Chapter 8
Urban Scrawl: Reconstructing Urban Landscapes Using Documentary Sources

Eleanor Ramsey

Abstract Whilst many heritage projects utilise new technologies for the creation and analysis of novel digital datasets, these projects require the object or landscape under study to currently exist. For urban landscapes that are no longer extant, however, there is a large amount of data in a non-digital format that can potentially be mined to reconstruct in detail those areas which are now physically beyond the reach of archaeologists. This chapter aims to show that by including documentary sources such as census returns and trade directories in a suitable digital format, technologies such as GIS can be used to facilitate access to this data, and also provide a way of analysing, understanding and visualising the information held within them in many novel ways. The period studied here, nineteenth century Britain, was a time of intense change, especially in terms of the booming population and industrial output and, as a consequence of the continued development of urban areas, the archaeology and built environment of this period is under considerable threat. Trade directories, census returns and GIS have all been used in historic and archaeological research period before, however, previous research tends to focus on specific industries or aggregate the data at a large scale. This chapter demonstrates that aggregation of data at street or suburb level provides a much finer level of detail and enables novel insights regarding the spatial distribution of buildings, population and trades, and furthermore enables new maps to be created that allow changes to these attributes to be mapped and analysed.

Keywords GIS · Urban landscapes · Nineteenth century · Trade directories · Census

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8.1 Introduction

The application of new spatial and visualisation technologies is now standard within many heritage projects and their use has resulted in the creation and analysis of novel digital datasets. It is true, however, that many of these projects actually represent extant physical structures, landscapes or directly linked proxy data such as that provided through remote sensing. This situation is not always true within urban landscapes. Urban landscapes may often be modified beyond recognition as the historic cores of towns are transformed into modern city centres. In some cases, the transition may be so dramatic as to break the link with past urban structures completely. Given that the development of urban structures is amongst the most important research themes within geographic or historic studies (Reader 2004), there is a clear requirement that we seek alternative routes to understanding the development of these complex entities. We are fortunate, therefore, that there is a large amount of data in a non-digital format that can potentially be mined to reconstruct, in detail, those areas which are now physically beyond the reach of archaeologists, geographers and historians. This research demonstrates that converting the information contained within documentary sources such as census returns and trade directories into a suitable digital format, allows technologies such as GIS to access the data, and provide a way of analysing, understanding and visualising the information held within them in many novel ways.

A suitable example of such a process can be provided through the study of Britain in the nineteenth century. This was a time of enormous national change, both physically and socially, and especially within industrial and urban areas. It has long been understood that the archaeological and built remains of this period are vulnerable, especially in urban areas marked for redevelopment. They are a fragile and finite archaeological resource, and while the relative importance of individual sites is perhaps only of local or national importance, aggregate data for these larger urban landscapes can be of international importance in understanding the nature and impact of urban change over time. Indeed, English Heritage state *In a globalised world it is all to easy to forget that England was the cradle of modern industry. The monuments to our extraordinary industrial past are all around us—but they are fragile and we neglect them at our peril* (English Heritage 2011).

The significance of the remains of this defining period is increasingly being acknowledged (ibid.). Individual monuments and industrial landscapes such as Ironbridge Gorge, Saltaire and Blaenavon are now UNESCO World Heritage Sites. However, much of the urban industrial landscape of the nineteenth century was not as impressive as these designated areas and has not attracted similar appreciation or protection. Indeed the Victorian terraces, courts and back-to-backs that had been constructed as housing for the new urban population, and the small-scale industrial buildings in which they worked, had deteriorated by the early twentieth century to the point they were considered slums, and the Housing Act of 1930 encouraged their clearance. However, these landscapes of the working class are also an important part of our industrial past. The West Midlands Regional

Research Framework identified several themes pertinent to this research (WMRRF 2003). These included the importance of studying both change and continuity during this period, as well as consideration of how to best use the abundance of documentary evidence to enhance the archaeological record.

While documentation of this period is quite extensive, both through records and maps, the majority of previous research using these resources is directed at individual people or specific industries (for example Knowles and Healey 2006). Likewise, although the use of GIS in historical and archaeological research is now well established, most recent or current studies involve the study of areas and aggregate data at a scale too great to be of use for detailed analysis of smaller areas (for example Raven and Hooley 2005).

This research focuses on the use of GIS and documentary sources to map, analyse and understand urban and industrial change in nineteenth century Dudley (Fig. 8.1), an area that saw considerable transformation throughout this important and dynamic period in history (DMBC 2004).

The study was carried out in order to create a holistic dataset that could map all of the data recorded in these sources, both spatially and temporally, at street and suburb level. By converting the information held in documentary sources into a digital resource, it would be possible to map the nature and evolution of the urban environment in detail, and in ways that had not previously been possible. In particular, using GIS-allowed elements of the urban landscape, such as the density of population, changes in number of buildings, range of trades and industries

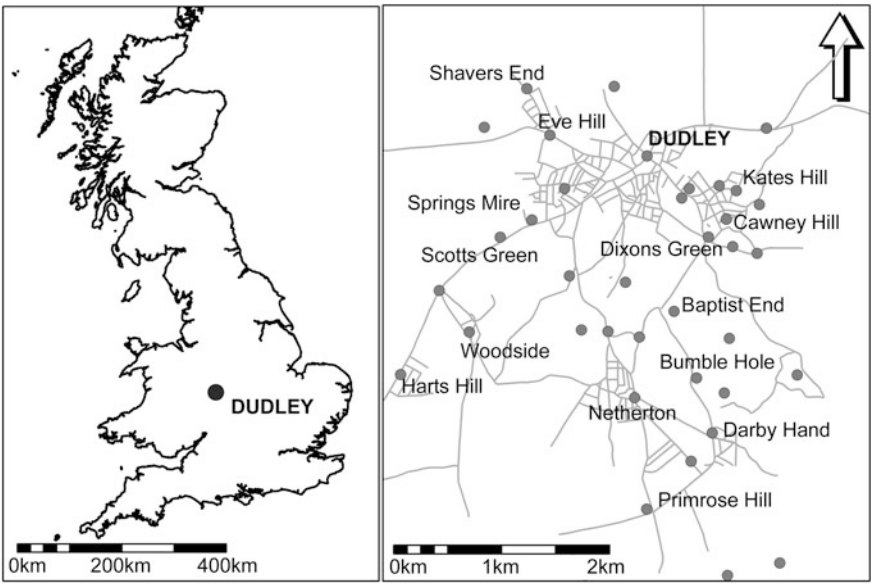

Fig. 8.1 Location of Dudley; streets and suburbs used in the research

present in any particular street or suburb and distribution of all specific industries to be mapped. Furthermore, this data could be used as a dataset that contextualises current repositories such as the Historic Environment Record (HER) and Black Country Historic Landscape Characterisation (BCHLC—Quigley 2009, 2010).

