



PERGAMON

Health & Place 8 (2002) 25–35

HEALTH
& PLACE

www.elsevier.com/locate/healthplace

Life and death of the people of London: a historical GIS of Charles Booth's inquiry

Scott Orford^{a,*}, Danny Dorling^b, Richard Mitchell^c, Mary Shaw^d,
George Davey Smith^e

^a *Department of City and Regional Planning, University of Cardiff, Glamorgan Building, King Edward VII Avenue, Cardiff CF10 3WA, UK*

^b *School of Geography, University of Leeds, Leeds LS2 6JT, UK*

^c *Research Unit in Health, Behaviour and Change, University of Edinburgh Medical School, Edinburgh EH8 9AG, UK*

^d *School of Geographical Sciences, University of Bristol, Bristol BS8 1SS, UK*

^e *Department of Social Medicine, University of Bristol, Bristol BS8 2PR, UK*

Abstract

Social reformer Charles Booth undertook a massive survey into the social and economic conditions of the people of London at the end of the 19th century. An important innovation of his Inquiry was the construction of large, detailed maps displaying social class of inner London on a street-by-street basis. These provide a detailed and vivid picture of the geography of poverty and affluence at this time. These maps have been digitised, georeferenced and linked to contemporary ward boundaries allowing Booth's measurement of social class to be matched to the measurement of social class in the 1991 census of population and standardised mortality ratios derived for all causes of death in the survey area between 1991 and 1995. The social class data were used to derive an index of relative poverty for both time periods and a comparison of the geographies of relative poverty and their relationship with contemporary mortality was made. Although the overall standard of living had increased, the geography of poverty at the end of the 19th century was very similar to that at the end of the 20th century. Moreover, the geography of all causes of death for people over the age of 65 was more strongly related to the geography of poverty in the late 19th century than contemporary patterns of poverty. This relationship was also true for mortality for specific diseases that are related to deprivation in early life. The paper concludes that the spatial patterns of poverty in inner London are extremely robust and a century of change has failed to disrupt it. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Poverty; Mortality; Correlation analysis; Social change

Introduction

The digitisation of historical material and the accumulation of historical digital spatial databases have become increasingly common within GIS during the past decade. Within the UK this has been perhaps best

exemplified by the Great Britain Historical GIS Project (Gregory and Southall, 1998), whose goal is to provide both unit boundaries and associated historical population statistics collected at a variety of spatial scales. The rationale behind this and other historical GIS projects is that mapping and spatially analysing historical data can often be crucial in understanding the patterns of present day social structures and the factors that have determined them. The problem of converting the bulk of paper historical sources into digital form, particularly unsystematic qualitative sources, poses special challenges to GIS, as does the problems of locating historical places and objects in order to assign them the

*Corresponding author. Tel.: +44-29-20875272; fax: +44-29-20874845.

E-mail addresses: orfords@cf.ac.uk (S. Orford), d.dorling@geog.leeds.ac.uk (D. Dorling), richard.mitchell@ed.ac.uk (R. Mitchell), mary.shaw@bristol.ac.uk (M. Shaw), zetkin@bristol.ac.uk (G.D. Smith).

geographical co-ordinates required by GIS (Knowles, 2000).

This paper investigates the creation of a specific historical GIS relating to the geography of poverty in late Victorian London as measured by Charles Booth. Like other historical GIS projects, the creation of the GIS involved digitising data that was collected over 100 years previous. The historical GIS is then utilised in a specific case study—to examine how spatial patterns of poverty in Booth's day are related to contemporary patterns of poverty and how both of these are related to contemporary patterns of mortality. The case study aims to show that spatial patterns of inequalities in the past continue to have a strong influence on inequalities in health in the present. This research is timely. The Charles Booth archive containing unpublished data relating to his Inquiry has recently become on-line whilst social historians have commented that there is a real need for the "reworking of Booth data for the study of long term economic and social change" (O'Day and Englander, 1993, p. 7).

The paper is divided into five parts. The first part places the historical data into context by examining the motivations behind Charles Booth's survey of inequality and poverty in London, the methods he used and the links with contemporary government surveys. The second part examines how Booth's data were digitised and matched to present day census data. It discusses the derivation of an index of poverty based upon Booth's data and the census data. The third part investigates the changing patterns of social class and poverty between late 19th century and late 20th century London, and describes the changes that have taken place. The fourth part explores how these patterns are related to contemporary patterns of mortality and the implications of these relationships. The paper then concludes with a discussion of the results and the new Charles Booth on-line resource.

