Charting changes in the geodemographic composition of British cities, 1881-1901.

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Summary

A plethora of research has been conducted to investigate the urban and population dynamics of towns and cities in nineteenth century Britain. This paper presents, for the first time, the nationwide pattern of neighbourhood changes in Victorian Britain at street or individual address level. Making use of georeferenced individual records from the 1881, 1891 and 1901 British Censuses, we devise a street-based historical geodemographic classification that charts the development of urban residential areas across Great Britain during a 20 year study period. Results from this granular analysis improve our understanding of urban and populations during the study period.

KEYWORDS: historical censuses; georeferencing; geodemographics; residential differentiation; Great Britain.

1. Introduction

Present day geodemographic analysis investigates, sometimes highly variegated, social similarities that characterise urban areas and charts their replication across national settlement systems (Harris et al., 2005, Vickers and Rees, 2007, Gale et al., 2016). The advent of digitally encoded historical census records makes possible geodemographic analysis in the same tradition, specifically using individual records of censuses that have become fully available under the '100-year rule' and have become available to the academic community through the Integrated Census Microdata (I-CeM) Project (Higgs and Schurer, 2019). Our analyses in this paper build upon the previous efforts of georeferencing the individual historical census records for 1881-1901 at street or individual property level (Lan and Longley, 2019). Here, we further reconstruct most of the historical residential streets for the three periods and create a historical geodemographic classification of the residential streets across Great Britain.

2. Reconstructing historical residential street patterns

To reconstruct the historical residential streets, we match the georeferenced census address points to their closest street segments from the OS Open Roads, using a maximum 500 metre buffer and prioritising records with matched thoroughfare names. We then define the extents of the major resident population concentrations by examining the contiguity of historical residential street segments for 1881, 1891 and 1901. Full consideration leads us to adopt the 200m contiguity threshold as sufficient to span physical structures such as rivers and to represent both the historical cores of both major and minor settlements. Figure 1 shows the street segments that bound London in 1901 along with the urban envelope defining the city in 1881.

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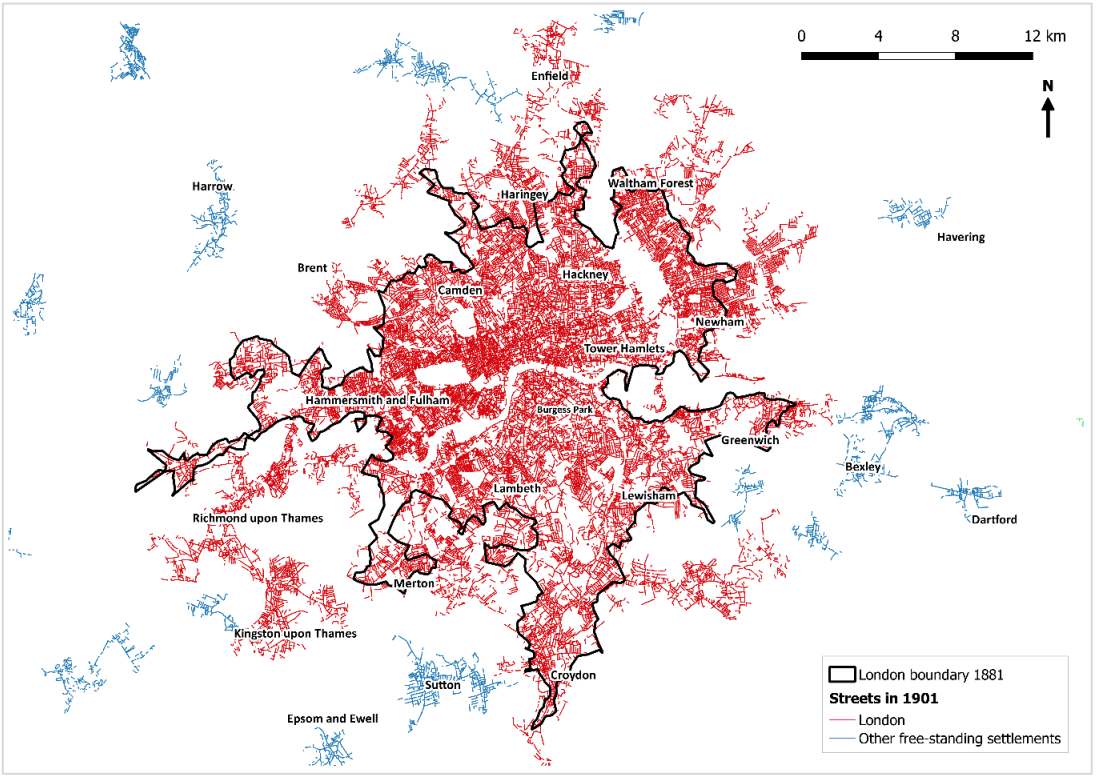