8.2 Methodology

In order to digitise as many streets and suburbs as possible, the Ordnance Survey 1st edition was used to rectify the earlier historic mapping, and these, along with the documentary sources were used to identify as many streets as possible. During this process, a central line was created for each street identified, and a point shapefile was created for the suburbs, denoting the approximate centre point of each individually named 'place'. Where these names changed overtime, the latest name was used.

The Trade Directories chosen for the analysis were those that were available online at www.historicaldirectories.org, and which were determined to be the most appropriate in terms of their accuracy and compatibility. Additionally, the Pigot Smith directory of 1860 was input, although this was not available online. This provided a relatively even temporal distribution of the datasets (1828, 1835, 1842, 1851, 1860, 1876). The initial trade directory database had the fields: Directory date, directory name, title, first name, surname, trade or occupation, address (number or name), address (street) and address (suburb). Where multiple names were recorded in the directory as one entry, such as Addenbrook and Cook, or Bloomer, Benjamin and Son, these were treated as one entry. The reasoning behind this decision was that the 'industry present in street' was the key data, not the person or persons involved. Where the same person or business was listed at two separate addresses, the entry was duplicated for each address for similar reasons.

The data was then manually cleaned and standardised. The trades and occupations were classified using the Booth-Armstrong industrial classification system, developed by Charles Booth at the end of the nineteenth century and published by W. A. Armstrong in 1972 (Armstrong 1972). This classification system for occupations comprises a hierarchical approach, by which 10 broader categories are further subdivided. The final database contained the additional fields Revised Street, Revised Suburb, New Trade Name, Simple Category (such as Dealing (D), Manufacturing (MF) etc.) and New Category (MF4 (Iron and Steel), MF6 (Gold and Silver) etc.). Information from the censuses from 1841, 1851, 1861 and 1871 were also inputted into a database. The initial census database contained the fields Census Date, Census Number, Sheet Number, Address (street/suburb) name, Houses inhabited, Houses uninhabited, Males and Females. This data was manually cleaned and standardised, with the final database containing additional fields Revised Street Name and Suburb.

The data in the two databases was then cross-tabulated at the Revised Street and Revised Suburb level to give a numeric value (count) of various attributes. Further attributes were calculated from these including ratios between the counts, and changes between the values for each consecutive year of the sources. In order to map the data, the new attribute databases were then joined to shapefiles using standardised fields.

It should be stressed that not all streets on the maps were able to be named, and not all addresses in the documentary sources were able to be mapped. Where there was correlation, however, the shapefiles and tables could be joined in ArcGIS using the unique streets and suburb names, giving each street and suburb a series of attributes regarding number of houses, individuals and trades present in each recorded year.

A series of maps was then produced that symbolised these attributes, and which were analysed, specifically to look for spatial components of character and changes in that character through time.

These results were then used to demonstrate how the results can enhance and contextualise previous research and sources of data. A particular street (Wolverhampton Street) was used, in order to demonstrate how the results can be used to enhance currently available datasets.

8.3 Background

Dudley is an English town situated in the heart of what is known as the Black Country, an area comprising a network of industrial towns to the north and west of Birmingham, centred on the South Staffordshire Coalfield. The term was coined in the nineteenth century and is presumed to be a reference to the industrial grime of the area, and today includes four Local Authorities; Wolverhampton, Walsall, Sandwell and Dudley (Quigley 2009, 2010). For the purposes of the research, the boundaries of Dudley and its suburbs were defined by addresses in the census returns and trade directories that had been recorded as Dudley etc., rather than any official boundary (Fig. 8.1). Historic mapping can be used to illustrate the origin and growth of the town; however, as the landscape continued to evolve after this period, much of the original landscape is lost to us now (Fig. 8.2).

Dudley was chosen as a study area for a number of reasons. While the town has a unique and important history of its own dating back to the medieval period, it is also representative of many of the industrial towns in the nineteenth century Black Country as a whole. This suggests that any successful methodologies developed could theoretically be applied to towns elsewhere in the region, and indeed other industrial areas within Britain as a whole. The size of Dudley was also an important factor. Due to the nature of the research, a town or area was needed that was substantial enough for the trade directories and census to list people by street (as opposed to smaller towns and areas which only listed by area), and not so large

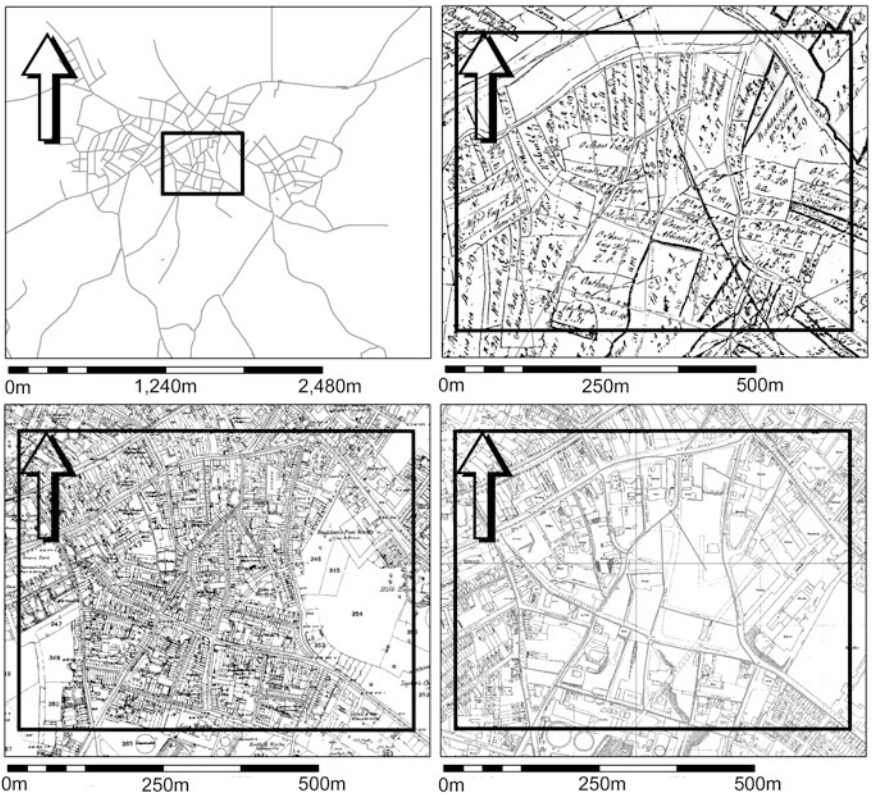

Fig. 8.2 Outline of streets; detailed maps of 1776; Ordnance Survey 1:2500 1890s; Ordnance Survey 1:2500 1960s

(such as Wolverhampton or Birmingham) as to make it impossible to input all relevant data.

