UCL DEPARTMENT OF GEOGRAPHY

YEAR 2022-23

EXAM CANDIDATE ID:	**XBXV1**
MODULE CODE:	**GEOG0030**
MODULE NAME:	**Geocomputation**
COURSE PAPER TITLE:	**Social Atlas**
WORD COUNT:	**1495**

Your essay, appropriately anonymised, may be used to help future students prepare for assessment. Double click this box to opt out of this ☐

INTRODUCTION

Over the past two decades, climate mitigation has become an increasingly important priority for all governments around the world. It gives rise to a shift away from the car-centric transport paradigm, as planners seek to enable people to travel more responsibly to reduce carbon footprint from the transport sector. In London case, the Mayor of London adopted a multi-pronged approach to shape the population's behaviour to embrace sustainable modes of transportation (SMOT), such as expanding ULEZs (TFL, 2023), improving cycling routes (Department of Transport, 2023) and public transport accessibility (Mayor of London, 2017).

This social atlas seeks to investigate if there is a spatial pattern between sustainable transport usage and accessibility to sustainable transport facilities in London. First, it analyses the spatial autocorrelation of sustainable transport usage in London. Subsequently, it zooms into two case study boroughs (hotspot and coldspot) to examine the possible relationship between high sustainable transport usage with public transport accessibility and last mile travel amenities.

From a macro perspective, the atlas aims to the suggest improving access to sustainable transport facilities (public transport routes, bike lanes and stands) to encourage more sustainable travel behaviours throughout London, thereby reducing reliance on cars and promoting a greener future.

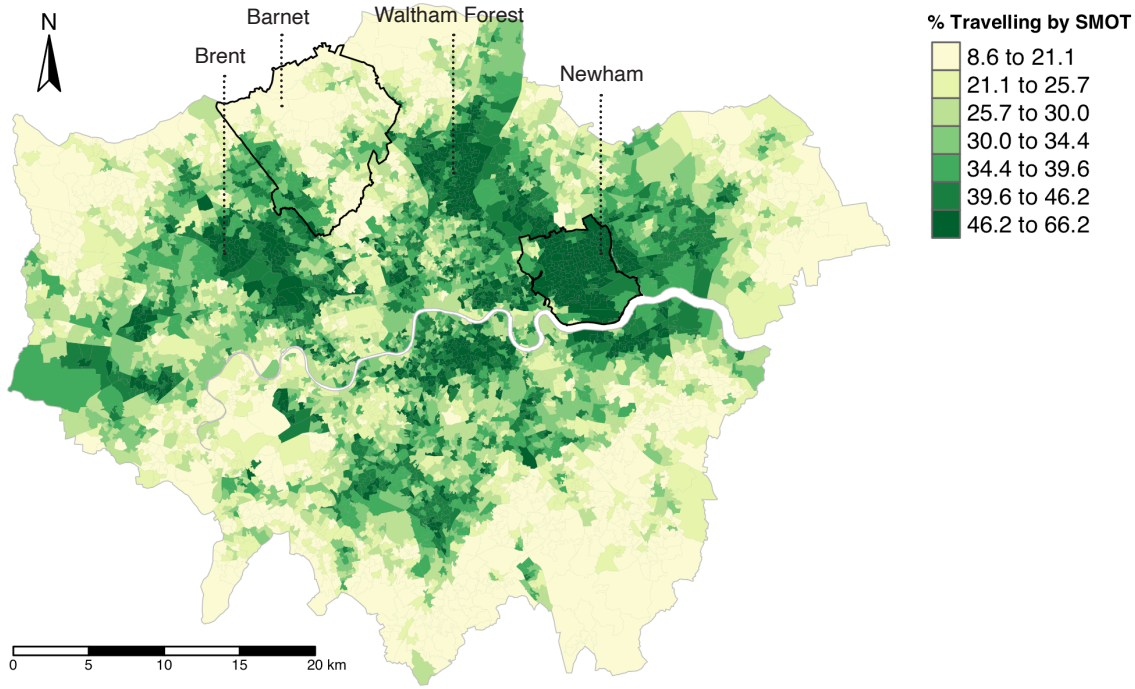
All data is calibrated at LSOA Super Output Area (LSOA) for a detailed spatial visualization. The atlas uses the percentage of people travelling to work by sustainable modes of travel (SMOT), including public transport, cycling or walking to showcase sustainable transport usage.

PART 1: Understanding the Context

Part 1 examines the patterns of distribution of SMOT usage in London. Map 1 visualises the percentage of people travelling to work using SMOT (public transport, cycling or walking) on LSOA level. The darker green areas indicate higher percentage of people using SMOT.

This map demonstrates that outer London generally has lower percentage of people using SMOT to work. This makes sense as outer London boroughs usually have poorer public transport accessibility and are too far for residents to cycle to work. However, patterns of clustering of high percentage of people using SMOT does not necessarily appear in inner London, but in areas such as Newham, Brent and Waltham Forest.

