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LIVERPOOL



Geographic
Data Science
Lab



LIVERPOOL
CITY REGION
COMBINED AUTHORITY

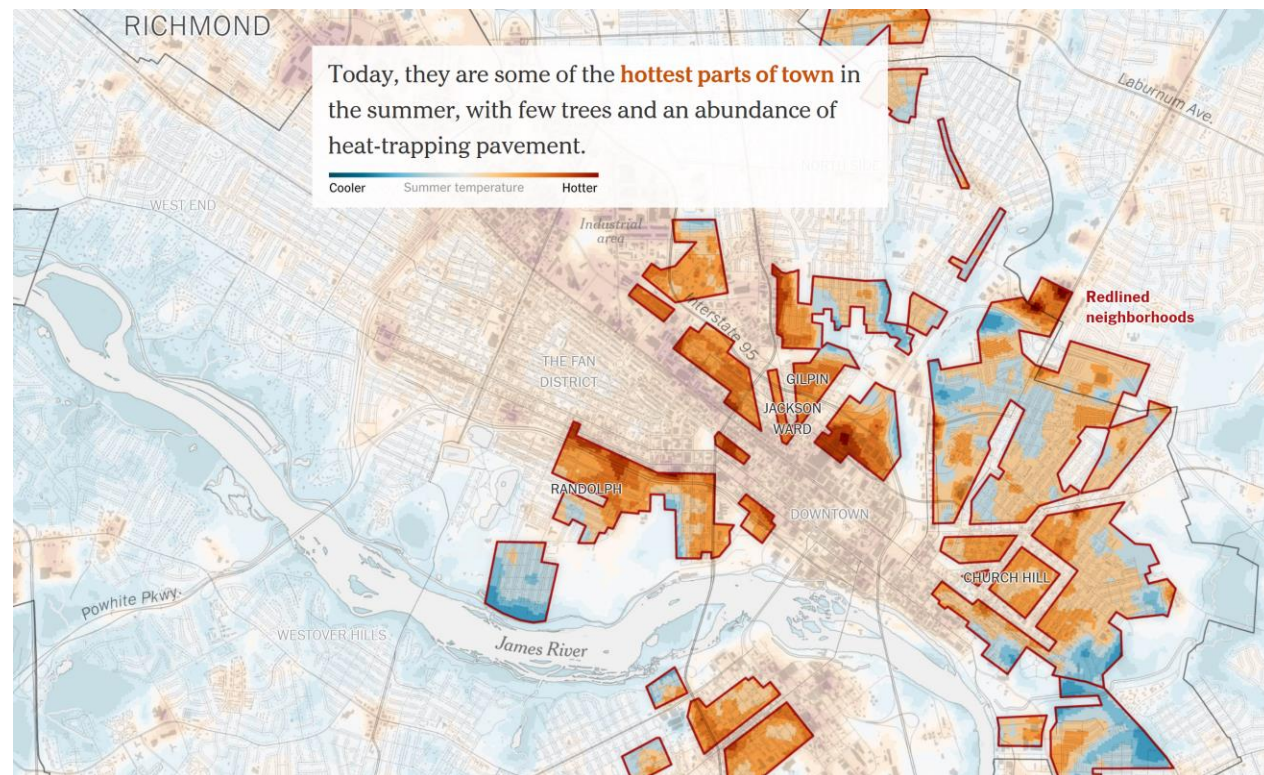
The
Alan Turing
Institute

Exploring inequalities in human spatial behaviours using new forms of mobility data