Dudley has a relatively comprehensive map sequence that covers the period under investigation. The earliest map used was from 1776, and while this map only shows Dudley itself as a solid block, it depicts the field systems surrounding the populated area, the pattern of which had a significant influence on the development of the later town. The next available maps are Treasure's map of 1835 and an anonymous map of 1836. The former is quite stylised, but does name many of the streets within the town centre, and the latter annotates many of the suburbs and areas that ringed the town. Richard's map of 1865 was also used, as were British Ordnance Survey 1st Editions from the end of the nineteenth century.

While many documentary sources from this period are available, the research focused on the census and trade directories. These two disparate datasets were used to gather data about population, buildings, and industry.

The earliest British trade directories (Fig. 8.3) were published at the end of the seventeenth century, although they became more widespread in the eighteenth

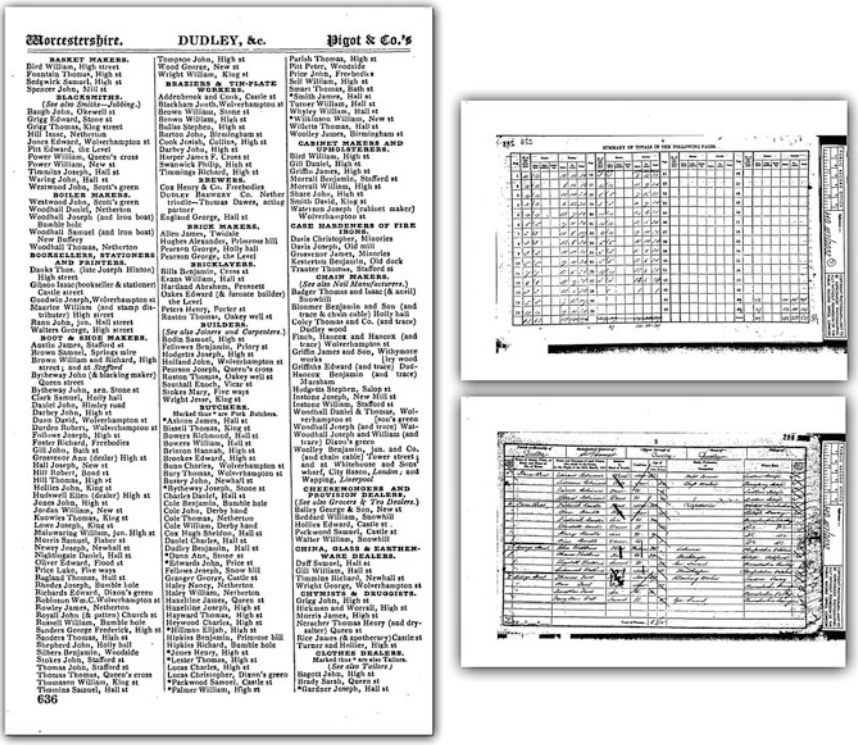

Fig. 8.3 Sample page from a trade directory; sample pages from the census

century, and grew in number substantially in the nineteenth century. They evolved in tandem with the growth of trade and commerce, with the earliest directories merely listing traders and their addresses, with later directories including additional information such as postal systems, private residents and municipal buildings (Shaw 1982).

Publishing trade directories was a commercial concern, which in some ways strengthens their viability as a resource, but in some ways introduces bias in what was recorded. They do not record the employment or profession of every individual, instead focusing on those who had a certain level of 'importance'. Previous assessments that compared the number of entries between the trade directories and census data have concluded there are significant omissions, both in the types of trades listed, and the location of where those trades were taking place, with central streets recorded more comprehensively than side streets and suburbs (Page 1974). However, individuals with similar trades were grouped together under specific headings, which adds a level of categorisation to the data. The trade directories vary by publisher, and some publishers were more comprehensive than others. While this limited the number of trade directories that could be used in analysis,

consecutive directories by the same publisher were acknowledged to be useful for comparing changes over time.

It should be noted that alternative datasets concerning the trades and industries of towns and regions are essentially unavailable. Despite requirements for national census enumerators to note whether an individual employed others, and the numbers, this requirement was only fulfilled on a piecemeal basis (Crompton 1998). Similarly, the recording of an individual's profession was also less than accurate in the census. The rate books only focus on particular types of data, and for properties over a certain value, leaving working class areas systematically under-represented in these records (Raven 1997).

As such, the information in trade directories, despite inherent bias and inaccuracies, has relative strength and value when researching subjects including the development of industry, trade and retail, but it should be accepted that it does not have the same value when socio-demographic subjects are the subject of study.

In contrast, the objectives of the national census (Fig. 8.3) were to accurately and comprehensively record data on all persons, houses and occupations. The methodology devised for the 1841 census was used throughout the century. In order to ensure accuracy of the data collected, avoiding omissions or double counting, it was decided that the census should be conducted at the same time, everywhere and preferably within a timescale of 1 day. The registration districts identified for the earlier censuses were subdivided into Enumeration Districts, and were limited in size by the number of houses they contained, or the distance between them in sparsely populated areas. 35,000 enumerators were required to cover the whole of England and Wales. The schedules were delivered to every householder a few days before the appointed day, ordering them to complete the forms with financial penalties for non-compliance. The complete form recorded who was sleeping in the house on the night of the census, and these were collected the day after, following which the enumerator transferred the answers to their own schedule University of Portsmouth and others (2009).

The data was then collected centrally, and published in three volumes. However, despite the intention to ensure uniformity and conformity in the data, it was still not always achieved. In particular, issues regarding the number of households in each building and who exactly was the head of house, were not well resolved. This was mainly because of the inherently complex nature of living arrangements. Very few instances actually record situations as simple as one family, one head of household, one building etc. (ibid.).

The recording of occupations, too, was less than standard. First, as there was no requirement to categorise the occupations, anything could be written down. The same occupation could be recorded in a number of ways and individuals with multiple occupations or skills were invariably a problem. Second, the occupations of individuals were recorded as they themselves understood their occupation. Consequently, there was a record of a specific occupation even if the respondees were actually unemployed, engaged in another occupation or simply retired. Consequently, the census record is not necessarily a record of the employment of the person at the time of record (Raven 1997).

The bias in sources therefore needs to be taken into account. Trade directories alone do not provide a comprehensive list of trades and industries, whilst the census, by definition, only really records population and therefore cannot be used to reconstruct much of the extractive and agricultural landscape.