Charles Booth's inquiry

In the last decades of the 19th century, social reformer Charles Booth (1840–1916) undertook a massive survey—even by today's standards—of economic, social and working conditions in inner London. The results were published as the Inquiry progressed between 1889 and 1903, when the third and final edition of the completed research was published under the title of 'Life and Labour of the People of London'. This impressive seventeen volume work was divided into three parts or series, each representing a different emphasis of the Inquiry: The Poverty Series, Vol. 1–4 undertaken between 1886–1891; The Industrial Series, Vol. 5–9 undertaken between 1891–1897; The Religious Influence (i.e. social influence) Series, Vol. 10–17 undertaken

between 1897–1903. The impetus behind Booth's Inquiry was complex, reflecting both political and philosophical ideologies combined with a compelling sense of social obligation and personal responsibility to remedy the problems of poverty that he saw as "the problem of all problems" (Bales, 1991). He was the son of a prosperous corn merchant from Liverpool, and was a successful business man, forming the profitable Booth Steamship Company together with his brother Alfred in the early 1860s. He distrusted philanthropy, believing it encouraged poverty, and socialism, believing instead that co-operation between employer and employee in the form of Trade Unions was capable of solving the problems of the working poor. Although he was not an academic, he was influenced by the positivist philosophy of Auguste Comte and was attracted to the positivist ideas of empiricism, believing that social problems such as poverty could only be remedied by making social science research as exact as natural science research. In this sense he saw the collection of quantifiable scientific 'facts' as a necessary prelude to the discovery of practical solutions. He thus disliked much contemporary social investigation which he regarded as shallow, sensationalist and unscientific (O'Day and Englander, 1993). This dislike ranged from the descriptive accounts by Mayhew on the London poor to empirical survey's such as the 1881 census of population that Booth believed to be incorrect, specifically with respect to the categorisation and collection of employment data (Bales, 1991). Crucially, he strongly disagreed with Hyndman's survey of the London poor published in 1885, which claimed that 25% of London's population were living in extreme poverty. Believing this to be an exaggeration because the problem had not been scientifically analysed, together with a general suspicion of information related to poverty, Booth set out to conduct his own survey of the condition of the people of London. He gathered together a diverse and educated team of young researchers, many of whom would later become implicit in the development of social statistical survey methods in academia and national government, and began his Inquiry into the Life and Labour of the People of London that would take 17 years to complete and would cost the equivalent of three million dollars today of his own money (O'Day and Englander, 1993).

The poverty survey

His first survey, the poverty survey, was initially concerned with the East End but eventually covered an area bounded by Hammersmith in the west to Greenwich in the east, and from Highgate in the north to Clapham in the south. The aim of the survey was to show that the incidence and causes of poverty could be accurately measured, and by doing so, indicate a way in

which policy might, for the first time, be designed to meet actual and measured needs (Bales, 1991). It is this survey that this paper is concerned with. The amount of detail recorded by Booth and his team was astonishing given that they were surveying an area that, in total, had a population of over four million. Booth and his team of researchers did not conduct house-to-house investigations but instead undertook in-depth and lengthy interviews with professionals who had expert knowledge and experience of working with the inhabitants of London. The most important of these professionals were the School Board Visitors who Booth believed had the most detailed knowledge of social conditions, and in particular poverty, of any official group of people in London (O'Day and Englander, 1993). The job of the School Board Visitors was to record information on every child of, or nearing, school age (5–13) for the purpose of school fees administration. The payment of school fees had become an important issue with the introduction of compulsory education in London in 1871, with non-payment resulting in the exclusion of the child from school and the prosecution of the parents for the child's absence. Importantly, poverty was no excuse for absence and non-payment of fees, although parents could apply for remission. This, however, required a form of means testing to prove that the parent's were not unduly wasting their income. Only the children of the deserving poor were granted access to free education. Hence the School Board Visitors had to obtain additional information concerned with the child's home circumstances and the family's means such as the occupation of the household, sources of income and rent, the number of rooms, whether the breadwinner was unemployed and the prospects of getting work (Bales, 1991). It was this information that Booth and his team were interested in obtaining. School Board Visitors were urged to pursue inquires with neighbours and employers and knew their districts extremely well and were much more cognisant of areas and all types of households within these areas than other officials. Thus, as Bales (1991) and others have argued, Booth had selected an excellent source of information, particularly about the poorest families.

The information gained from the School Board Visitors were checked against the 1881 Census, the opinions of other officials such as the clergy, and street-by-street fieldwork undertaken by Booth and his team. These checks convinced Booth that the data obtained by the School Board Visitors were acceptable and capable of providing a measure of poverty, despite the inherent bias towards families with children living in poorer areas (O'Day and Englander, 1993). The information provided by the School Board Visitors and others were subsequently used to classify households on a street-by-street basis. The purpose of the classification system was to provide "a statistical record of impressions of degrees

of poverty" (Hennock, 1991, p. 190) and households were classified by their conditions of poverty. An innovative feature of Booth's work was the plotting of these classifications by household onto maps, the most important of these being the 'Descriptive Map of London Poverty' (Reader, 1984). This map shows the streets of inner London—from Pentonville prison in the North, Millwall docks to the East, Stockwell smallpox hospital to the south and Kensington palace to the West—building by building coloured to correspond to one of seven categories reflecting the condition of poverty of the resident household described in Table 1.