Alessia Calafiore

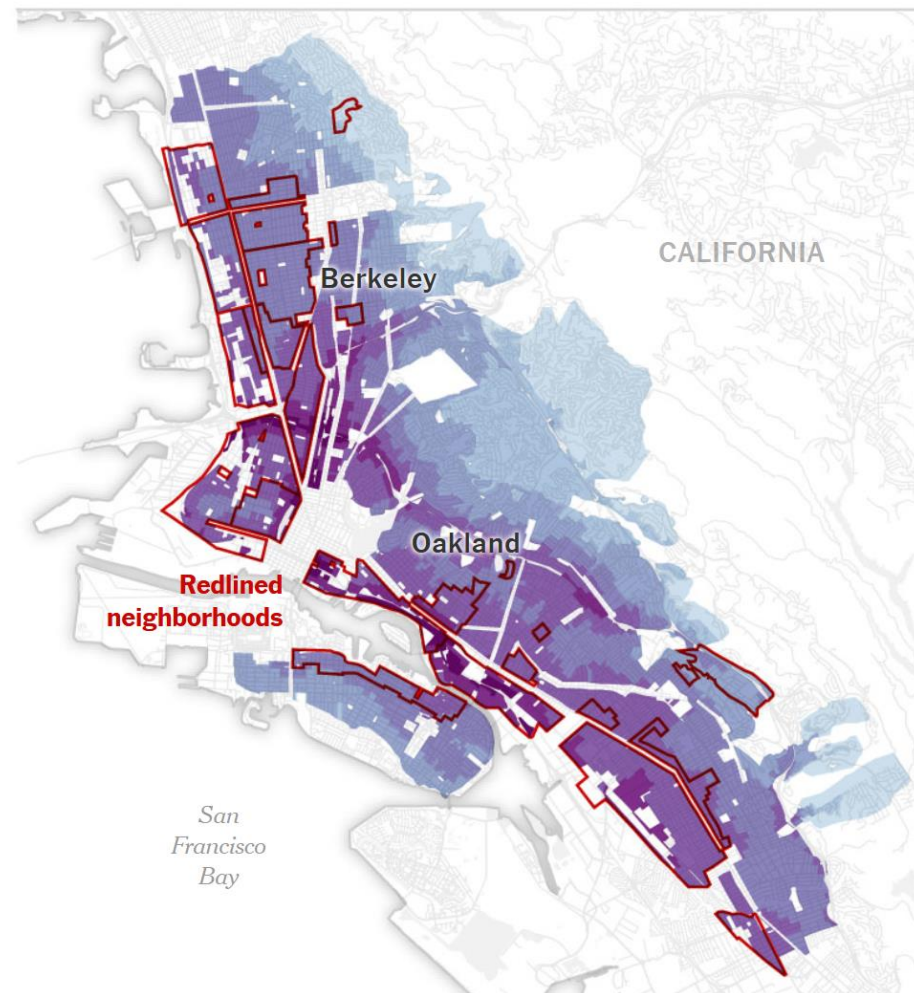
Lecturer in Urban Data Science and Sustainability
University of Edinburgh

Urban Inequalities



Nitrogen dioxide pollution, 2010

0 p.p.b. More → 20 p.p.b.



The New York Times



Green Infrastructure
Amenities
Urban density/sprawl

**Built
Environment**



Urban Issues

Air Pollution
Heat islands effect
Car dependence



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HOME



9:00 AM



11:00 AM



2:00 PM

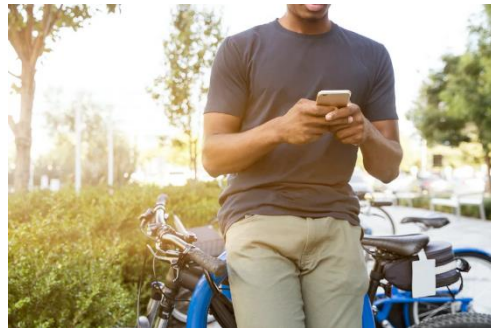


5:00 PM





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Human Mobility and New Forms of Data

Spectus.ai

anonymised trajectory data

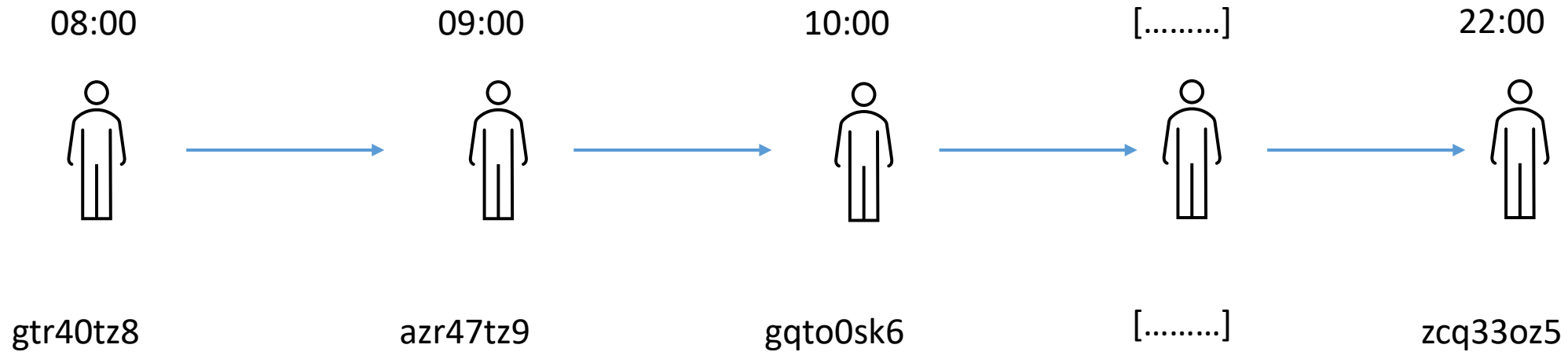
Anonymised **GPS trajectories** collected from mobile phone apps in **2019** in **Great Britain**.