Despite this, the study of Dudley research clearly demonstrates that this data, when mapped in GIS can show in much more detail, and for certain areas, the evolution of the industrial and urban landscape of Dudley in the nineteenth century.

8.4 Results and Analysis

A total of 735 attributes were generated from the data and joined to the GIS shapefiles (Ramsey 2012). Not all these attributes were analysed, or visualised in the final GIS project. They are, however, all present within the attribute tables of the street and suburb shapefile, which can be disseminated to support future research.

An attribute of First Date was generated for the street shapefile that filled in the gap in the historic map sequence by identifying when each street was first mentioned in the documentary sources. This attribute shows discrepancies between the two datasets, as several streets were depicted on the 1835 and 1836 maps that were not mentioned in the 1836 Trade Directory or 1841 census. The cumulative length of the streets within each suburb was calculated (Fig. 8.4), and, overall a pattern

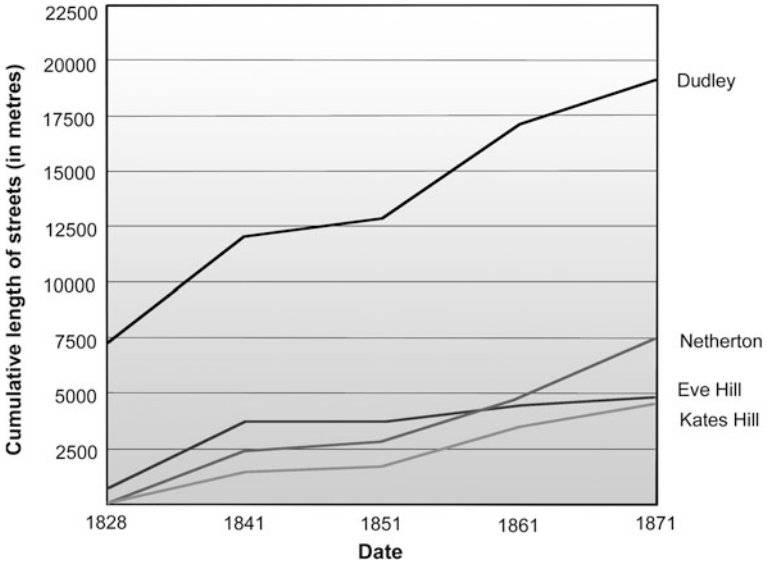

Fig. 8.4 Growth of Dudley and selected suburbs by cumulative street length

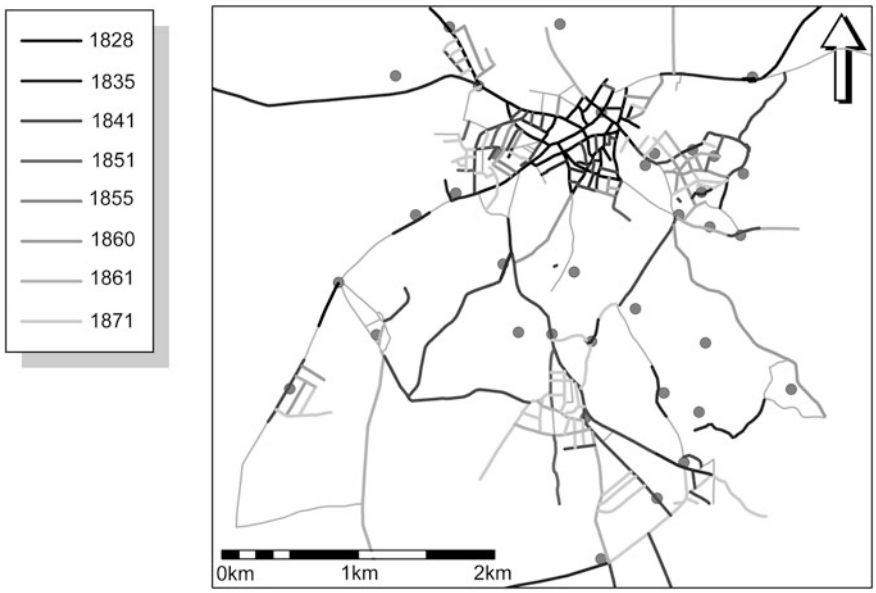

Fig. 8.5 Streets by first date mentioned in the documentary sources

emerges not only of outward growth, but of development within previously urbanised areas (Fig. 8.5).

Attributes were generated for both suburb and street level, with the hope of identifying broader patterns within the landscape at suburb level, and then being able to analyse these in more detail in a street level. The numeric data itself showed various patterns of growth, change and decline, and these trends were visualised spatially through mapping.

The attributes can be divided into four different categories; counts for street and suburb in individual years, ratios for street and suburb in individual years, change between the counts for street and suburb in consecutive years and change in the ratios for street and suburb in consecutive years.

In general terms, it was hoped that counts of buildings and population would help map the relative size of each urbanised area in terms of the built environment and the inhabitants. Likewise, mapping counts of trades, albeit very biased in terms of the original recording, was hoped to provide an indication of the size, nature and distribution of particular industries and occupations throughout the area. The range of category count was provided in order to map diversity of trades within the landscape at both suburb and street level.

The counts included range of trade categories (Fig. 8.6), number of trade entries, count of population (Fig. 8.7a) and number of buildings. Counts of individual occupations and industries at Simple Category level and New Category level (Fig. 8.7b) were also calculated, as were counts of specific selected occupations within the MF4 (Iron and Steel) category itself (Fig. 8.8a–d).