When households of different classes inhabited the same building, the building was divided and plotted the corresponding colours. This was quite common in both poor districts, where the poorest families often inhabited the basements, and affluent districts, where wealthy households employed live-in servants (i.e. the 'upstairs-downstairs' household structure). This map is only one of several that Booth and his team produced, illustrating in detail the social geography of late Victorian London. With the exception of the last class (Black), which is a description of a lifestyle (Hennock, 1991), Booth's classification of households reflects "their apparent status as to means" (Booth, 1889, p. 24). It is this system of classification that Booth is most commonly remembered, and his classification remained for a long time a convenient set of terms in social description (Gillie, 1996). In fact, as it will now be explained, it is still used today in an altered but recognisable form in the UK census of population statistics.

The measurement of social class

The Registrar General's social class scheme based upon five categories of occupation used in the 1991 census of population is similar to Booth's scheme. Indeed, the former was in part derived from Booth's work (Szreter, 1984). This is only to be expected. As a

Table 1
Booth's classification used on the descriptive map of poverty

Code	Colour	Booth's description
A	Yellow	Wealthy; upper middle and upper classes
B	Red	Well to do; middle class
C	Pink	Fairly comfortable; good ordinary earnings
D	Purple	Mixed; some comfortable, others poor
E	Light blue	Poor; 18–21 shillings a week for a moderate family
F	Blue	Very poor; casual labour, chronic want
G	Black	Lowest class; vicious, semi-criminal

result of working on the Inquiry, researchers on the team gained prominent positions within government departments, particularly those associated with the collection of social and economic statistics (Bales, 1996). Furthermore, as a result of his work on the poverty survey Booth urged the Registrar General to include “some simple facts by which the position and manner of life of each family could be measured” (O’Day and Englander, 1993, p. 14), and these subsequently appeared in the 1891 census. Hence there is historically a strong link between Booth’s Inquiry and subsequent government social surveys. This link and the similarity between the two schemes makes it possible to derive a hybrid which can be used as the basis for comparison between these two time periods. Table 2 shows how these two classifications fit together, with the bottom three Booth social class categories becoming aggregated into a single category and this being assigned to the Registrar General’s social class V. The remaining four Booth categories are then equivalent to the remaining four Registrar General classes. Hence, Booth’s ‘wealthy’ class is assigned to Registrar General I; ‘Well to do’ class to Registrar General II and so on.

Digitising Booth’s map and deriving measures of poverty

Booth’s Descriptive Map of London Poverty was used as a basis to form an empirical measure of poverty in late 19th century London. The aim was to extract information on the location of each individual household on the map and Booth’s classification of that household with respect to its social class position. The maps were digitised using a tablet digitiser as opposed to a scanner. There were several reasons for choosing this method, most of them pragmatic relating to the

resources available and the subsequent use of the digitised data. Accurate scanning requires access to sophisticated hardware and also involves image rectification, edge matching and image processing to extract the necessary information from the scanned image. For instance, to measure the proportions of households of each social class living in a specified area, the image would require extensive analysis to extract the number of households represented by each colour. This will also require a method of identifying the edges of individual buildings in the scanned image so that different households classified by the same colour in a continuous block of buildings can be enumerated separately. Hence it was decided that it would be easier, efficient and possibly more accurate to digitise the map manually, entering each household on the map as a point, whilst simultaneously attaching the Booth social class code. If a building contained households of different classes, indicated by the building being coded by two different colours, each class was digitised separately. In total, 120,000 points were digitised and the GIS was subsequently georeferenced to the OS National Grid using features on the Booth map that could be identified on current OS maps (e.g. railway bridges).

The GIS was randomly sampled and compared to the Booth map to ascertain any errors in data input. It was found that the digitised map contained very few errors, and those that were discovered were insignificant and corrected. Fig. 1 illustrates the digitised version of Booth’s map. This gives a good impression of the geography of social class in late Victorian London, with yellow (wealthy) households in the West End and black and blue houses (poor) dominating the East End and the area immediately south of the River Thames (Southwark and Bermondsey). Wealthy households also occupy the suburban edges. The white area in the centre

Table 2
Booth’s classes (1896) and Registrar General’s classes (1991)

Booth class	Percentage of households in 1896	Registrar General class	Percentage of households in 1991 ^a	1896 SEP indicator	1991 SEP indicator
Yellow	8.4	I	9.2	0.042	0.046
Red	27.7	II	37.3	0.223	0.278
Pink	35.2	III	33.8	0.537	0.634
Purple	16.2	IV	12.8	0.794	0.867
Light blue	7.4				
Blue	3.7	V	6.9	0.937	0.965
Black	1.5				

^a Excludes households with no social class allocation in the 1991 census (those described as in the army, inadequately described, and others without a social class). Registrar General class V includes people of working age who have not worked in the last 10 years.