Figure 1. Street segment cluster (shown in red) defining the 1901 residential extent of London and its bounding envelope in 1881 (shown in black).

3. Geodemographic classification of historical streets

Following the modern Output Areas of the 2011 Census (Gale et al., 2016), we adapt the standard cluster analysis approach to summarise neighbourhood characteristics using our consistent 1881-1901 street segment geography. 26 candidate variables are initially selected to represent geodemographic domains of demography/household structure, employment, occupation, and residential mobility (see Table 1). After a series of data exploration such as data transformation, standardisation and Pearson correlation, 17 variables are thus retained in the geodemographic classification. We pool data from a set of street segments identified in 1881, 1891 or 1901 together with non-geocoded streets identified by thoroughfare names and use k-means clustering (Vickers and Rees, 2007) to derive a common classification.

Table 1. Descriptions of the initial input variables.

Domains	ID	Variables	Definition (by road segments)
Demographics and household structure	1	infant	% of people aged 0-4
	2	y_child	% of people aged 5-10
	3	o_child	% of people, aged 11-14
	4	adult	% of people, aged 15 or over
	5	single	% of single people (age >= 12 for females or age >= 14 for males)
	6	married	% of married people (age >= 12 for females or age >= 14 for males)
	7	widowed & divorced	% of widowed or divorced people (age >= 12 for females or age >= 14 for males)

	8	overseas	% of people born outside the (then) UK
	9	longevity	% of people aged > 41 (male) or > 43 (female)
	10	hhs	Average household size
	11	hh_kid6	% of households that had 6 or more children
	12	hh_kins	% of households that lived with relatives
	13	hh_sers	% of households that had live-in domestic servants
	14	hh_inmates	% of households that had live-in lodgers/boarders
Employment	15	work_kids	% of children aged 11-14 who had jobs
	16	work_f15	% of female adults aged 11 and over who had jobs
Occupation	17	g123	% of people (age>14) who were professional, managerial, clerical workers (e.g., scientists, doctors, government administrators, religious workers)
	18	g123_head	% of household heads (age>14) who were professional, managerial, clerical workers
	19	g4	% of people (age>14) who were sales workers in wholesale or retail trade and business services (e.g., shop owners, insurance salesmen, estate agents)
	20	g5	% of people (age>14) who were service workers (e.g., housekeepers, cooks, servants, waiters)
	21	g6	% of people (age>14) who were agricultural, animal husbandry and forestry workers or fishermen(e.g., farmers)
	22	g7	% of people (age>14) who were factory production and raw material processing related workers (e.g., miners, weavers, dyers)
	23	g8	% of people (age>14) who were artisanal workers (e.g., shoemakers, blacksmiths, toolmakers, jewelers)
	24	g9	% of people (age>14) who were general labors and physical workers conducting routine jobs (e.g., bricklayers, construction workers, engine operators, dockers)
Residential Mobility	25	local_birth	% of people resident in their parish of birth
	26	local_head	% of household heads resident in their parish of birth

4. Results

The geodemographic classification comprises six Groups: (1) High Social Status Households and Service Workers; (2) Sales and Service Families; (3) Artisanal Communities; (4) Hard-pressed Production Families; (5) Poverty and Casual Employment; and (6) Rural Residents. These Groups contribute to and manifest urban change in very different ways.

Radial plots detailing the distinctive profiles of the six clusters are shown in Figure 2. Group (1) manifest nascent professional occupations along with industries that require managers and clerical workers, while Group (2) includes the many sales workers (such as shop assistants, insurance salesmen and estate agents) that make up the burgeoning middle class in the study period. Growth in Group (3) household numbers manifests an industrial structure grounded in small enterprises such as shoemakers, blacksmiths, toolmakers and jewellers, in contrast to the factory production, raw material extraction and processing undertaken by members of Group (4) households. The industry structure underpinning predominance of Group (5) is different from all of these, being predominantly grounded in casual employment in equipment operation, bricklaying, construction work or dock labour. Employment in agriculture, forestry and fishing underpins the industrial structure of areas outside of urban areas dominated by Group (6).