Sustainable Transport to Work London, 2021

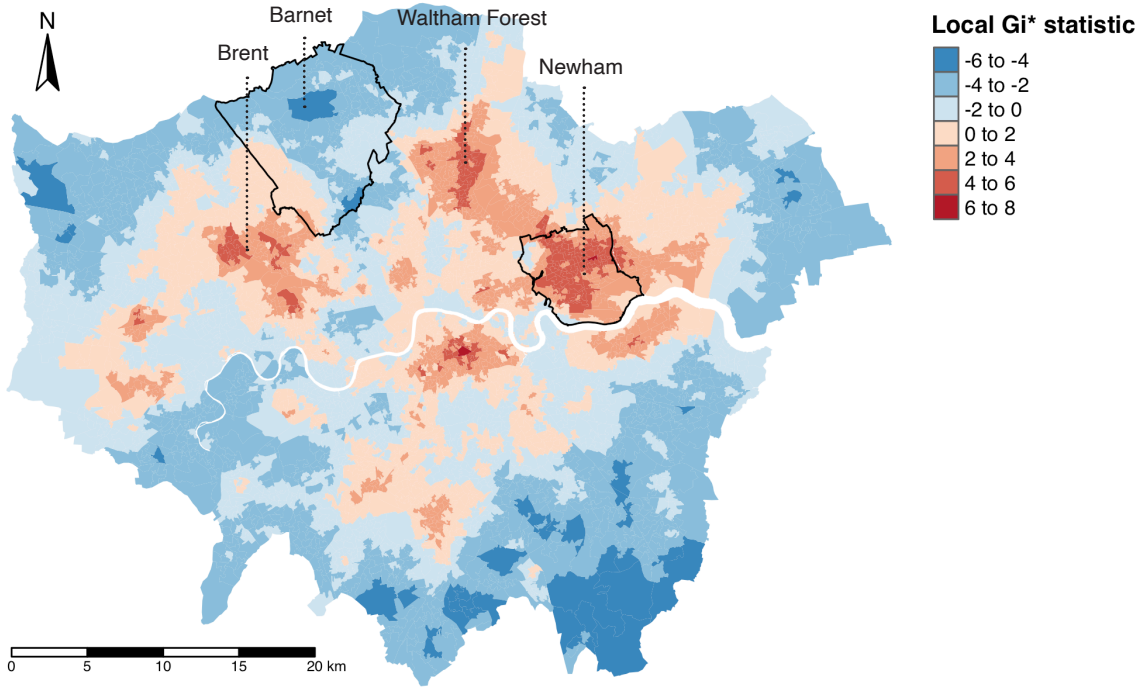


Map 2 substantiates observations of Map 1 by carrying out spatial autocorrelation test using Getis-Ord Gi Statistics on percentage of people using SMOT. This test identifies hotspots and coldspots, which are statistically significant clusters of features with high and low z-scores respectively (Bivand and Wong, 2018). The Queen contiguity is used because when neighbourhoods share a common boundary, spatial interactions (and similarities) increase (Getis, 2007).

The results support observations from Map 1: there are hotspots in Newham, Brent and Waltham Forest. However, these areas are not geographically near major employment work centres such as Westminster and City of London. This raises the question if these areas have good public transport facilities that motivate residents to use more SMOT.

This will be further investigated in Part 2. Newham (hotspot) is selected for more in-depth analysis on the availability of facilities that support SMOT, such as tube stations, bike stands and lanes. For comparison, Barnet (coldspot) is selected for the same study.

