Profiling Burglary in London using Geodemographics

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Summary

A geodemographic classification provides categorical summary class assignments of neighbourhood areas based on salient population characteristics and built environment attributes. The regional London Output Area Classification (LOAC) is an example of such a classification, created using the same methodology as the national 2011 Output Area Classification. Police.uk data coded to LOAC provides an alternative perspective on burglary rates in London, with dwellings in different geodemographic clusters having experienced stark differences in the rate of burglaries. We conclude LOAC benefits from a greater predictive ability when compared to a national classification for differentiating socio-spatial structure, thus providing a more detailed insight into the variations of burglary across London.

KEYWORDS: Geodemographics, Burglary, Crime, London, OAC

1. Introduction

Geodemographic classifications are summary indicators of the social, economic, demographic and built characteristics of a small area zonal geography. They are designed to facilitate comparison between locations, for example, highlighting similarity in patterns of population structure between different parts of a country, or contrasting crime rates by coding Open Data sources. Within the UK, there is a lineage of freely available small area geodemographic classifications. The most recent example at the national level is the 2011 Output Area Classification, or 2011 OAC (ONS, 2014). This was built using 2011 UK Census data and output areas (OAs), the smallest spatial element of UK Census geography and primary unit of dissemination for the last two UK Censuses.

2. 2011 London Output Area Classification

A criticism of national classifications such as the 2011 OAC is that they do not adequately accommodate local or regional structures that diverge from national patterns. This is particularly evident in London where 85% of OAs belong to three of the eight 2011 OAC Super Groups. This has been deemed unsatisfactory by some users who only require a geodemographic perspective of London, such as the Greater London Authority (GLA). Consequently, the GLA commissioned the creation of the 2011 London Output Area Classification (LOAC). LOAC was created using the same inputs and methodology to the 2011 OAC, however, with a geographic extent limited to London. Further details of the classification are available from (Longley and Singleton, 2014).

3. LOAC and crime

The utility of LOAC as a tool for stratifying policy interventions within London can be explored using an illustrative example in the context of recorded crime. Data for individual recorded crimes have been made available on a monthly basis since December 2010 from the Police.uk website.

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Crimes are presented at a record level by crime category alongside a georeference of a location proximal to where the crime was recorded as occurring. In total 4 million crimes were recorded in London from December 2010 to July 2014.

The majority of recorded crimes are geocoded by police forces using a variety of methods such as tagging by mobile GPS receivers or address referencing. However, such data in raw form present a high risk to individual disclosure (Kounadi et al., 2014), and as such, it is not possible to publicly release crime data of this level of precision within a UK context given legislative constraints (Singleton and Brunsdon, 2014). As such, publically accessible crime data released through Police.uk are anonymised so that no individual crime event location is identifiable (Tompson et al., 2014). Crimes are allocated to a nearest centroid point of a pre-defined zonal geography (Tompson et al., 2014) which represent a collection of streets. This geography was created using Voronoi polygons drawn around street segment centroids and points of local relevance. To ensure privacy, polygons were merged if necessary to ensure each contained at least eight addresses (Singleton and Brunsdon, 2014; Tompson et al., 2014). Data made available by Police.uk uses these centroids as the recorded location of any crimes that occur within each polygon. As such, multiple crimes can be recorded at a single spatial location.

