Exploring the impact and effectiveness of the 'Project Optimal' Burglary Reduction Initiative in Leeds: A Spatio-Temporal Approach

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1. Introduction

The current paper presents the findings from a project that explored the impact and effectiveness of the 'Project Optimal' Burglary Reduction Initiative in Leeds. The Project Optimal Initiative was implemented in March 2012 as part of a range of initiatives introduced across Leeds to address the city's highly publicised burglary problem (see Safer Leeds Partnership 2011; West Yorkshire Police 2012). This initiative is a form of *Predictive Policing*, used to help identify areas at risk of burglary based on previous burglary offences. Specifically, the initiative was introduced as part of the city-wide *Burglary Reduction Programme* introduced in September 2011 by the Safer Leeds Partnership, Leeds' Safer Cities agency (Safer Leeds Partnership 2011; West Yorkshire Police 2012). Based on work undertaken as part of the Trafford Burglary Model implemented by Greater Manchester Police in 2010, the model is derived from the 'Optimal Forager' theory of behaviour, and supported by previous research that links this theory to offending behaviour (Johnson and Bowers 2004; Jones and Fielding 2011). The model suggests that following an initial burglary offence, the risk of subsequent burglaries is increased across a 400m radius over a subsequent 3 week period (Jones and Fielding 2011).

This research sought to explore the impact and effectiveness of the Project Optimal initiative on burglary within Leeds, through the analysis of spatial and temporal burglary patterns during the four month periods preceding and following the model's implementation. The two main aims were;

- To explore the impact of the Project Optimal Initiative through an analysis of the spatio-temporal patterns of burglary across Leeds
- To explore the effectiveness and predictive ability of the Project Optimal Model

2. Data

Police recorded data on all actual and attempted burglaries that took place within Leeds between August 2010 and June 2012 were provided by the Safer Leeds Partnership. Whilst these data were used to help facilitate understanding of more longitudinal burglary trends, specific focus was placed on the 4 month periods prior to and following implementation of the Project Optimal Initiative (November 2011 to June 2012). This subsequent 8 month period comprised of data on 4,042 burglary offences, however, 15% (616) of these were excluded from the final analysis due to a variety of factors, including missing temporal data.

3. Methodology

The project encompassed a range of different methodologies to explore the impact of the Project Optimal model on burglary within Leeds. These included the methodologies utilised within the Project Optimal approach, whereby a series of colour coded buffers were drawn around the preceding 3 weeks' offences to depict dynamic risk over time (illustrated in Figure 1). Specific timebands were derived to disaggregate offences based on the time(s) in which they occurred; this helped to facilitate the exploration of temporal burglary patterns. Timebands were based on the variance of offence 'from' and 'to' times, in addition to peak burglary times identified through the Aoristic Analysis method. Visual exploration of patterns was then undertaken across timebands to identify patterns both prior to and following the model. More longitudinal temporal patterns were explored using a variety of graphical representations.

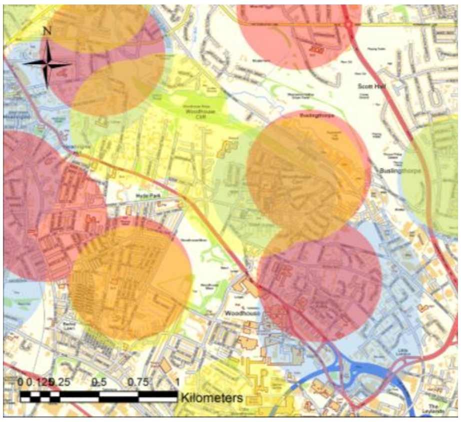


Figure 1. Indicating Dynamic Risk through the Project Optimal Initiative in Leeds.
Source: Safer Leeds Partnership/ West Yorkshire Police 2012

Effects of displacement and/ or diffusion of benefit were examined using a range of different calculations based on comparisons between response and comparison areas (see Guerette 2009). These were explored at the Medium Super Output Area level, focusing on the 5 wards in the North-West of Leeds (where the model is being trialled) where gross and net effects of the models' impact were greatest. The ability of the model in predicting the current week's offences was also examined; through considering the model's overall predictive ability, the predictive ability of the model based on randomly allocated crimes, and the predictive ability of the model through randomly allocated figures based on current crime figures.