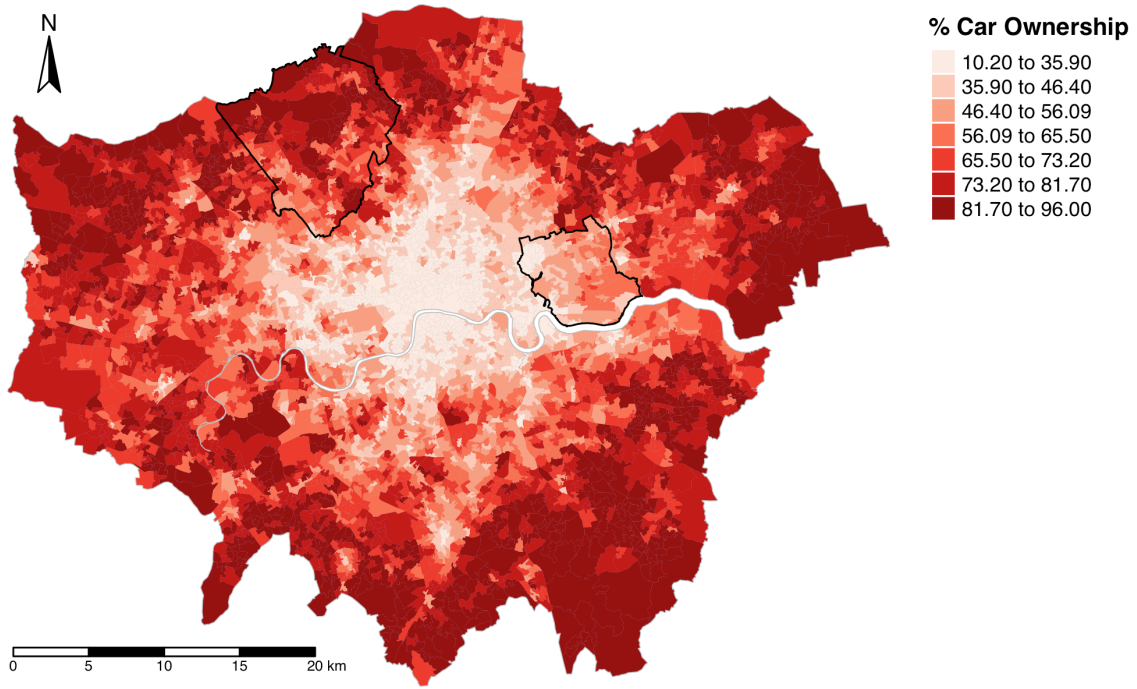
Hot/Coldspot Map of Sustainable Travel to Work, 2021



Map 3 continues to investigate behaviours using SMOT, showing a choropleth of percentage car ownership on LSOA level. Areas with darker red have higher car ownership.

The general trend resembles a reverse of Map 1, where outer London has significantly higher car ownership. Interestingly, previously identified hotspots of high SMOT usage do not have the lowest car ownership. For instance, Newham has 48.3% car ownership and Brent has 54.9%, which are comparable to London's average (57.9%) and much higher than some other boroughs (Camden, 36.4%). This possibly suggests that a proportion of the people in these areas are opting to travel to work by SMOT despite owning a car, which makes the phenomenon worth investigating.