Such disclosure controls make the coding of crime events by the LOAC typology problematic, given uncertainty introduced by the intersecting tessellations of the Voronoi polygons and the 2011 OA geography. To understand the extent to which the aggregation of crime events impact LOAC cluster assignment, an estimation of the Voronoi zonal geography for London was created. Using all recorded crime events in London since December 2010, a total 94,667 Voronoi polygons were created, which represents an approximation of the zonal geography used to report crime by Police.uk (Singleton and Brunsdon, 2014). Figure 1 shows a subset of the Voronoi polygons and crime event centroids overload on LOAC, illustrating how the eight LOAC Super Groups intersect each polygon. The creation of this geography enabled the evaluation of two different methods of assigning crime events to LOAC Super Groups. The first method assigned a LOAC Super Group on the basis of the Output Area into which the recorded crime centroid fell. This has the advantage of being simple to compute, however, ignores that Voronoi polygons and the 2011 OA geography do not perfectly nest. As such, a second method was implemented that overlaid the 94,667 Voronoi polygons onto the boundaries of London's 25,053 OAs. The proportion of each OA within the Voronoi polygons were calculated. The total number of recorded crimes assigned to each Voronoi polygon were then re-assigned proportionally to each Output Area, and by association, each LOAC Super Group. For example, if 120 crime events were recorded in a Voronoi polygon which had 81% of its area belonging to 'London Life-Cycle' and 19% to 'Ageing City Fringe', then by multiplying these proportions (0.81*120 and 0.19 * 120) it can be estimated 97 crimes might have occurred in 'London Life-Cycle' and 23 within 'Ageing City Fringe'. An assumption of this method is that that crime distributions would be uniform across and OA, which in reality may not be the case given variable land use patterns.

The distribution of crimes across the eight LOAC Super Groups using these two allocation methods are shown in Table 1, and indicate few notable differences. As such, for the remaining analysis, the first method was implemented where crime centroids as supplied by Police.uk were used to assign LOAC clusters as this represented the least data manipulation and assumption about the geography of residential structure.The Police.uk website uses a number of different categories to classify crime. However, not all crime types would sensibly be profiled using LOAC, given that the typology relates to residential population characteristics. As such, a crime category that might be considered appropriate to explore is burglary, where offences would be more prevalent in residential locations (Maguire and Bennett, 1982). Calculating rates of burglary requires a denominator, and residential population is one of the most commonly used attributes (Andresen, 2006), however, established research has also shown using different denominators can impact observed patterns of crime (Boggs, 1965). Therefore, others have argued that using the number of occupied households may be considered as a preferable denominator for burglary rate calculations due to population movements during the working day and weekends (Harries, 1981; Ratcliffe, 2010).