4. Results

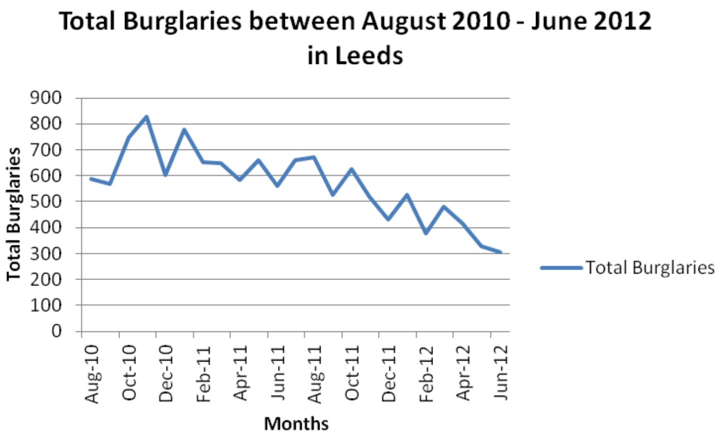
In presenting the results from this project, for purposes of clarity these have been divided into 2 sub-sections; sub-section 4.1 highlights general patterns within the data, with sub-section 4.2 highlighting the apparent impact of the Project Optimal Initiative.

4.1. General Patterns

4.1.1. Longitudinal Trends

In considering longitudinal trends of burglary within Leeds, Figure 2a) indicates a relatively stable decline in burglary during the preceding 2 years. Figure 2b) compares total monthly burglary figures across Leeds during the preceding and subsequent 4 month periods from Project Optimal's implementation, in addition to the corresponding 8 month period during the preceding 12 months. Figure 2b) highlights how burglary within Leeds appears to adopt a similar yearly temporal pattern; albeit to a lower extent during the four 4 months prior to and following implementation of the Project Optimal model. However, it remains unclear whether this may be due to a wider decline in crime, implementation of the Project Optimal model, or other contributory factors.

Fig. 2a)



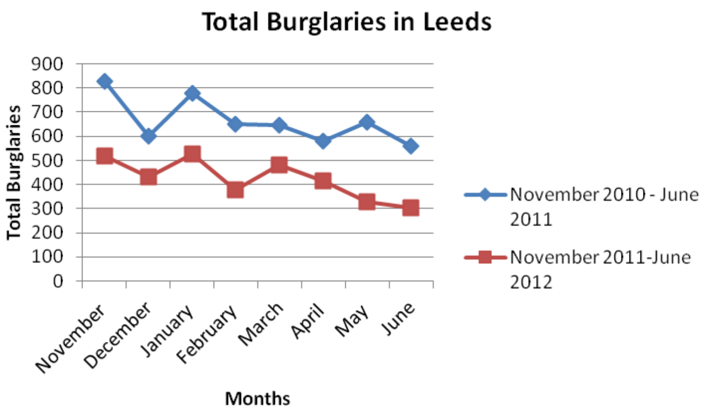


Fig. 2b)

Figure 2. Longitudinal trends in burglary; between August 2010 and June 2012 (Fig. 2a); and during the 8 month periods November 2010 – June 2011 and November 2011 – June 2012 (Fig. 2b). Source: Safer Leeds Partnership/ West Yorkshire Police 2012

4.1.2. Deriving Timebands and Analysis of Peak Burglary Times

Three timebands were derived to help facilitate temporal analysis; 'Early' (6am-2pm); 'Late' (2pm-10pm) and 'Overnight' (10pm-6am). The emerging findings were in line with published seasonal effects of burglary; for example burglary risk appeared greatest during the 'Late' timeband prior to the model, where there was decreased daylight hours and extended cover for offenders (see Coupe and Blake 2006). This is supported through the analysis of peak burglary times, which found that peak risk appeared to shift from the late to the overnight timeband between the pre- and post-model period (see Figures 3a) and 3b), respectively).

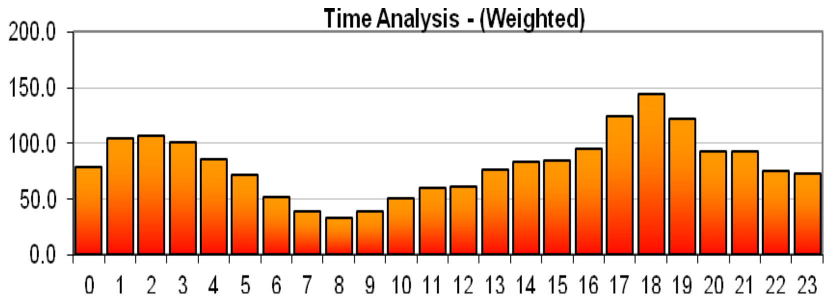


Fig. 3a)