Car Ownership in London, 2021

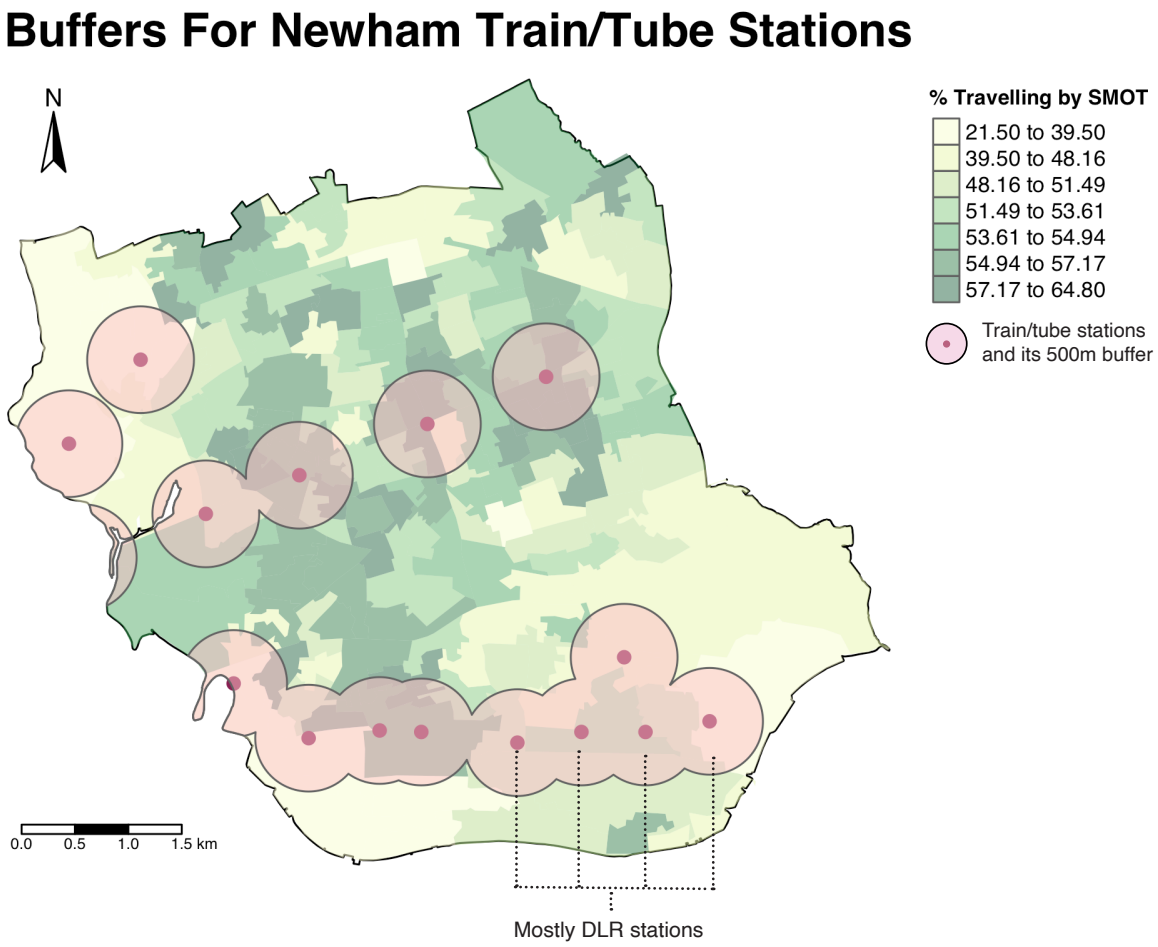


PART 2: Detailed Analysis of Newham & Barnet

Part 2 zooms in onto on a hotspot (Newham) and a coldspot (Barnet) to investigate the relationship between usage of SMOT and the availability/accessibility of sustainable transport facilities.

Buffer zones around tube/train stations is a direct way of visualising whether tube/train facilities increase usage of SMOT (De Smith et al, 2007). A short walking distance to public transportation stations is hypothesised to encourage usage of SMOT. In Map 4, London tube/train stations and their 500m buffers are projected onto a map of SMOT usage clipped to Newham. 500m buffer is chosen to correspond roughly to 5-minute walking distance (de Sa and Ardern, 2014).

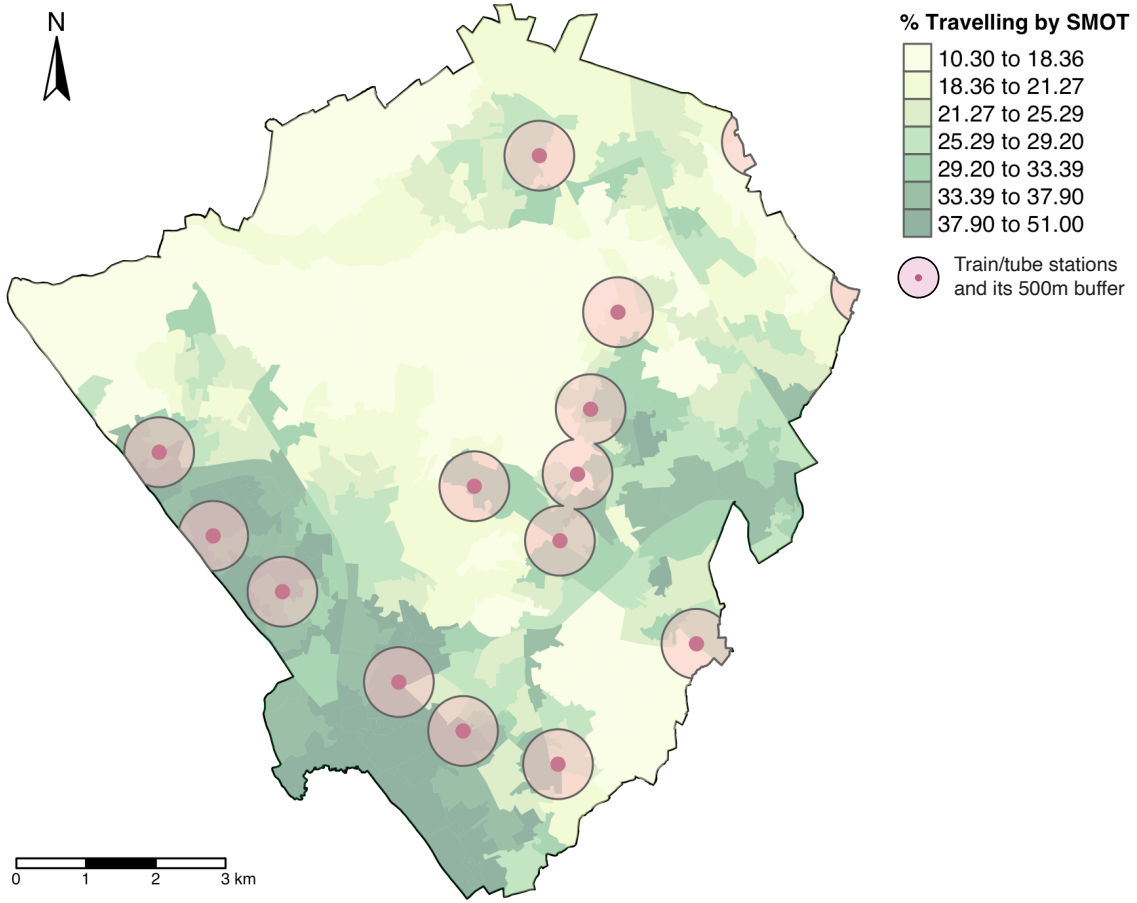
Many areas covered by buffers show higher usage of SMOT, but it is not always the case. This may be due to a difference in connectivity of trains at various stations and other complex variables of the urban environment. For instance, the cluster of tube stations at South Newham are DLR stations, which serve a more regional purpose than tube (evident from shorter distance between stations). Such differences could explain deviations from the general trend.



