Visualising manufacturing activity in London

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Summary

A series of urban manufacturing data sets are integrated on an interactive map tool to explore their relationships with urban form at multiple scales in London. Despite the limitations of resolution of the underlying data, this tool proved to be a contribution for the exploration of manufacturing data often not scrutinised at a fine-grained scale. The study offers insights for further defining contemporary urban manufacturing and understanding the spatial and economic implications of industrial land displacement and mixed-use planning in relation to the urban structure.

KEYWORDS: Urban Manufacturing, Economic Geography, Geo-visualisation, GIS, Space Syntax, Web Mapping.

1 Introduction

This paper discusses the process of researching manufacturing activity in London visually and quantitatively, using open and official data sources. This research sits within the context of a broader multidisciplinary investigation of the complex inter-relationships between contemporary urban manufacturing and urban form that interrogates the current convention in planning for advocating 'mixed use' urban environments. The research is descriptive and exploratory rather than explanatory. We apply a spatial configuration approach to investigate urban form using Space Syntax measures as a 'mode of enquiry' and development of the 'right questions' (Griffiths, 2014).

Contemporary urban manufacturing is difficult to define as it comprises a mixture of remaining traditional manufacturing activities and new types of manufacturing that have arisen supported by new technologies. The picture is further complicated because while some types of manufacturing are organised around the provision of services (e.g. repair of machinery and equipment), others involve greater share of design and development work (i.e. 'differentiated production')(Jacobs, 1970) which

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blurs the absolute distinction between goods and services. It is evident that the classification standards used to organise the data on economic activities does not reflect the ambiguities of some manufacturing businesses (e.g. UK Standard Industrial Classification - SIC). Nevertheless, given that such standards are used for the collection and publication of economic statistics in the UK, our definition of manufacturing activities followed the official classification framework.

Although industrialised cities saw the decentralization and offshoring of large-scale manufacturing activity under Fordism, some significant manufacturing remained in the core urban area and we are increasingly seeing the revival of smaller-scale urban manufacturing in many cities (see Cities of Making, 2020, for an overview of the European context). The economic benefits of an urban location for manufacturing activities include the supply of both cheap and specialist labour, and shorter distances to suppliers, other businesses in the production chain, and a large customer base -referred to as external- or agglomeration economies (see Wood & Dovey, 2015; Ferm & Jones, 2017). This implies competing demands for urban space between primary land uses (residential, industrial and commercial). Under real-estate market rules this competition often results in the displacement of industrial land and premises, which tend to be lower density and command lower land and property values than residential land and buildings (see case of London in Ferm & Jones, 2017). Although there are planning policies in place to balance competition at a metropolitan scale, it is less clear how land uses can be successfully integrated into a mixed-use environment at a fined-grain urban scale. A review of building types illustrates the design complexities and requirements at play in the integration and intensification of industrial and residential land uses (Greater London Authority, 2017a) but it is circumscribed to the building/block scale, which limits the analysis. Here, we aim to expand and complement the study of industrial-use building types by investigating the street patterns and the spatial configuration of such urban environments at multiple scales.

The spatial configuration analysis seeks to spatially describe the structure of urban street systems and allows to identify areas on a spectrum of low to high urban movement intensity based on Space Syntax theories (Griffiths, 2014). These measures represent patterns approximated to pedestrian and vehicular scales of movement (2 km and 10 km respectively), which are developed from empirical observations (Hillier & Iida, 2005).

All metrics were overlaid on a set of interactive maps to provide an interface for investigating their relationship, which has rarely been examined from the spatial-morphology perspective of the city rather in administrative zones.

2 Methodology

For the purpose of the analysis, we used a range of data with different spatial resolution and geometric representation, described in Table 1. The study area was defined by the administrative boundary of the Greater London Authority (GLA). Data representing manufacturing and industrial activity, and spatial configuration were processed separately before it was combined together in a geo-visualisation tool.

2.1 Data on manufacturing and industrial activity

Manufacturing and industrial activity was mapped using three data sets. We first created the London business directory point map using the geographic coordinates of the companies' registered office address included in the data set. Out of over one million records, 22,320 (≈ 2%) are classified as "Manufacturing". This provided the most fine-grain spatial description of the location of manufacturing businesses.

Then we explored manufacturing 'intensity' by looking at the number of manufacturing jobs per geographical area from the Business Register and Employment Survey (BRES). This data is reported at lower super output area (LSOA) statistical geographies, therefore has a lower spatial resolution than the point data in comparison with a choropleth map. The 4,835 LSOAs show a long tail distribution for absolute and relative values (job counts, and job counts percentage). Therefore, to obtain a clearer picture of manufacturing intensity we selected the observations above the 3rd quartile; LSOAs with more than 40 and 6% manufacturing jobs.

Finally, we observed manufacturing and industrial activity from a planning perspective by quantifying the total area of industrial land per LSOA. The area of the polygons representing industrial land were spatially overlaid with the LSOA boundaries and summarised to create a choropleth map.

As a result, we obtained a set of maps to explore the geography of manufacturing activity in London which showed manufacturing businesses locations, manufacturing jobs concentration and manufacturing/industrial land concentration.

2.2 Data on spatial configuration

The spatial configuration analysis for London is a subset of a Space Syntax model of the UK. Data is published already processed for radii of 2, 10 and 100 km. (SpaceSyntax, 2019). For the purpose of our research we studied 'choice' and 'integration' at 2 and 10 km ("to" and "through" pedestrian and vehicular movement)(see notes on Space Syntax for interdisciplinary research in Griffiths, 2014). Only the higher 20% values of these metrics were mapped as these provide a clearer visual structure of the most relevant streets in terms of movement activity at the metropolitan scale. The outcome is a matrix of 4 maps (see Figure 1) which were then integrated with the cartography of manufacturing activities.