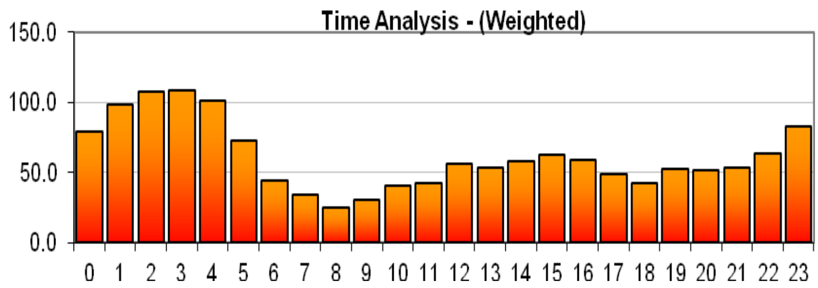


Fig. 3b)

Figure 3. Peak Burglary Times; both during the 4 months prior to implementation of the Project Optimal Initiative (Fig. 3a); and during the 4 months following the model's implementation (Fig. 3b). Source: Safer Leeds Partnership/ West Yorkshire Police 2012.

4.2. Impact of the Initiative

4.2.1. Visual Exploration of the Data

Visual exploration of the data suggested behavioural patterns indicative of an Optimal Forager. Specifically, burglary offences appeared to cluster in time and space over a short period (for example, 1-2 weeks), before moving to a nearby area, where further 'clusters' were developed, creating a network of burglary 'clusters' across an area; (see Figures 4a) and 4b). However, Figure 4b) shows that offences during the post-model period appeared to be less clustered; this was confirmed through a Nearest Neighbour clustering analysis. The post-model implementation period also indicated fewer burglaries (see Table 1). Further findings included instances where offences were committed in close proximity; suggesting that these may have been committed by the same offender(s) (see Figure 5). In addition, a number of repeat/ near-repeat offences (offences that appeared to occur in the same or close locations, respectively) appeared to occur in areas with increased cover and lower chances of being overlooked; such as grassland or recreational fields, particularly during later timebands (see Figure 6).

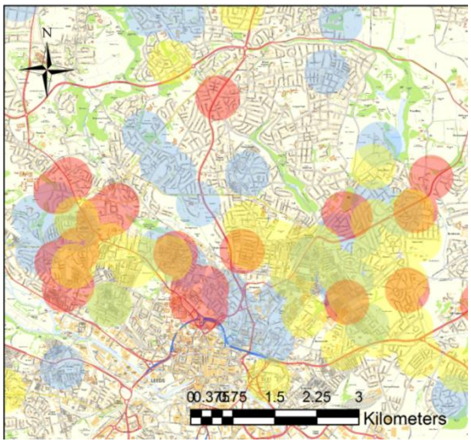


Fig. 4a)

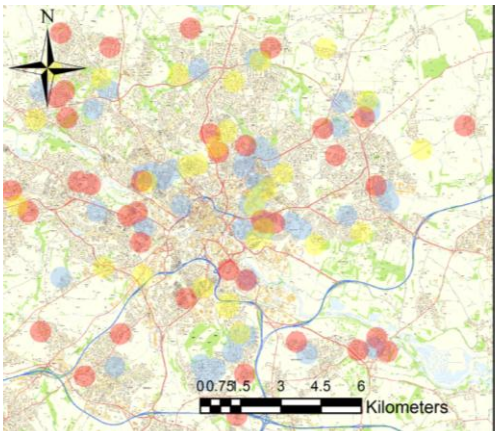


Fig. 4b)

Figure 4. 'Slippery' nature of burglary movement akin to the Optimal Foraging Theory both prior to (Fig. 4a; 'late' timeband) and following the Model's implementation (Fig. 4b; 'overnight' timeband). Source: Safer Leeds Partnership/ West Yorkshire Police 2012.

Table 1. Proportions of offences in timebands pre and post the Project Optimal scheme. Source: Safer Leeds Partnership/ West Yorkshire Police 2012.

Timeband	4 months prior to scheme implementation	Proportion (%)	4 months post scheme implementation	Proportion (%)	Total	Proportion (%)
Early	351	18%	269	18.2%	620	18.1%
Late	829	42.5%	425	28.8%	1254	36.6%
Overnight	771	39.5%	781	53%	1552	45.3%

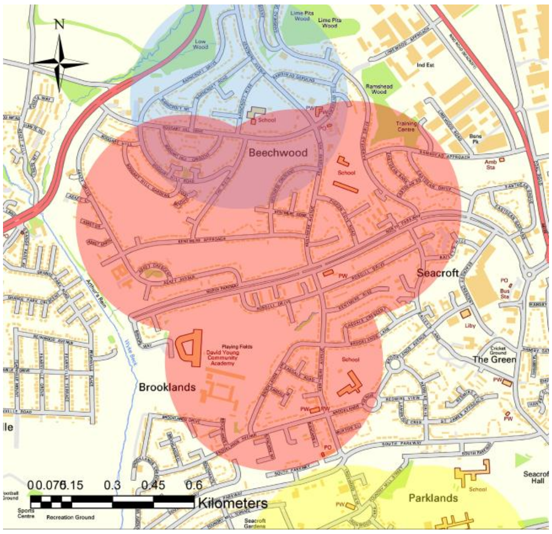


Figure 5. Offences occurring in close proximity. Source: Safer Leeds Partnership/ West Yorkshire Police 2012.