Map 5 shows London tube and train stations and their 500m buffer is projected over the map of percentage using SMOT clipped to Barnet.

The correlation between public transport facilities and higher SMOT usage is more noticeable in Barnet's case, where all areas with a low usage of SMOT do not overlap with train/tube stations' 500m buffer. This stronger visual relationship may be because Barnet is poorer in other forms of public transportation (buses) and transport infrastructure, resulting in a stronger reliance on tube/train as SMOT.

Buffers For Barnet Train/Tube Stations

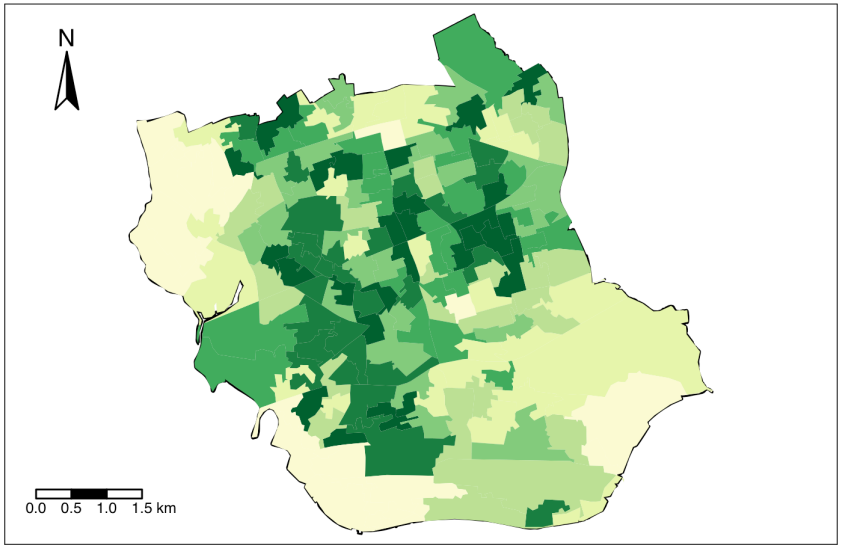


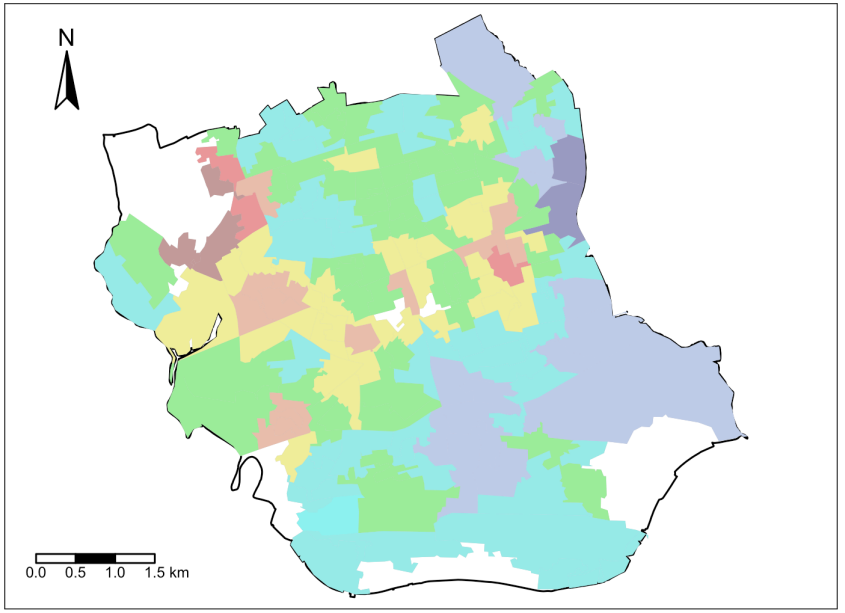
For a more detailed analysis on access to all forms of public transport, Map 6 and 7 examines public transport accessibility levels (PTALs).

PTAL is a detailed measure of the accessibility of a point to the public transport network, accounting for bus, train and tube services, as well as walk access time and service availability (TFL, 2023). Accessibility increases from 1 (least accessible) to 6b (most accessible). PTAL is projected onto LSOA and cross compared to local usage of SMOT.

In Map 6, areas with good PTALs (Stratford, West Ham, East Ham) correspond to areas with higher usage of SMOT. It suggests a positive correlation between public transport accessibility and usage of SMOT.

