area after the intervention, At_0 is the crime count in the treated area before the intervention, and Ct_1 is the crime count in the control area after the intervention, Ct_0 is the crime count in the control area before the intervention. The numerator measures the extent of displacement and the denominator measures the success of the scheme.

Finally, correlation analysis is used for investigating the association between the intensity of the SmartWater deployed in the treated area (i.e. the ratio of uptake by households in the respective area) and the extent of spatial displacement (or diffusion of benefit) derived through WDQ.

Figures 2(a) and 2(b) show the result of the differential local Moran's I test across central London to account for changes in burglary and non-burglary crimes before and after the intervention at the LSOA level. It identified areas with major changes (High-High areas) (regardless of the direction of the changes) and areas with little changes (Low-Low areas) scattered across the area. While areas that underwent considerable changes (High-High areas) tend to form clusters (Figure 2(a)), not all of them were treated areas. Figure 2(b) suggests that the majority of the significant changes in non-burglary cases occurred around the river where no SmartWater was implemented.



(a) (b)

Figure 2. Differential Moran's I Map for (a) burglary and (b) non-burglary crime in Camden and surrounding boroughs

The WDQ analysis was applied to each of the treated LSOAs with their surrounding LSOAs used as the buffer. Fifteen non-treated LSOAs within Camden and the surrounding boroughs were randomly selected as control areas. The result suggests that the diffusion of benefits occurred across most LSOAs analysed (84 out of 119 LSOAs).

Correlation analysis shows that no significant correlation was found between the WDQ value of each treated LSOA and the intensity of the SmartWater deployed in the respective area.

3. Discussion

Results from the WDQ analysis indicates that the operation has been largely successful in preventing burglaries and extending its effect to the surrounding areas. Most areas that saw crime displacement are adjacent or close to one or more treated areas. Further analysis would improve our understanding of what crime opportunities in those

small areas yield displacement. The differential Moran's I test also confirmed that SmartWater deployment made an overall positive impact in reducing the number of crime incidents, as majority of the areas with major changes (High-High areas) saw changes with decrease in their burglary numbers. Whether the proximity to the treated areas forms a clear pattern is still under investigation. Interestingly, the number of non-burglary incidents saw significant changes with increase in their numbers in non-treated areas, implying that the criminals may be pursuing displacement of crime types. Understanding the causality of such changes requires further investigation that account for other factors (e.g. other policing activities) that may have affected the outcome. Association between the intensity of deployment and the extent of displacement (or diffusion of benefit) could not be confirmed. This could mean that even a small number of kits in an area could prove effective in discouraging burglars from committing burglary in those neighbourhoods. These points need further investigation at a finer spatial granularity.

Findings from this study broadly confirms recent literature where crime displacement is often found to be insignificant and that diffusion of benefits occur more regularly. It should give more confidence to decision makers in implementing relevant prevention and policing schemes with less concern for crime displacement. The relatively fine spatial scale of the LSOA level data used in this study enabled a more detailed measurement of the extent of crime displacement and spill-over than many existing studies did. Further analysis using datasets with smaller geographical units would help uncover more detailed micro-scale shifts in the patterns of crime.

4. Biography

Villy Kozatsani is an Analyst at the Home Office. Her interest lies primarily with the geospatial analysis of crime displacement. In addition she is a civil servant working on the development of digital solutions for policing.

Shino Shiode is Senior Lecturer at Birkbeck, University of London where she serves as Director of the GIS programme. Her area of expertise extends to geography of crime, spatial epidemiology, as well as development of theory and methods for spatial analysis.

Narushige Shiode is Reader in Geocomputation and Spatial Analysis with Department of Geography, King's College London. He has worked mainly in the fields of urban geography, spatial analysis and GIS to identify patterns of changes in areas of built and natural environment.

Phillip Ridley is an Intelligence Analyst at SmartWater Technology's Centre for Infrastructure and Asset Protection. As well as covering a variety of roles on various SmartWater operations, Phill is the Centre's expert on spatial mapping for both research and operationally.

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