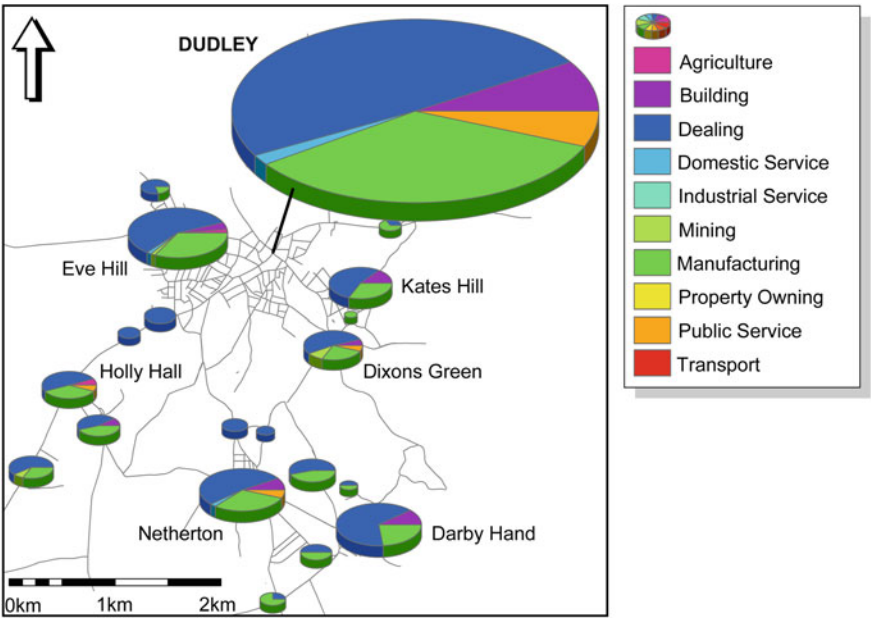

Fig. 8.6 Range of trades listed by simple category in 1842

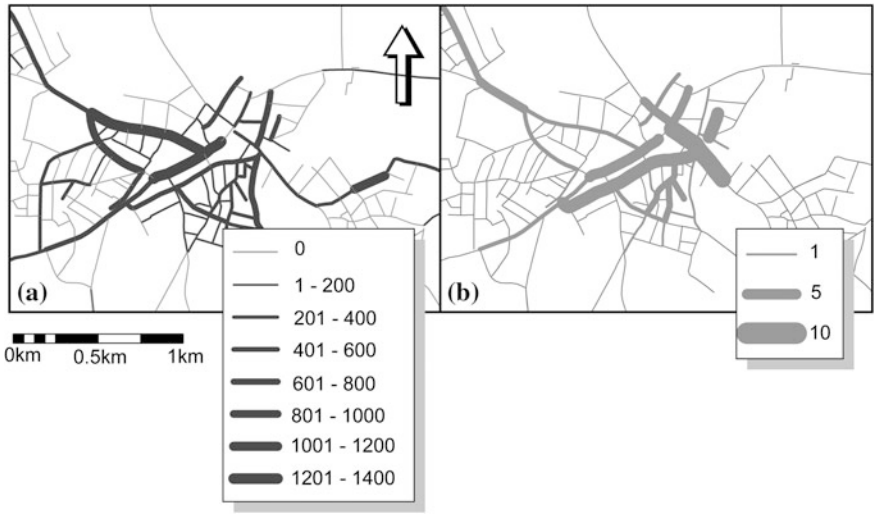

Fig. 8.7 **a** Count of population in 1841; **b** Count of trades allocated to the ironworking category in 1842

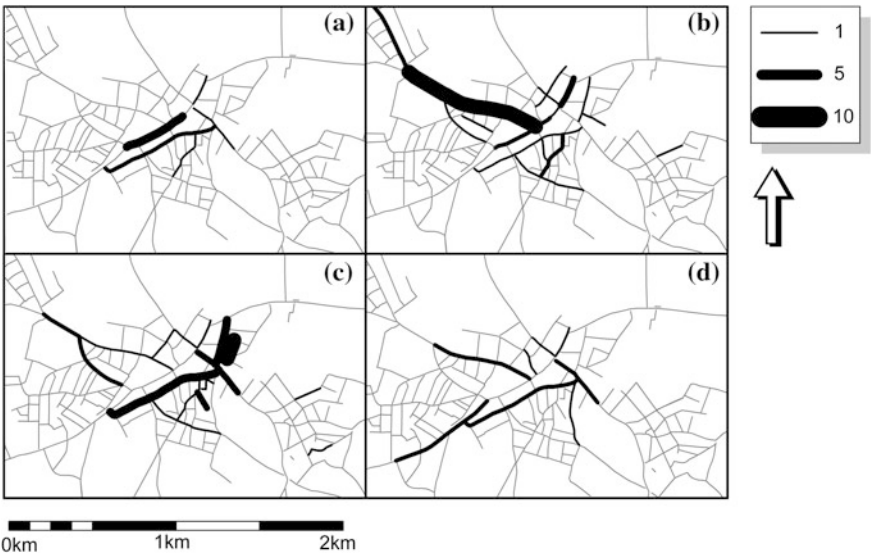

Fig. 8.8 **a** Count of iron founders in 1835; **b** Count of chain, anchor, trace and nail manufacturers in 1835; **c** Count of fenders and fire irons makers in 1835; **d** Count of blacksmiths and wheel wrights in 1835

It was determined that while the tables of simple counts could be used to symbolise the streets, the count itself was not always appropriate. The number of buildings, people or trades recorded is linked to the length of a street, and anomalies can occur when the count for an individual street or suburb is very low. Ratios of selected datasets were, therefore, also calculated to attempt to analyse and visualise the data in a more coherent way.

In mapping these ratios, it was hoped to highlight areas of overcrowding of population and buildings (potentially as an indicator of wealth), and of the character of an area in terms of the occupations of its inhabitants. For instance, from the census data, an index of population density was created by comparing the number of buildings to the number of people. Throughout the period under investigation, this showed a general trend downwards (Fig. 8.9). This suggests crowding (Fig. 8.10a), as although the number of buildings themselves would give an idea of density, the number of inhabitants per building may be used as an index of relative wealth, status or condition. Another index was created to compare the number of buildings to street length (Street Length/Buildings Fig. 8.10b). This particular index is likely to be erroneous for the longer, linking streets where buildings would cluster at particular places, but is considered relevant in built up, established areas. Mapping attributes such as the percentage of manufacturing activities was carried out to identify industrial areas within Dudley and the suburbs, in contrast to more residential areas (Fig. 8.10c).

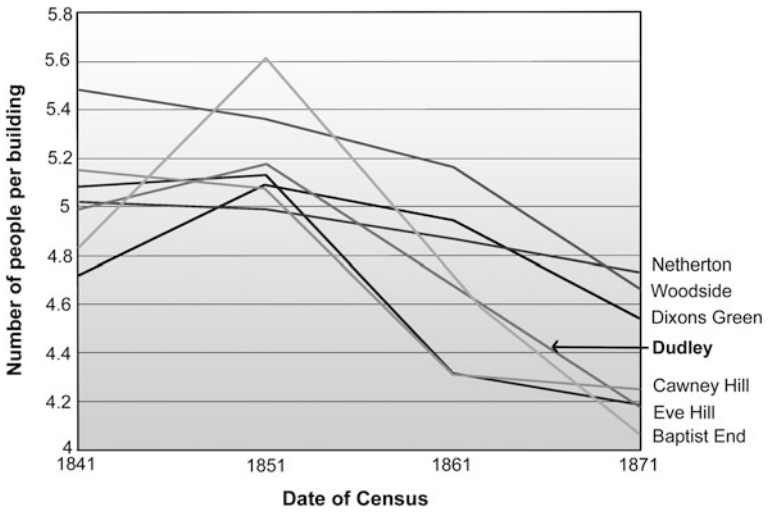

Fig. 8.9 Ratio of population per building calculated from the censuses for Dudley and selected suburbs

An idea of the bias in the trade directories, in terms of spatial distribution of entries, can be gained by calculating the ratio of trade directory entries to the results of the census data (Fig. 8.10d). Only the 1851 directory and census were of a comparable date, although further studies may allow researchers to extrapolate the counts between years. The trade directory data (count per street) was compared with count of population, but may also be compared with buildings, rather than individuals for the year 1851. This ratio would reflect the fact that the census data as was inputted did not record the ages of the population (although that data is in the original dataset). The population count, therefore, does not take into consideration how many people were of employable age. However, it is likely (though not necessarily the case) that each building would contain one or more households with someone who was an employer or employed.