Socioeconomic position (SEP) indicators are cumulative proportions of households in each social class, weighted by the relative position of the class in the social hierarchy of the time and summing the weighted proportions. For class I the proportion of households is $(I/2)/(I + II + III + IV + V)$; for class II, $(I + II/2)/(I + II + III + IV + V)$; for class III, $(I + II + III/2)/(I + II + III + IV + V)$; for class IV, $(I + II + III + IV/2)/(I + II + III + IV + V)$; for class V, $(I + II + III + IV + V/2)/(I + II + III + IV + V)$.



Fig. 1. GIS of Booth's 1896 poverty map.

of the map represents the City of London that Booth and his team did not survey. The contemporary road network has been overlain to act as a reference and to demonstrate how affluent households border the principal thoroughfares out of the city, even in the East End.

Data was then extracted from the 1991 UK census of population relating to the classification of occupation for the same area that Booth surveyed. Since occupation is contained in the 10% sample of population, this information was obtained at ward level to prevent problems associated with small sample sizes that may occur at Enumeration District level. The Booth social class data was then aggregated to 1991 ward boundaries using GIS techniques. Point-in-Polygon overlay was used to assign each Booth household to a ward and then the total number of households in each social class was calculated for the ward. Booth's survey area included 104 complete wards and the majority of the 28 wards that are located around its edge. The proportions of each social class within a ward were then calculated following the hybrid classification scheme in Table 2. Two ward level indexes of relative poverty were then derived from Booth's survey and the 1991 UK census survey. Each index was calculated by computing the proportion of households in each social class, weighting that proportion by the relative position of the class in

the social hierarchy of the time, and summing the weighted proportions. The index of poverty thus assumes that social class is a proxy for poverty and that the extent of poverty in a class is related to its position within the class hierarchy. The extent of poverty within a class has thus been estimated using the number of people in higher social classes. The index for a particular ward is:

Ward Poverty Index

$$= \frac{(I wI + II wII + III wIII + IV wIV + V wV)}{(I + II + III + IV + V)},$$

where I is the number of households in class I in the ward and wI is the socioeconomic position (SEP) indicator associated with that class shown in Table 2. The formulas to calculate the SEP indicators are given in the footnote to Table 2, but basically the SEP indicator relates to the proportion of the population in the entire study area that is at a higher socioeconomic level than the midpoint of the group and hence they are cumulative proportions. The use of such indicators takes into account the fact that the distributions of socioeconomic groups in 1896 and 1991 were different, and have been widely used in inequalities in health research (e.g. Davey Smith et al., 1998a; Pamuk, 1985). The index is low in areas where large numbers of the resident households

were in more affluent social classes and high in areas where they were in less affluent social classes.

In addition, all deaths that took place within the surveyed area between 1991 and 1995 were identified and assigned to the same wards. Standardised mortality ratios (SMRs) for major causes of death strongly related to material circumstances were calculated for each ward for all ages, for deaths under age 65 and for deaths over age 65. SMRs for deaths from stomach cancer and stroke were also calculated since these are strongly related to conditions of poverty in childhood (Davey Smith et al., 1998b) and thus may have a stronger association with the geography of poverty in the past. Simple weighted and partial correlation analysis was used to estimate the contribution of the indices of poverty from 1896 and 1991 in predicting ward level SMR in the early 1990s. Partial correlation analysis was utilised to ascertain the extent to which predictive power was duplicate between the indices. All the analyses were carried out in SPSS and ESRI's ARC/INFO GIS.

The changing geography of London's social class

Table 2 and Fig. 2 both summarise the proportion of households in each of Booth's social class categories. The greatest percentage of households (nearly two thirds) represents the burgeoning middle-classes (pink

and red). People in poverty (Black through to purple) represent 29% of the households, whilst the wealthy almost 10%.

These figures bode well with Booth's own findings of 30% of London's population in poverty, reflecting the accuracy of the digitising. Table 2 also summarises the percentage of households in 1991 in each of the Registrar General's class categories. Fig. 2 illustrates the differences between the percentages of people in each of the different classes. The first the thing to note is that, although 100 years has passed, there is generally very little difference in the social make-up of Inner London. Despite a 100 years of social policy initiatives, two world wars and the creation of a welfare state the social structure of inner London has remained remarkably stable. The main changes that have occurred have been the continued growth of the middle classes and the decline in the working classes. There are slightly more wealthy people in inner London than a 100 years ago, whilst the equivalent of those that Booth would have described as poor has decline by 10%.