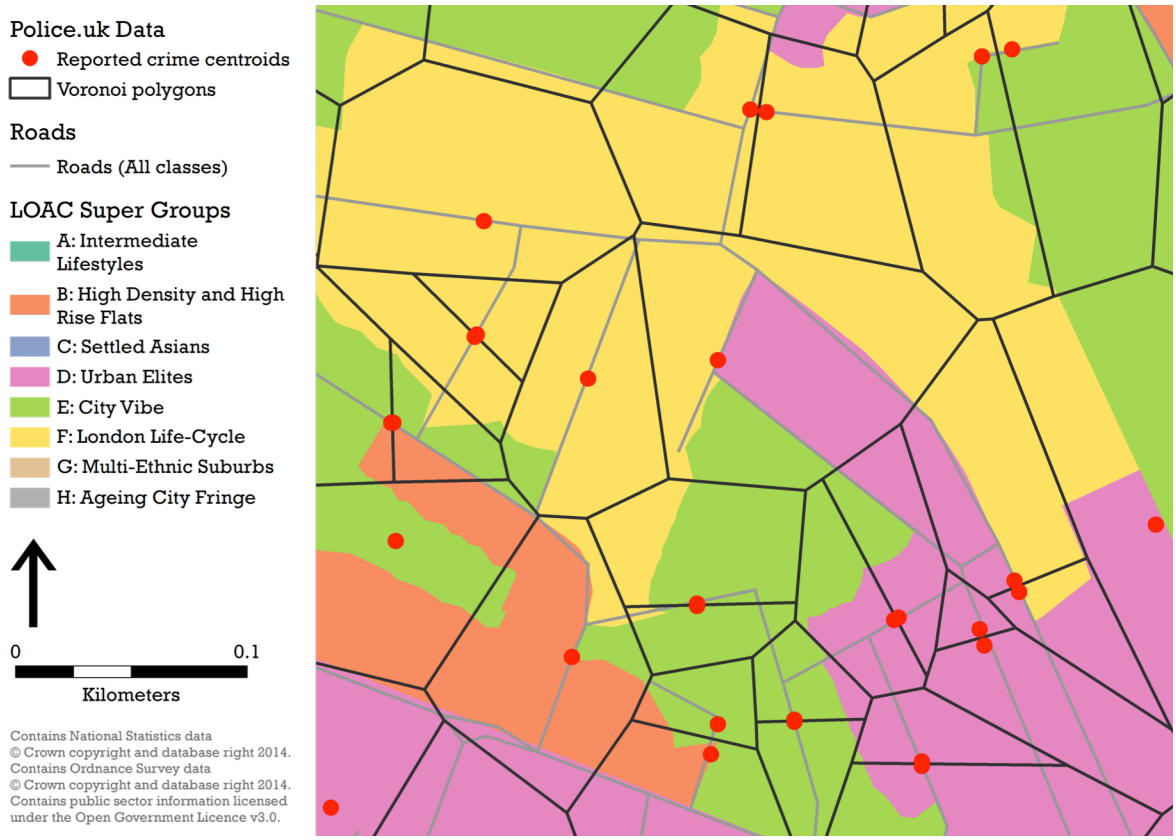

Figure 1: Police.uk Voronoi polygons and crime event centroids overlaid on the LOAC Super Groups

Table 1: Percentage of recorded crime assigned to LOAC Super Group using centroid location and the proportional assignment method

	Recorded crimes based on centroid locations	**Recorded crimes based on proportional assignment**	**Difference**
A: Intermediate Lifestyles	10.25%	10.26%	0.02%
B: High Density and High Rise Flats	13.88%	13.56%	-0.31%
C: Settled Asians	11.38%	11.09%	-0.28%
D: Urban Elites	16.36%	16.51%	0.16%
E: City Vibe	15.28%	15.48%	0.20%
F: London Life-Cycle	8.69%	8.52%	-0.18%
G: Multi-Ethnic Suburbs	18.34%	19.10%	0.76%
H: Ageing City Fringe	5.84%	5.47%	-0.36%

Burglary rates were calculated using a denominator of taxable dwellings, as a surrogate for the total number of households, in London in 2011, made available through the ONS Neighbourhood Statistics website. These are presented as index scores in Figure 2. These scores illustrate the propensity for burglaries to occur by LOAC clusters relative to the London average. A score of 100 is a rate the same as the London average of 98 burglaries being committed per 1,000 dwellings between December 2010 and July 2014, a score of 200 is twice the average, and 50 is a half. Dwellings within OA classified into the Super Groups 'C: Settled Asians', 'D: Urban Elites', 'E: City Vibe' and 'G: Multi-Ethnic Suburbs' LOAC Super Groups all have higher relative rates of burglary compared to the London average. For example, OA classified into the Super Group 'C: Settled Asians' exhibit burglaries at a rate 25% higher than the London average, whereas dwellings within 'H: Ageing City Fringe' have a likelihood of burglaries being committed at a rate 9% less than the London average. The 'C: Settled Asians' and 'H: Ageing City Fringe' LOAC Super Groups are both predominantly found in the outer Boroughs of London which are more suburban areas, yet display very large variation in burglary rates. A similarly divergent pattern also exists for clusters predominantly found within inner London, where the 'D: Urban Elites' and 'E: City Vibe' Super Groups have higher burglary rates than the London average, yet burglary in the 'B: High Density and High Rise Flats' cluster are 30% less likely.