Mapping changes to these values using both count and ratio helped identify growth, decline and character, in terms of buildings, population and industry, within the landscape at both suburb and street level (Fig. 8.11a–c). Overall trends in the data can be seen to be unevenly spatially distributed, and these not only indicate change, but may go some way to identify the type of change occurring, be it a change in building stock, individual wealth or a change in industrial character of a particular street or area.

The change values can be calculated as a count, or as a percentage rise or gain of population or buildings. Changes in density by buildings/street length can be calculated giving an indication of physical change in any particular street, but also trends in the density of population within each building, which can perhaps be used as an indication of change in social status.

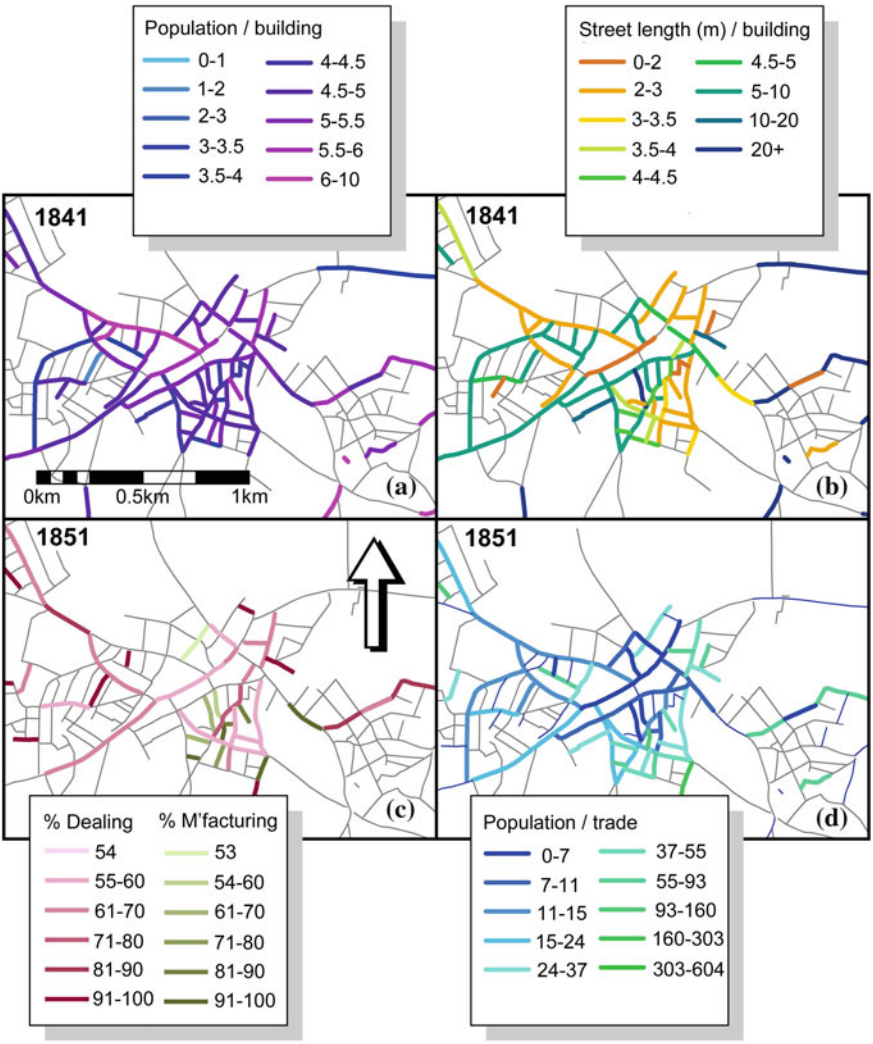

Fig. 8.10 **a** Ratio of population count per building in 1841 census; **b** Ratio of street length (in metres) per building listed in 1841 census; **c** Percentage of manufacturing and dealing categories relative to total counts (where the percentage was greater than 50 %): **d** Count of buildings listed in the 1851 census per entry in the 1851 trade directory

8.5 Integration with Existing Datasets

As well as illustrating overall patterns within the urban landscape, the mapped data can also be used to enhance our understanding of pre-existing GIS datasets, such as the Black Country Historic Landscape Characterisation and Historic Environment Record (BHLC).

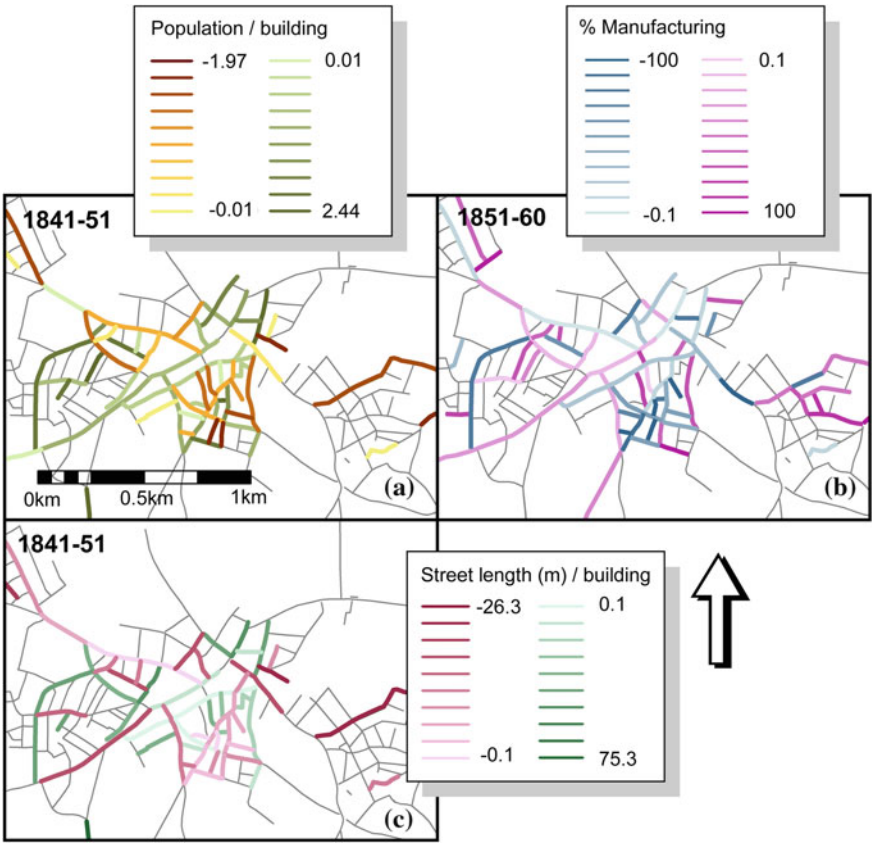

Fig. 8.11 **a** Changes to the ratio of population per building between 1841 and 1851; **b** Changes to the percentage of manufacturing trades compared to overall entries listed in the directories of 1851 and 1860; **c** Changes to the length of street per building between 1841 and 1851