Comparing geographies of poverty

Table 3 illustrates how the geographical mixing of social class has changed since 1896 and how much more homogeneous the city has become with respect to the incidence of poverty. The difference between the richest and poorest wards, as measured by the poverty index, has decreased by just over 40%. However, a significant proportion of this decrease has been a result of a marked decline in the SEP of the richest wards rather than a marked increase in the SEP of the poorest wards (the SEP of the richest ward has decreased by 0.189 whereas the SEP of the poorest ward has increased by 0.088). Hence the average ward has got slightly poorer although the overall differences in poverty between the wards have got smaller (shown by the smaller standard deviation for the 1991 wards). This suggests that areas in London have generally converged with respect to their social economic position over the last 100 years, with less number of areas classed as either very rich or very poor and with a corresponding growth in middle-income areas.

It is important to examine the ward level changes in the geography of poverty in London. Fig. 3 is a map of

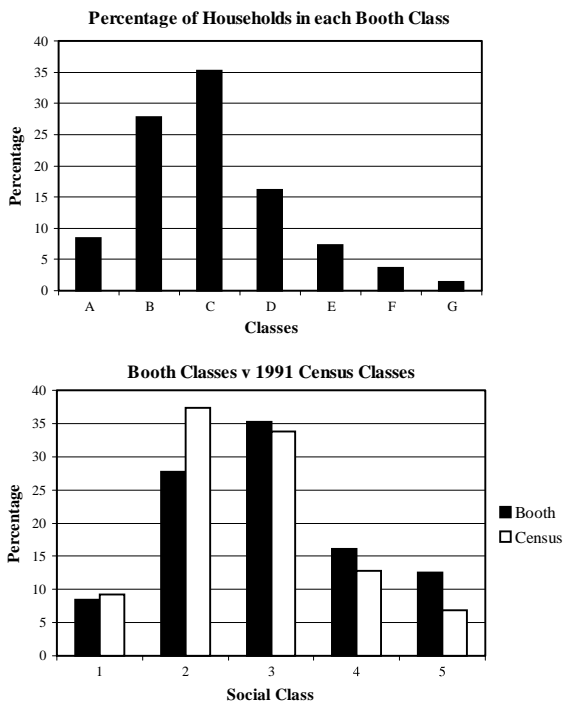


Fig. 2. Comparison of social class in 1896 and 1991.

Table 3
Statistical summaries of the poverty indexes

	Richest ward	Poorest ward	Median ward	Standard deviation
1896	0.118	0.781	0.497	0.158
1991	0.307	0.693	0.518	0.095

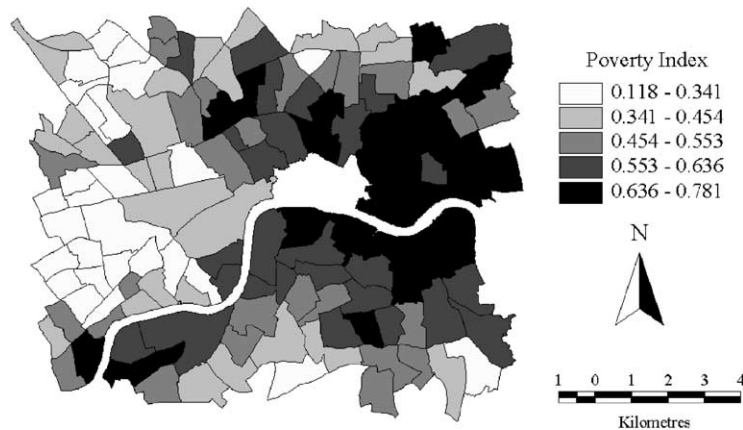


Fig. 3. Distribution of relative poverty in inner London in 1896 by 1991 census wards.

the distribution of relative poverty of inner London in 1896 plotted by 1991 wards. This shows clearly the east–west split demonstrated in Booth’s digitised map. The West End of London is characterised by rich wards, the richest being Fitzjohns, with 80% of households being described by Booth as ‘wealthy’ (yellow), the next Courtfield (65% yellow) and then Belsize (50% yellow). None of these wards have people described by Booth as being poor. Very few wards in the West End have people living in poverty, the principal exception being Church Street ward in Marylebone and a cluster of wards bordering the River Thames (Sands End). The map also clearly shows the extent of poverty in the East End and the area bordering the Thames south of the river. These were the areas that Booth was initially interested in when he undertook the poverty survey and form the focus of the first volume of his series of books. There are a few pockets of affluence north of the East End towards Hackney and the suburbs south of the River Thames such as South Lambeth, Camberwell, Lewisham and Nunhead but generally the areas outside the West End are characterised by the lower-middle classes, working classes and the poor.