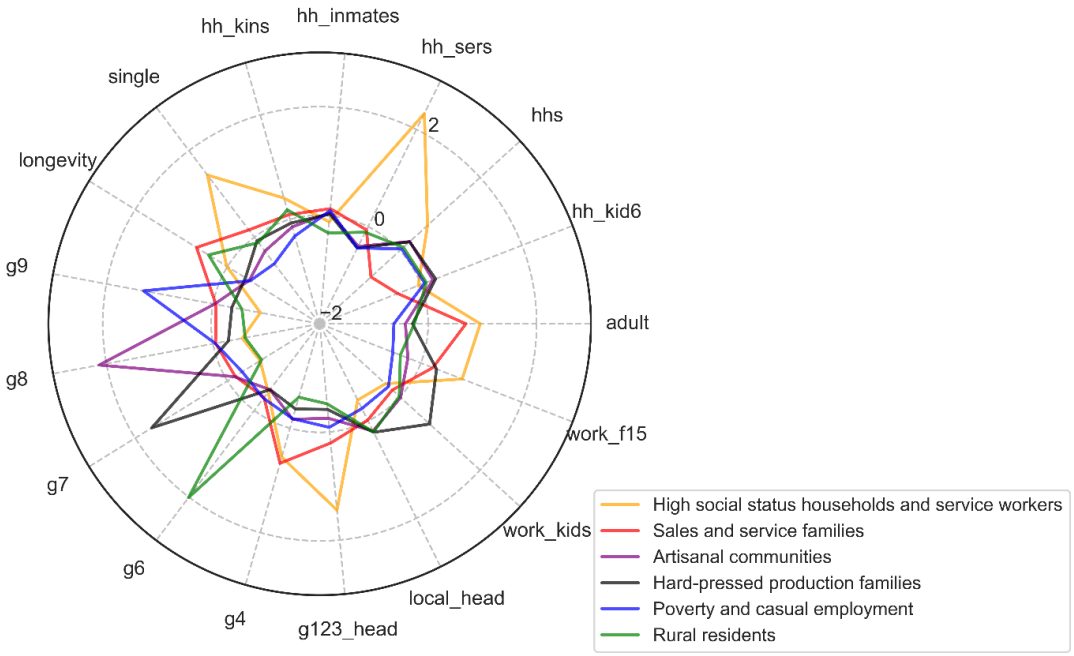

Figure 2. Radial plot showing the Group variations from the mean values of the input variables across the pooled 1881-1901 Census data.

This geodemographic classification of street segments makes it possible to develop comparative historical analyses over space and time. We observe that the internal residential structures of contiguous urban areas across nineteenth-century Britain take a number of very different forms, reflecting town or city function and social organization within the wider settlement system.

Radio plots of a system-wide perspective and representative elements are shown in Figure 3, in which the radial distances on the plots identify the percentages of the populations of the selected urban areas that fall into each geodemographic Group in 1881, 1891 and 1901. The five selected settlements exhibit an urban typology arising from inspection of the plots from the wider settlement system, viz.: (a) service and administrative centers, such as Bristol, Edinburgh and London that host distinctive blends of casual, professional and service employment; (b) urban structures that are underpinned foremost by artisanal occupations, such as Birmingham and nearby Midlands towns such as Sheffield; (c) industrial towns such as Manchester and Nottingham with blends principally of production and service workers; (d) ports such as Liverpool and Hull that primarily function through casual and service employment; and (e) factory towns such as Bradford and Dundee in which production workers predominate but service workers are also present.