An illustration of how the new data can be used to enhance our understanding of the character and evolution of the urban landscape and the integration with other datasets can be provided with reference to a BCHLC unit along Wolverhampton Street (Fig. 8.12a, b).

This unit (HBL6911) is described as small domestic terrace dating from the late eighteenth or nineteenth century. 176 Wolverhampton Street is listed on the HER (4977), and also within this polygon are two historic buildings associated with a school. The historic map sequence depicts the frontages, as developed by 1835, in stylised detail (Fig. 8.12b), with the school shown to the rear of the properties in the OS 1st Edition in the 1880s.

It can be seen from the new data that in the early part of the nineteenth century, the houses along Wolverhampton Street were some of the most crowded in terms of people per building in the region (Fig. 8.10a), with 6–10 people recorded per building in 1841. In addition to this, Wolverhampton Street had the most

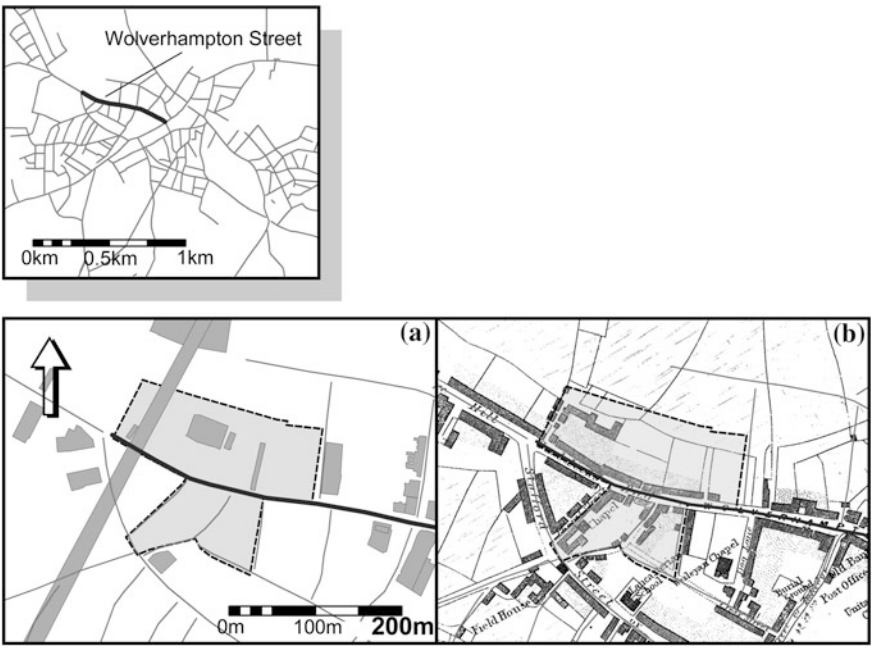

Fig. 8.12 **a** BCHLC region HBL6911 shown in *light grey*, HER entries shown in *dark grey*; **b** Wolverhampton Street on Treasure's map of 1835

nail-makers of any street in Dudley (Fig. 8.8b). This small-scale industry was likely to have been conducted out of these properties. As the century progressed, after 1835 nail-making in Wolverhampton Street (as regards its inclusion in the Trade Directories at least) declines. At the same time it can be seen that the ratio of people per building decreases (Fig. 8.11a), and the number of people listed as residents increases.

It might be suggested therefore that the character of Wolverhampton Street changes throughout the century from small-scale industrial to less-crowded residential, and that the construction of the school was a response to, and part of this change in character. Furthermore, as the ratio of buildings per street length appears to remain relatively stable, it can also be suggested that this change in character was one of population and occupation, rather than one of the built environment, something that is not possible to ascertain from the historic map sequence.

8.6 Discussion

Overall, the study achieved its aims in filling in gaps in our understanding of the urban and industrial landscape within the Dudley area, and illustrating changes within that landscape during the mid-nineteenth century. The town of Dudley and

its environs can be seen to have undergone dynamic changes, not only in the physical growth of the urban area, but also in respect of the population, the built environment in developed areas, and urban character in terms of trade and industry itself. These are characteristics that cannot be represented on the historic map sequence. The research also achieved the aim of creating an accessible resource that can be integrated with other spatial datasets and used as a basis for further research.

The map sequence illustrating streets by date first mentioned, as has been noted, is not quite in concordance with the historic mapping. However, whether a street was mentioned in the sources or not may be significant, as it potentially shows the 'importance' of a street. It can also omit speculative building projects from the study whereby a street might look occupied but not actually have anyone living in it. It also shows clearly whether a particular street at a particular time has associated data. The growth sequence itself shows that the urban development was not a smooth progression away from the centre, and that individual areas were developed at specific times and that the area was impacted by infilling of land blocks within the town centre as well as growth on the outskirts.

Mapping the distribution of buildings, and changes in the number of buildings at a suburb level between censuses, potentially shows in a finer temporal detail changes to the built environment at the time (although it should be noted that only residential buildings are recorded on the census, and not factories, works and municipal buildings).

It is also true that mapping the value of street length per building does not necessarily give an accurate indication of the actual size of the buildings (determined by frontage), but does give an indication of the density of buildings within a particular street or area. The mapping from 1835, 1836 and 1865 depicts stylised buildings along the frontages of the roads, and little can be drawn from these other than a building's presence. Comparison between the patterns identified within the street length/building maps and Ropers map of 1850 (not used in the analysis) does suggest that this is relevant, and therefore the methodology has the potential to identify areas of particularly dense buildings including those behind the frontage and in areas where no detailed mapping was available. Also, changes between years can highlight areas where there were physical modifications within the built environment, and identify these changes down to the nearest decade. Moreover, the analysis suggests that there were significant trends in the population per building value, and was able to map these to determine spatial patterns.