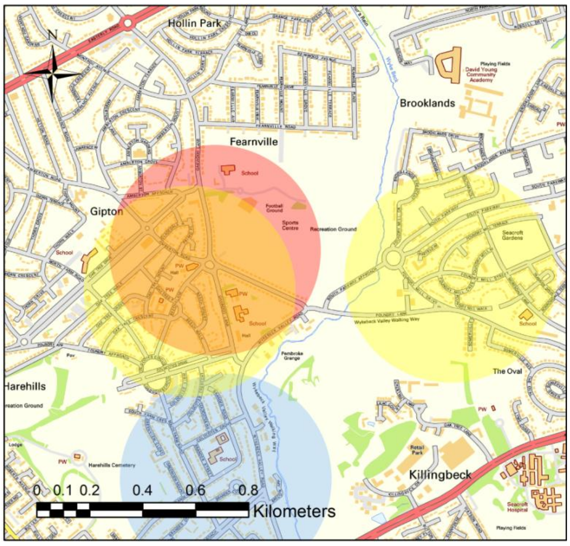


Figure 6. Near-repeat offences occurring in grassland/ recreational areas. Source: Safer Leeds Partnership/ West Yorkshire Police 2012.

4.2.2. Predictive Ability of the Model

The model's predictive ability was explored through examining the proportion of the current week's offences that were predicted (highlighted within buffer areas from the preceding week, two weeks', and three weeks' offences). Specifically, approximately 20% of the current week's offences were predicted by offences from the preceding week; 30% of offences were predicted by offences from the preceding two weeks, and approximately 40% of offences were predicted by offences from the preceding three week period. Where the current week's offences were randomly allocated, only a very small proportion of offences were predicted. However, where the current week's offences were randomly allocated based on current crime figures by ward, the proportion of predicted offences were noticeably larger. Whilst the resulting numbers were lower than the overall predictive ability of the model, the results appeared to mirror trends found in terms of predictive ability across timebands and distinctions between the pre and post-model periods.

4.2.3. Effects of Displacement/ Diffusion of Benefit

With regards to effects of displacement and diffusion of benefit, the majority of areas examined appeared to indicate diffusion of benefit. Where evidence of displacement was suggested, this appeared predominantly within the Headingley and the University 'student' wards. Furthermore, exploration of temporal displacement indicated displacement from late to overnight timebands between the pre and post-model periods, supporting the previously discussed seasonal effects found.

5. Discussion

This project utilised a range of methodologies and analytical methods to explore patterns within the data, whilst taking a somewhat novel approach in deriving timebands to help identify temporal burglary patterns. The results appeared consistent with previous research; for example in offenders' use of cover to evade detection and the importance of (reduced) daylight hours (see Coupe and Blake 2006); apparent both prior to and following model implementation. Notwithstanding this, the project identified limitations with the study; these often highlighted areas that would benefit from future exploration, for example more detailed geodemographic data to explore displacement/ diffusion of benefit.

6. Areas for Future Research

The current project uncovered a number of areas in which this research could be developed. For example, future work to explore crime displacement/ diffusion of benefit could incorporate more detailed geodemographic data when determining appropriate response and comparison areas. A more longitudinal study could help to explore the impact of the Project Optimal Model over time. Furthermore, work to develop knowledge of potential 'typologies' of burglars may help support the future allocation of Police resources. The use of 'agent-based' computer models is also raised as a potential avenue for future research in helping to predict areas at risk of burglary.

7. Acknowledgements

In presenting this research it is important to acknowledge the support of the Safer Leeds Partnership, for without whom this project would not have been possible. In addition to providing data for the project, they have been extremely helpful in discussing the project prior to, during and following its completion; providing valuable insight into this area.

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Biography

I have recently begun a PhD (October 2012) which seeks to develop an agent-based model of residential burglary. With a strong grounding in Criminology/ Psychology through my previous employment as a Prison Psychologist, my research interests now focus on Environmental Criminology, Social Simulation, and their role within Crime Analysis/ Prediction.