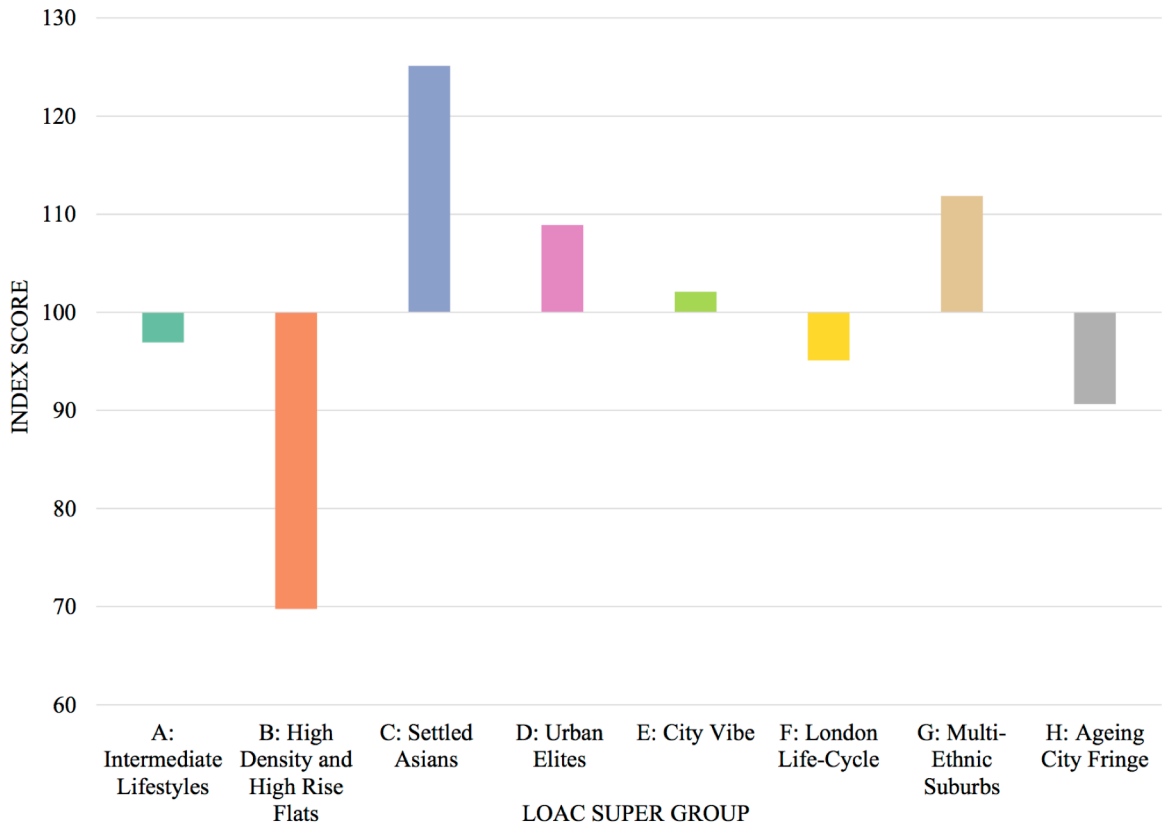

Figure 2: Index scores of burglary rates in LOAC Super Groups between December 2010 and July 2014 standardised using the total number of households

4. Conclusion

The stratification of burglary rates using LOAC illustrates stark differences between each Super Group within London. The rate of burglaries range from being 25% higher than the London average in the 'C: Settled Asians' Super Group to 30% lower in 'B: High Density and High Rise Flats'. The utility of LOAC for such public policy targeting applications highlights how regional classifications

can provide a level of detail not possible at the national level. More generally, the combination of demographic, socio-economic and physical conditions of London as represented by LOAC, rather than traditional administrative geographies, provides a unique perspective and method of summarising burglary statistics; thus providing a simplified way of comparing criminal activity across the socio-spatial variations found in London. Looking prospectively, the example of profiling crime data with LOAC is just one example of how it can be used to derive insight from the growing wealth of Open Data sources available for London.

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6. Biography

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