PTAL and Sustainable Transport to Work Newham, 2021



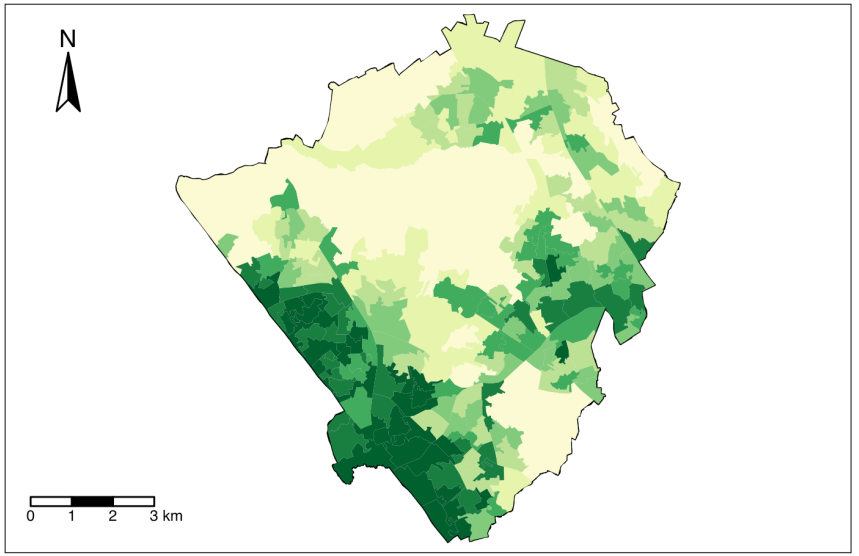


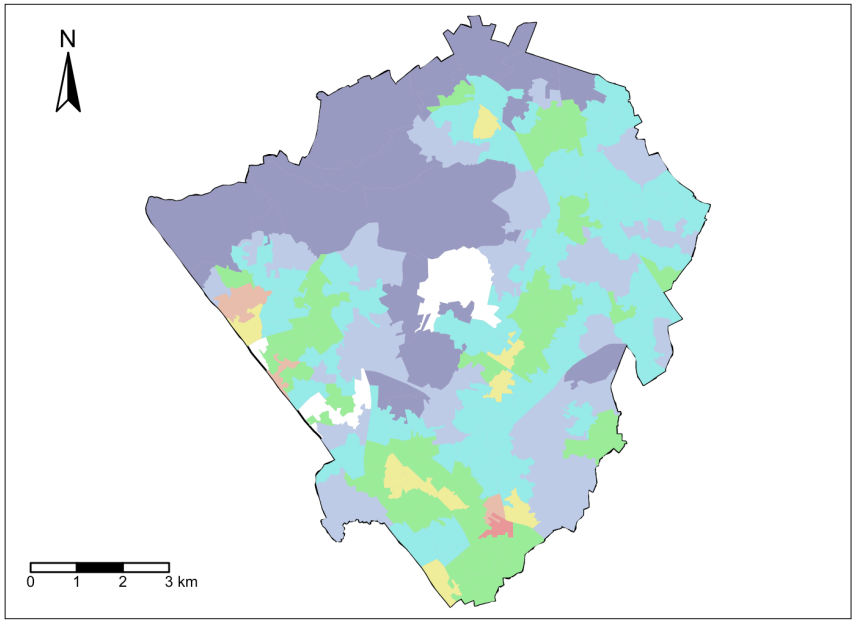
For comparison, Map 7 shows the PTALs of Barnet.

In general, Barnet has much fewer areas with good PTAL ratings compared to Newham (partially occupied by Green Belt), suggesting a poorer accessibility by public transportation. Like Map 6, areas with good PTALs correspond to areas with higher usage of SMOT.

The past few maps suggests that areas with higher public transport accessibility (Newham) is a hotspot for usage of SMOT and vice versa. This points to a likely correlation that public transport accessibility encourages usage of SMOT.