Fig. 4 shows the distribution of poverty as measured by the 1991 index. It is clear how little the West End has changed and in fact, has increased the relative concentration of rich wards, particularly towards the River Thames. However, those wards that were relatively poor in the West End in 1896 are still relatively poor in 1991, particularly to the north (e.g. Church Street, Harrow Road, Priory and Kilburn wards). The East End has experienced a general decrease in the number of poor wards, with the poorest wards concentrated in Bow, Bromley, Mile End and Whitechapel. The wards to the south of the River Thames have become generally poorer, with the exception of the old industrial areas bordering the river that have experienced extensive regeneration. However the two maps shows that there

has been little overall change in the distribution of poverty in inner London between the 19th and 20th centuries. This is demonstrated by the correlation coefficient between the two poverty measures of 0.73 (significant at the 1% level).

To understand the changes in the geography of poverty, standard deviation changes in the poverty index between 1896 and 1991 were mapped for each ward—Fig. 5. These were calculated by taking the 1991 score from the 1896 score and dividing the result by the standard deviation of the 1896 score. Again, it clearly shows the east–west split, with West End wards becoming relatively poorer and East End wards becoming relatively richer. This supports the earlier findings that areas in London have become more alike with respect to their standards of living over the last 100 years. It highlights the importance of regeneration along the area bordering the River Thames and the increase in poverty in wards south of the river.

A more detailed description of changes in ward level poverty may be gained by examining how wards have changed their relative positions in a ranking from rich to poor. Table 4 compares quartiles of wards based on 1896 and 1991 measures of poverty, one being the richest quartile and four being the poorest quartile.

It can be seen that almost half of the wards (46%) have not changed their relative position with respect to poverty between 1896 and 1991 (the middle diagonal). The greatest shifts in relative positions occurred in the middle quartiles with very little changes at the two extremes, particularly with wards that were in the richest quartile in 1896. The table shows that three-quarters of these wards have maintained their premier position in the social hierarchy throughout the 100-year period. This compares to the wards in the poorest quartile of which just under half (45%) moved up to a richer quartile in 1991.



Fig. 4. Distribution of relative poverty in inner London in 1991 by 1991 census wards.

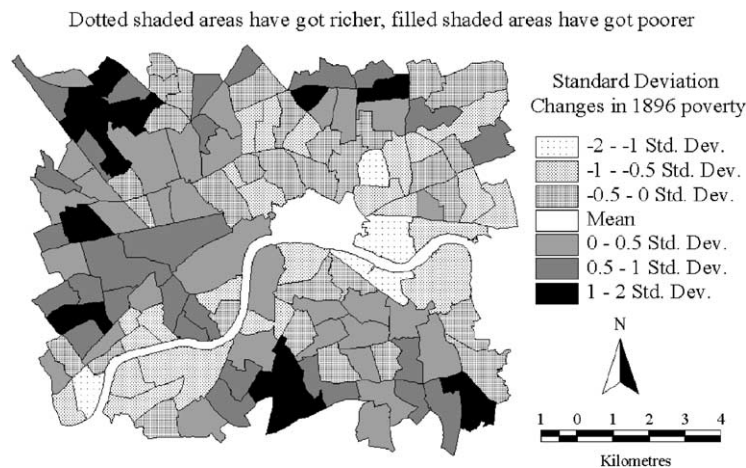


Fig. 5. Changes of relative poverty between 1896 and 1991.

Table 4
A comparison of the 1896 and 1991 ward level poverty indexes by quartiles

	1991 Rich 1	1991 Rich 2	1991 Poor 3	1991 Poor 4	
1896 Rich 1	25 (76%)	5 (15%)	2 (6%)	1 (3%)	33
1896 Rich 2	6 (18%)	11 (33%)	14 (42%)	2 (6%)	33
1896 Poor 3	2 (6%)	12 (36%)	7 (21%)	12 (36%)	33
1896 Poor 4	0 (0%)	5 (15%)	10 (30%)	18 (55%)	33
	33	33	33	33	132

Fig. 6 shows a summary of Table 4. Here, wards have been classified as ‘rich’ if they occupy the first two quartiles (1 and 2) and as ‘poor’ if they occupy the last two quartiles (3 and 4) for both time periods. The map only shows the wards that have had a change in SEP of more than half a standard deviation in order to

emphasize wards that have experienced a significant change in their relative position. The map thus highlights those wards that have changed from ‘rich’ to ‘poor’ (rich-poor in the legend) or ‘poor’ to ‘rich’ (poor-rich in the legend) between 1896 and 1991. This demonstrates that, although wards have become more alike in terms of their social economic mix between 1896 and 1991, East End wards continue to be poor (poor in 1896 and 1991) and West End wards rich (rich in 1896 and 1991). Areas in which some groups of immigrants have settled since the Booth Inquiry have moved down the social scale, notably in south London where some wards have gone from rich to poor. The intense regeneration of the docks can be seen in the wards bordering the Thames. Interestingly the gentrification of the wards neighbouring Islington can be detected as having noticeably made the transition from poor to rich between the two time periods. However, overall, rich areas have remained rich and poor areas have remained poor.