Occupations that were conducted within a residence such as shopkeeping and small-scale manufacturing are unlikely to show on the historic map sequence, but by mapping the trade directory data at both street and suburb level, this detail can be added to the landscape. Although it is difficult to make concrete statements about urban character without looking at the actual composition of the trades identified and listed for each street, overall changes to areas and streets can be identified. This may objectively highlight areas of continuity or change that might be worth investigating further. Also, by mapping the data at a variety of scales, and with a range of details (from general category down to specific trade/industry

groups) the trade and industrial character of the landscape and changes in this character can be put into context against other values and datasets. For instance, changes in the number of trades within a street can be analysed against changes in particular trade categories, and can be verified against overall changes in the number of buildings and the actual population. While this still represents only a part of the activities within the study area, such data certainly enhances our current knowledge of these areas.

Underlying problems with the datasets themselves, along with the processing methodology, need to be acknowledged. Individual maps generated by the project are not necessarily illuminating on their own, and at times may be downright misleading. While many biases and inaccuracies are noted within the sources, it was assumed that these biases were consistent through time for comparable editions. While only those trade directories that were initially identified as reliable and comparable were used in the research, further analysis did identify changes in recording methodology for these publications. Consequently, any changes identified between certain years may reflect this, rather than representing real change within the landscape. It should be noted, however, that it is only by looking at the datasets as a whole and by assessing the comparative evidence for overall change that such biases can be identified and taken into consideration.

In this way, although perhaps the count and distribution of trades reflects only a small part of the overall industry of an area, identifying change between years is still a valid exercise. It may be that the precise nature of the change is not fully understood by analysis of this data alone, but it is possible to objectively highlight areas where change was occurring and at the same time, drill down into the data to potentially identify what was driving that change.

However, irrespective of any bias within the datasets, caution is needed when interpreting the results. The values themselves can be quite misleading if taken out of context, and it is important to assess the data further for significance in the results. For instance, a 100 % increase in the number of manufacturing entries listed for a particular street, may only represent a change from 1 to 2 entries. Also values such as the street length per building are likely to be erroneous for ribbon development along arterial routes where only some of the road digitised was colonised at any particular time. However, an attempt was made to counter these potential problems by creating a variety of values that calculated both count and ratio, so that the most appropriate value for any particular question could be mapped.

Analysis of the census data indicates further problems. In some areas there were omissions of data, and not all streets were identified. For the most part, the street layout itself did not change dramatically throughout this period, and the Ordnance Survey 1st edition is representative of early street networks. Where there had been changes within the urbanised area, these tended to be infilling of street blocks, rather than wholesale demolition and reconstruction as has happened in the twentieth century. However, it was not possible to find some streets listed in the documentary sources.

The underlying database itself undeniably has research value in its own right, and it might be suggested that the true value of such a study comes from its comparative value with other spatially recorded data.

8.7 Conclusion

Previous research using Trade Directories and GIS has proven its value in analysing spatial and temporal changes within industries. Raven and Hooley (2005) for instance conducted extensive research looking at urban and industrial change for towns in the Midlands, which included the relative distributions of industries, growth of industries over time and increase of specialisations within the towns (Raven and Hooley 2005). Knowles and Healey (2006) used industry specific trade directories along with approximately 50 other sources to create a comprehensive GIS project involving mapping sites associated with the iron industry. In the case of the research by Raven and Hooley (and with much other research that uses trade directories), the data was aggregated at a 'town' level, and it is hoped that the current research can complement this by developing a methodology that utilises the spatial component of the trade directory data as well as census data at a finer 'street' level. Likewise, while trade directories and GIS in mapping the distribution and change of specific industries has been successfully used (Knowles and Healey), it was hoped that by creating a comprehensive, rather than selective, database for all industries, individual industries can be analysed in context.

At a local level, it can now be demonstrated that where there is confidence in the data, a far more detailed picture of the people and occupations of Dudley in the mid-nineteenth century can be provided. This mapping can be used in its own right to highlight patterns of population movement and industry, at a broad scale and detailed level. By splitting the data to a street level gives an element of detail and description not easily accessible or visible previously.

Combining the information in the databases with a GIS project allowed the visualisation of the data, which helped identify and highlight spatial patterns held within the documentary sources, as well as providing detailed information regarding particular streets and particular industries. In addition, by combining numeric attributes such as the number of buildings with spatial attributes such as street length, new information can be generated.

The data might be used in several ways. The first is to gain an overall insight into the nature, distribution and changes of occupations and population in the landscape, by using the whole dataset to create broadscale mapping. While the attributes themselves need further research to identify whether there is genuine meaning to the values, they can be used to identify character and changes to that character within the landscape over time. In this way, the temporal resolution of the changes evident in the historic mapping can be improved, as changes present within the documentary sources can be identified at closer units of time than the historic mapping itself.

Another way is to use the particular details at a street level, to give added information to previously identified spatial units. These could be those identified on the BCHLC or listed buildings on the Historic Environment Record, or to areas of proposed development, to enhance and facilitate desk-based assessments and Environmental Impact Assessments.

While only a small amount of detailed mapping was generated, specifically for the MF4 Ironworking category, there is the potential for further maps similar to this to be created for other manufacturing or activity categories. There is much previous work conducted using trade directories to map the locations of specific occupations and industries, however, by having the data on a database and linking the data into a GIS facilitates this type of research and also allows the data to be analysed and cross-referenced with other forms of geographic information.

The use of spatial technologies as analytical tools, both for visualisation and dissemination, suggests further uses of urban datasets both in the British Midlands and in other urbanised areas with similar data. If this is the case, then the results of analysis provided here indicate how such studies may develop. For instance, it is generally presumed that urban expansion and development is best understood as a horizontal process, with new build inevitably, and primarily, encroaching on the fields surrounding the towns and cities. The data for Dudley demonstrates that urban development was actually far more sophisticated and that there were substantial changes within the already urbanised areas themselves. These areas show fluctuations and patterns of population movement, and potential rebuilding that would not be evident from the results of a standard map analysis. Consequently, this evidence is rarely considered in the literature. However, this information is critical if we are to understand the nature rather than the extent of urban development. Such changes must have been evident to the population of Dudley and without that information, we cannot really provide an adequate assessment of the overall nature of historic urban change, or indeed the quality of life, within any historic town.

In many senses, cities remain "the defining artefacts of civilisation" (Reader 2004, p. 1) and it also remains true that as urban populations inevitably, and exponentially, expand, that we must seek to understand the processes that lie behind their development and provide the unique living environments for their inhabitants. This chapter presents a first step in the process of understanding historic urban development in a holistic manner, but it is clear that we still need to take these issues further and develop methodologies or technologies that explore these factors extensively, with greater resolution and more efficiently if we are to proceed further.

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