PTAL and Sustainable Transport to Work Barnet, 2021



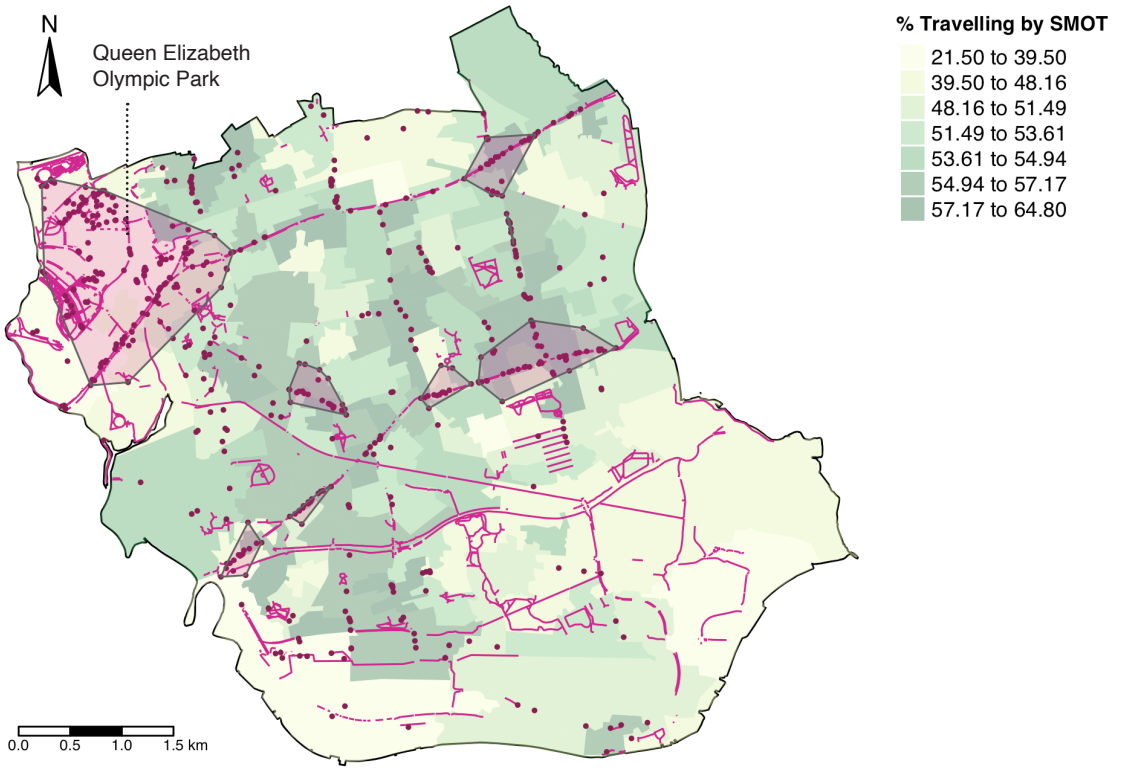


The next section analyses ease of first/last-mile travel using availability of cycling infrastructures. This adds on to public transport accessibility as a package that provide relevant infrastructures to support SMOT (Shaheen and Chan, 2016).

Map 8 examines the availability of cycling infrastructure in Newham using density-based spatial clustering of applications with noise (DBSCAN). DBSCAN is used to visualize clusters of bike parking, using minimum density level estimation (Ester et al., 1996) based on a minimum threshold of 15 neighbours within 300m (epsilon). Violet dots refer to bike parking, violet lines are cycle lanes, and cycle infrastructure clusters are highlighted in pink.

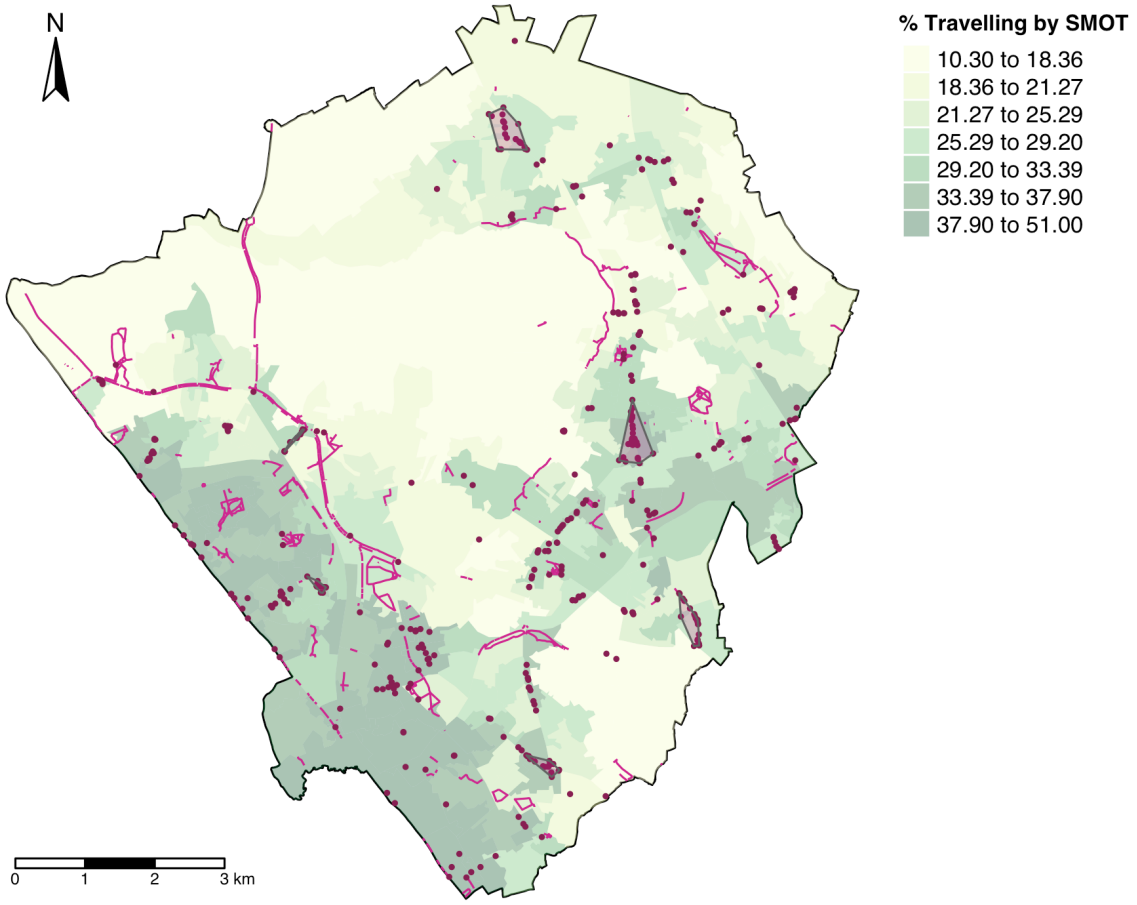
Many cycle infrastructure clusters overlap with areas of high SMOT usage. In other areas with high usage of SMOT, there are also ample cycle infrastructures (even if it does not form a cluster under the DBSCAN conditions). However, the biggest cluster in Northwest Newham overlaps with an area with low usage of SMOT. It's likely an anomaly as the area is largely occupied by Queen Elizabeth Olympic Park, hence explaining the large amount of cycling infrastructure and low usage of SMOT.