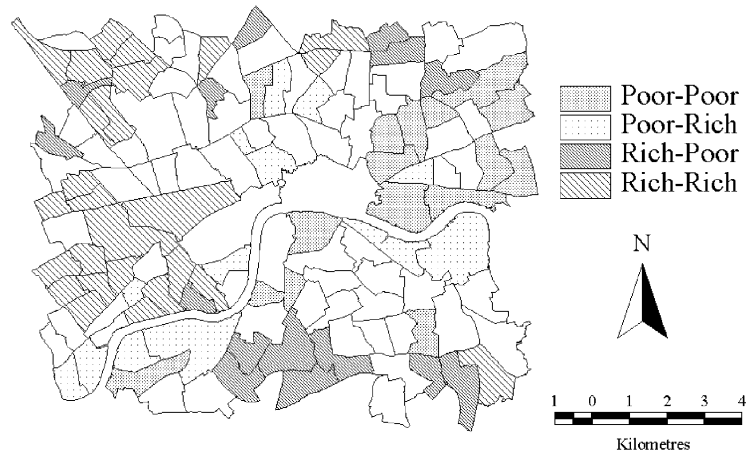


Fig. 6. Changes in rich and poor areas with more than 0.5 standard deviation difference in poverty between 1896–1991.



Fig. 7. Standardised mortality ratio for deaths from all causes.

Changing social structure and the effects upon health

Fig. 7 shows the map of all age standard mortality ratios, showing all cause mortality, and demonstrates the close relation between poverty and mortality. The standard mortality ratios are much higher in the poorer areas of east and south London and lower in the wealthy areas of west London. Table 5 shows the simple and partial correlations between the poverty measures and the standardised mortality ratios. Both indices of poverty were related to all cause ratios, with the partial correlation coefficients in the table showing that the 1896 poverty index contributed more to predicting deaths from stroke and stomach cancer in the late 20th century than that derived from the 1991 census. For other causes of death, the modern index contributed more.

The results of further correlation analyses suggest that for deaths under the age of 65 the 1991 index makes a slightly greater contribution to predicting all cause

mortality ($r = 0.56$, significant at the 1% level) than does the 1896 index ($r = 0.46$, significant at the 1% level). When only deaths at ages greater than 65 are considered however, both indices make a similar contribution to the model; the correlation coefficients are $r = 0.56$ (significant at the 1% level) and $r = 0.57$ (significant at the 1% level) respectively. The fact that the 1896 poverty index performs so strongly as a predictor of mortality is perhaps partly because the median age of death of the people dying in the period 1991–5 is approximately 78. This means that, while very few would have been alive at the time of the Booth Inquiry, almost half would have been born before 1915. The majority of these individuals, however, will have migrated in the intervening period. Hence the predictive power of the 1896 poverty index is more of an illustration of how the nature and social hierarchy of different areas of London has remained stable despite constant changeover of the resident individuals.

Table 5
Correlations between poverty in 1896 and 1991 and standardised mortality ratios for all ages for death in 1991–1995

	Simple correlation 1896	Partial correlation 1896	Simple correlation 1991	Partial correlation 1991
All causes	0.56	0.22	0.60	0.35
Coronary heart disease	0.58	0.21	0.65	0.41
Stroke	0.40	0.22	0.36	0.11 ^a
All cardiovascular disease	0.56	0.20	0.61	0.37
Chronic obstructive pulmonary disease	0.58	0.24	0.61	0.35
Pneumonia	0.26	0.07 ^a	0.30	0.17
Lung cancer	0.61	0.30	0.62	0.33
Stomach cancer	0.49	0.24	0.47	0.20

^aInsignificant at 5% level.

Migration maintains the social hierarchy because the people coming into a poor area are like those already there. Similarly only the affluent can afford to live in rich areas. Hence the processes associated with London's housing market and the maintenance of differential housing values across the city help steer patterns of migration and structure the incidence of poverty. Hence the social divide between areas is constantly reinvigorated by the migration of people making decisions about where they want to live and their willingness to spend to maintain the status quo. Moreover, the ambitious housing programmes of the 20th century have failed to substantially alter the geography of poverty since there have been no large scale policies for the integration of rich and poor people. Indeed, efforts to integrate social housing in traditional owner occupied areas have often met with fierce opposition. Slum clearance simply replaced poor housing with better housing. It did not necessarily change the circumstances of the people who moved out of the old housing and into the new developments. In addition, many of the new housing projects have subsequently become as run down and neglected as the slum housing they replaced, exacerbating the existing divide between rich and poor areas. Finally, although the results have identified the 'Islington effect', this is actually very uncommon in other London neighbourhoods. As has been demonstrated in Table 4, most places have either remained in the same relative position in the social hierarchy or have only experienced a slight shift. Wholesale shifts of neighbourhoods within the social hierarchy are a rare occurrence.