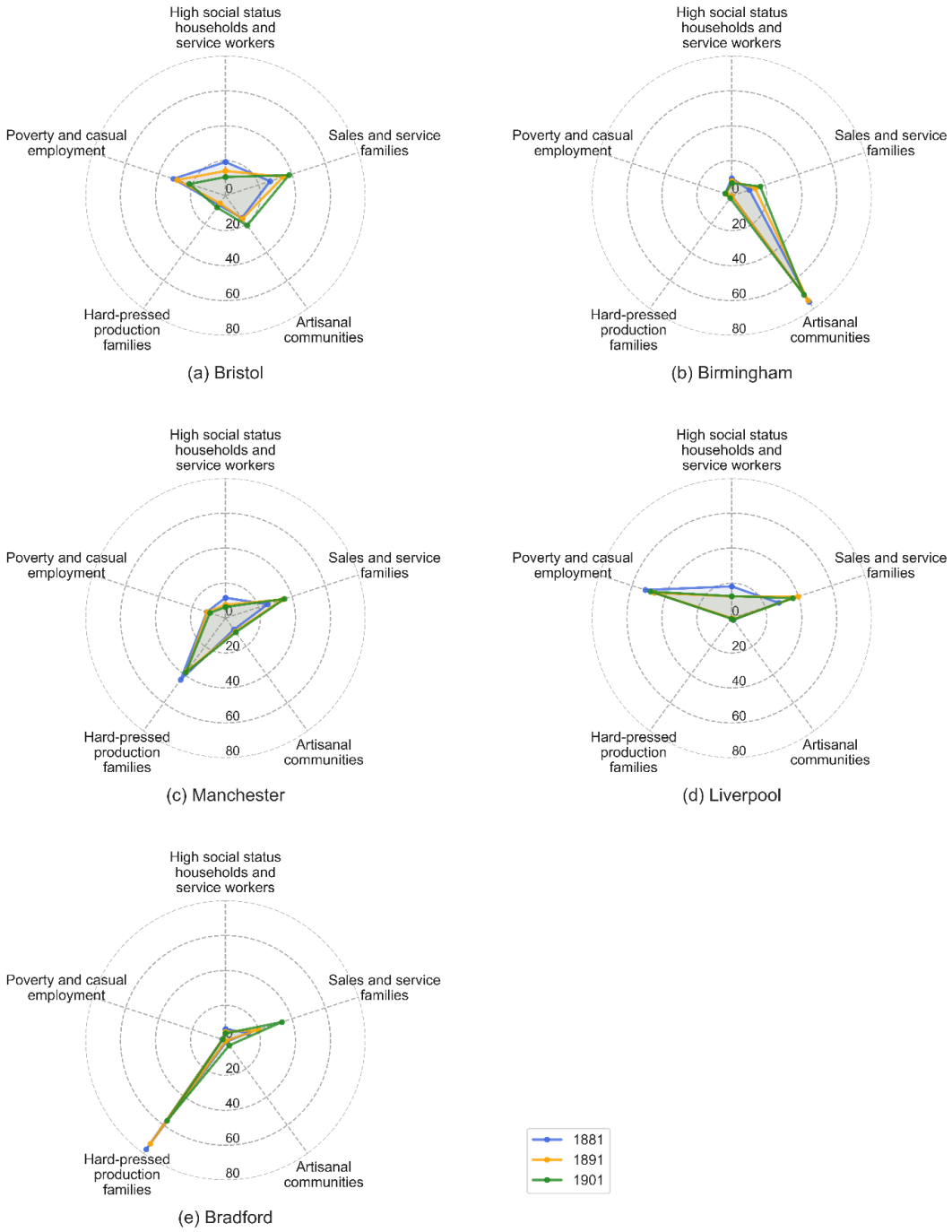

Figure 3. Radial plots of changes in population composition of (a) Bristol, (b) Birmingham, (c) Manchester, (d) Liverpool and (e) Bradford over the period 1881-1901.

5. Conclusion

We have built a consistent geodemographic and physical infrastructure for a 20-year period that makes it possible to demonstrate the patterns of change in the built environment and the population that resides within it. We see our contribution as, to our best knowledge, creating the first GB-wide framework within which the comparative analysis of the detailed compositions of residential areas within towns and cities can be developed. Findings from this study improve our understanding of the ways in which cities and their populations evolve over time and space. The GB-wide residential streets and geodemographics also open up opportunities for future studies on urban morphology and residential differentiation across Great Britain.

6. Acknowledgements

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Biographies

Tian Lan is a Research Associate, working in the Geospatial Analytics and Computing group at the Department of Geography, UCL. His research primarily focuses on urban geography, social/spatial inequalities and GIS.

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