Cycle Infrastructure Clustering in Newham, 2021



Map 9 examines the availability of cycling infrastructure in Barnet's case using DBSCAN. It is evident that Barnet has much fewer (and smaller) cycling infrastructure clusters compared to Newham. That said, the cycling infrastructures and clusters mostly overlap with areas with high usage of SMOT.

Cycle Infrastructure Clustering in Barnet, 2021



CONCLUSION

Visually, there is a positive relationship between accessibility to sustainable transport facilities and usage of SMOT, which suggests that the availability of sustainable transport facilities will encourage more people to use SMOT. This result has a policy implication that encourages improving access to public transportation and cycling infrastructures especially in the coldspots identified in map 2, with the condition that such improvements make financial and geographical sense.

That said, this atlas has two main limitations to be taken into consideration. First, the data used in this study is from Census 2021, which is obtained during the COVID-19 pandemic. This may impact how people travel to work, and who travels to work (the WFH population is ignored in this study).

Second, this atlas is only a visual analysis of how usage of SMOT may be related to accessibility to sustainable transport facilities and does not use other statistical methods to test for correlation.

Nonetheless, this atlas identifies hotspots and coldspots of usage of SMOT, and how various sustainable transport facilities relate to the usage of SMOT on LSOA level.

BIBLIOGRAPHY

Bivand, R.S. and Wong, D.W. (2018). Comparing implementations of global and local indicators of spatial association. *Test, 27(3)*, pp.716-748.

Department for Transport (2023). *£200 million to improve walking and cycling routes and boost local economies.* [online] GOV.UK. Available at: https://www.gov.uk/government/news/200-million-to-improve-walking-and-cycling-routes-and-boost-local-economies [Accessed 20 Apr. 2023].

De Sa, E. and Ardern, C.I. (2014). Neighbourhood walkability, leisure-time and transport-related physical activity in a mixed urban–rural area. *PeerJ, 2*, pp. 440.

De Smith, M.J., Goodchild, M.F. and Longley, P. (2007). Geospatial analysis: a comprehensive guide to principles, techniques and software tools. Troubador publishing ltd.

Ester, M., Kriegel, H.P., Sander, J. and Xu, X. (1996). A density-based algorithm for discovering clusters in large spatial databases with noise. *In kdd Vol. 96*, No. 34, pp. 226-231.

Getis, A., 2007. Reflections on spatial autocorrelation. *Regional Science and Urban Economics*, 37(4), pp.491-496.

Mayor of London (2017). *What is the Mayor doing to improve transport in London?* [online] London City Hall. Available at: https://www.london.gov.uk/city-hall-blog/what-mayor-doing-improve-transport-london-0 [Accessed 20 Apr. 2023].

Shaheen, S. and Chan, N., 2016. Mobility and the sharing economy: Potential to facilitate the first-and last-mile public transit connections. *Built Environment*, 42(4), pp.573-588.

Transport for London (TFL) (n.d.). *Planning with WebCAT.* [online] Transport for London. Available at: https://tfl.gov.uk/info-for/urban-planning-and-construction/planning-applications/planning-with-webcat.

Transport for London (TFL) (n.d.). *ULEZ Expansion 2023.* [online] Transport for London. Available at: https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/ulez-expansion-2023#:~:text=If%20you%20drive%20anywhere%20within [Accessed 22 Apr. 2023].