Conclusion

Charles Booth's Inquiry provides a unique source of information pertaining to the social and economic structures of Victorian London. However, very few

social scientists have taken advantage of this resource, particularly the Charles Booth archive that remains relatively unexplored. This may change with an online guide to the papers of Charles Booth (<http://booth.lse.ac.uk>), compiled by the London School of Economics (LSE), becoming live in April 2001 (GeoEurope, 2001). The website consists of twelve scanned searchable maps depicting social status of households for the whole of the county of London, linked to 31 scanned notebooks relating to information compiled on walks accompanied by policeman collected during the investigation into social influences between 1897 and 1903. The on-line site will also allow access to a detailed on-line catalogue of the Booth archives held at LSE describing the original notebooks used in the Inquiry, an on-line catalogue of the Booth archives at the University of London Library, covering correspondence and Booth family materials and a digital version of the Booth family magazine 'The Colony'.

The intention is to allow the Booth Archive to be available more generally for research purposes. Bales (1991) has argued that "further attention to, and analysis of, Booth's work is warranted because of what it holds for modern social scientists" (p. 99). This has been demonstrated in this paper. The construction of an historical GIS of Charles Booth's poverty map has allowed a unique comparison of social and economic changes in London across 100 years with the principal outcome being that despite an overall rise in the standard of living, the social hierarchy of areas of London has not significantly changed.

An index of poverty derived using the GIS has shown that social and economic conditions in London 100 years ago is a strong predictor of present day mortality. Since almost everyone who was surveyed during the Inquiry will have died or left London by this time, this strong association suggests that either the higher mortality rates of present day poor areas is a result of the continuous migration of individuals at a relatively

higher risk of mortality or to some accumulative mortality risk raising the effects of day to day life in the area. Since the 1896 poverty index (in comparison to the 1991 poverty index) is related more strongly to causes of death that have previously been shown to be sensitive to deprivation in early life, such as stroke and stomach cancer (Davey Smith et al., 1998b; Leon and Davey Smith, 2000), then to some degree it is reasonable to argue that the ecological associations with past and present deprivation levels of areas do reflect the individual level associations of deprivation that people encounter at different stages of their life.

References

- Bales, K., 1991. Charles Booth's survey of Life and Labour of the People in London 1889–1903, In: Bulmer, M., Bales, K., Kish Sklar, K. (Eds.), *The Social Survey in Historical Perspective, 1880–1940*. Cambridge University Press, Cambridge, pp. 66–110.
- Bales, K., 1996. Lives and labours in the emergence of organised research, 1886–1907. *Journal of Historical Sociology* 9 (2), 113–138.
- Booth, C., 1889. *Life and Labour of the people. First Series (i) East, Central and South London*. Macmillan, London (republished 1969).
- Davey Smith, G., Hart, C., Hole, D., Mackinnon, P., Gillis, C., 1998a. Education and occupation social class: which is the more important indicator of mortality risk? *Journal of Community Health* 52, 153–160.
- Davey Smith, G., Hart, C., Blane, D., Hole, D., 1998b. Adverse socioeconomic conditions in childhood and cause specific adult mortality: prospective observational study. *British Medical Journal* 316, 1631–1635.
- GeoEurope, 2001. Charles Booth's Notebooks revisited. *GeoEurope* April 2001, pp. 19.
- Gillie, A., 1996. The origin of the poverty line. *Economic History Review* 49.7, 715–730.
- Gregory, I., Southall, H., 1998. Putting the past in its place: the great Britain historical GIS. In: Carver, S. (Ed.), *Innovations in GIS 5*. Taylor and Francis, London, pp. 210–221.
- Hennock, E.P., 1991. Concepts of poverty in the British social surveys from Charles Booth to Arthur Bowley. In: Bulmer, M., Bales, K., Kish Sklar, K. (Eds.), *The Social Survey in Historical Perspective, 1880–1940*. Cambridge University Press, Cambridge, pp. 189–216.
- Knowles, A.K., 2000. Historical GIS: the spatial turn in social history—introduction. *Social Science History* 24 (3), 451–470.
- Leon, D., Davey Smith, G., 2000. Infant mortality, stomach cancer, stroke and coronary heart disease: ecological analysis. *British Medical Journal* 320, 1705–1706.
- O'Day, R., Englander, D., 1993. *Mr Charles Booth's Inquiry: Life and Labour of the People in London Reconsidered*. The Hambledon Press, London.
- Pamuk, E.R., 1985. Social class inequality in mortality from 1921 to 1972 in England and Wales. *Population Studies* 39, 17–31.
- Reader, D.A., 1984. Charles Booth's Descriptive Map of London Poverty 1898. *London Topographical Society, London, 1984 (Publication No 130)*.
- Szreter, S.R.S., 1984. The genesis of the registrar-general's social classification of occupations. *British Journal of Sociology* 35, 522–546.