2.3 Interactive map matrix

The mapping outputs were combined together on an interactive map matrix that allowed the multidisciplinary research team to explore the data and reach their own conclusions (see Figure 2, and online version at https://npalomin.github.io/NUM_london/index.html). More specifically this research tool supported the visualisation of multiple spatial data inputs simultaneously for comparison and cross-verification.

Because the multi-scale nature of the data was a relevant aspect of the research the maps interface includes navigational interactivity (pan and zoom) to browse areas of interest and to explore the

Table 1: Data summary

Data	Description	Source	Characteristics
Directory of London Businesses	"financial accounts submission of either a whole company or part of one." (corresponds to Companies House data also published under commercial license as FAME database)	London Data Store (1)	Points (registered office address), N = 1,130,474, (2018)
Business Register and Employment Survey (BRES)	"An employer survey of the number of jobs held by employees detailed industry (5 digit SIC2007)"	NOMIS - Official Labour Market Statistics ONS (2)	Polygons (statistical lower super output area boundary), N = 4,835, (2017)
Spatial configuration metrics (Choice and Integration)	"Choice is based on the graph measure of Betweenness Centrality." (throughmovement), "Integration is based on the graph measure of Closeness Centrality." (to-movement)	Space Syntax Limited (3)	Lines (street segments), N = 111,582, (2019)
Industrial Land Supply baseline	Geodatabase of the supply of industrial land across London. Prepared by AECOM for the GLA	GLA (available upon request)	Polygons (industrial sites), (2015)

(1)https://data.london.gov.uk
(2)https://www.nomisweb.co.uk
(3)https://spacesyntax.com

metropolitan and local contexts at the appropriate levels of detail (Smith, 2016). The development of the interactive tool, which is often expensive, was done with ease using R 3.5.0 (R Core Team, 2018) and the *mapdeck* package (Cooley, 2019) and shared online.

3 Discussion

Contemporary urban manufacturing is a difficult phenomenon to observe. Despite the increasing availability of data sets, the spatial resolution of the data is not sufficiently appropriate for studying the relationships with urban form at the scale of basic urban elements. Nevertheless, the integration with data on spatial configuration in an interactive map interface was valuable for scrutinising the available data. Especially because the navigational interactivity allowed an overview of the multiscale patterns of manufacturing activities in relation to different scales of street movement.

The data on manufacturing needs to be interpreted with caution. For example, the London Business Directory showed a high concentration of manufacturing businesses in the area of Marylebone in central London. Nevertheless, empirical evidence suggests that this might be accountant offices or

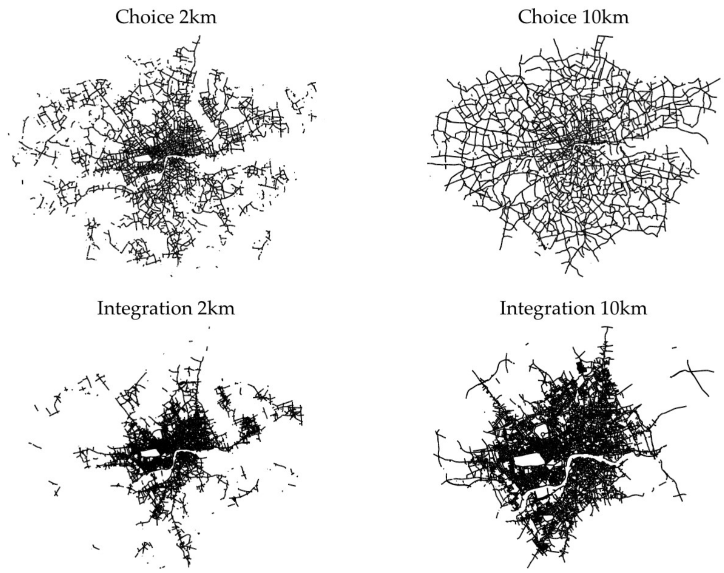

Figure 1: Spatial pattern of street ”through-movement” (Choice) and ”to-movement” (Integration) at pedestrian (2 km) and vehicular (10 km) scales (see details in Griffith, 2014)

manufacturing business headquarters rather than manufacturing premises. Also, the LSOA adjacent to Buckingham Palace in Westminster reported 6,000 jobs in manufacturing, which is difficult to provide any immediate explanation for. However, at a metropolitan scale both the employment and land use surveys showed a similar spatial pattern with higher concentration of manufacturing activity in well-known and planned industrial locations; along the Lee Valley, the Thames Gateway, Heathrow, Park Royal and Wandle Valley (Greater London Authority, 2017).

The observations on urban manufacturing at the metropolitan scale appeared less relevant for the purposes of investigating mixed-use environments. Our intentions of analysing the relationships between the spatial structure, street movement and manufacturing activity were significantly undermined by the unreliability of the points data. However, the deployment of the manufacturing data integrated with the spatial configuration analysis was pertinent for designing the following stages of the research that considered field observations at a more detailed scale which offers an opportunity for greater precision and accuracy.

Overall, the interactive map matrix was important for visual communication and sharing the spatial analysis on a dynamic platform. Given the impacts of the location on the performance of manufacturing activities, the use of this type of tool can significantly contribute to understand the implications mixed land uses at multiple scales and provide insights into the research of future urban policy.

Figure 2: Interactive map matrix showing 12 maps that summarise the relationship between manufacturing activities and spatial configuration at different scales in London. Accessible online at https://npalomin.github.io/NUM_london/index.html

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5 Biography

Nicolas Palominos is an urban design researcher at the Centre for Advanced Spatial Analysis. His research bridges urban design with a quantitative understanding of cities. He is specially interested in the potential of urban data for the creative and strategic spatial analysis of urban systems.

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