All data is collected from **opted-in users** who provided informed consent for anonymised data collection for research purposes under a GDPR framework.

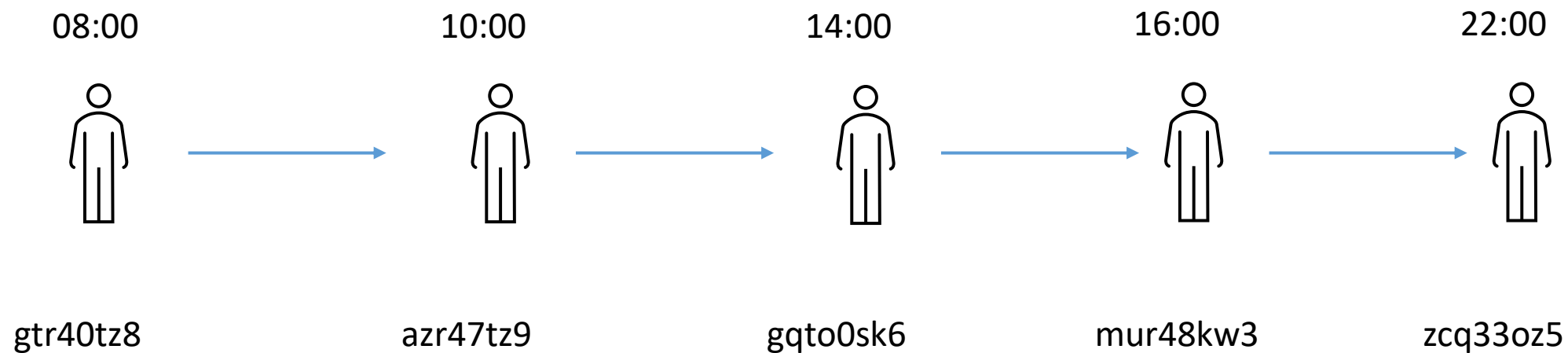
Spectus.ai pre-processes the data to identify approximated privacy preserving **home and work locations**, as well as **stops** using geohash.

A **stop** is a collection of locations aggregated to obtain a single stop entity with **one space referent** and **dwell time**.

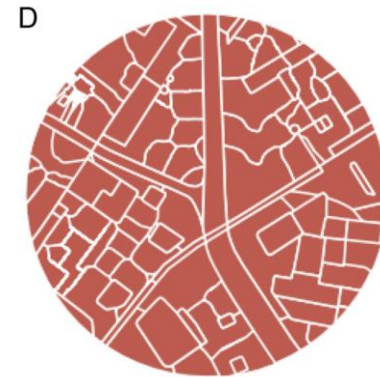
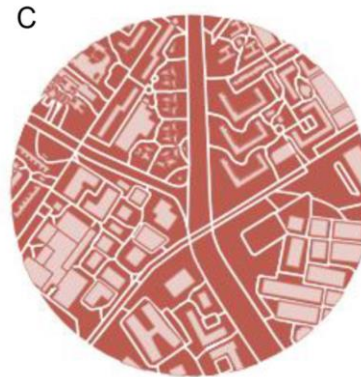
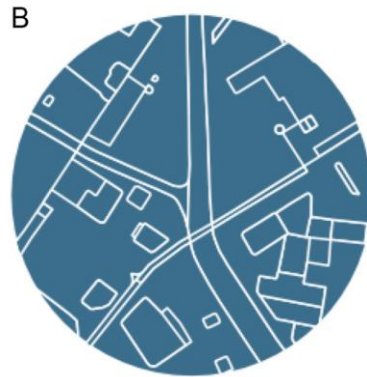
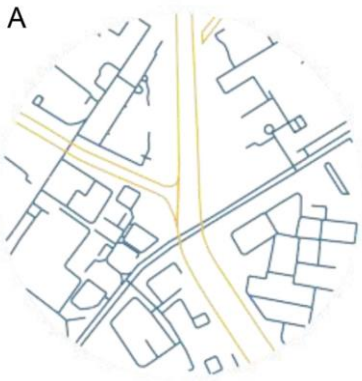
Space and Time



Context



Enclosed Tessellations



Arribas-Bel, D. and Fleischmann, M., 2022. Understanding (urban) spaces through form and function. *Habitat International*

Functional Signature

Input

146 variables

population, workplace
population, night light intensity,
types of amenities, land cover,
NDVI, accessibility to retail and
services and presence of listed
buildings

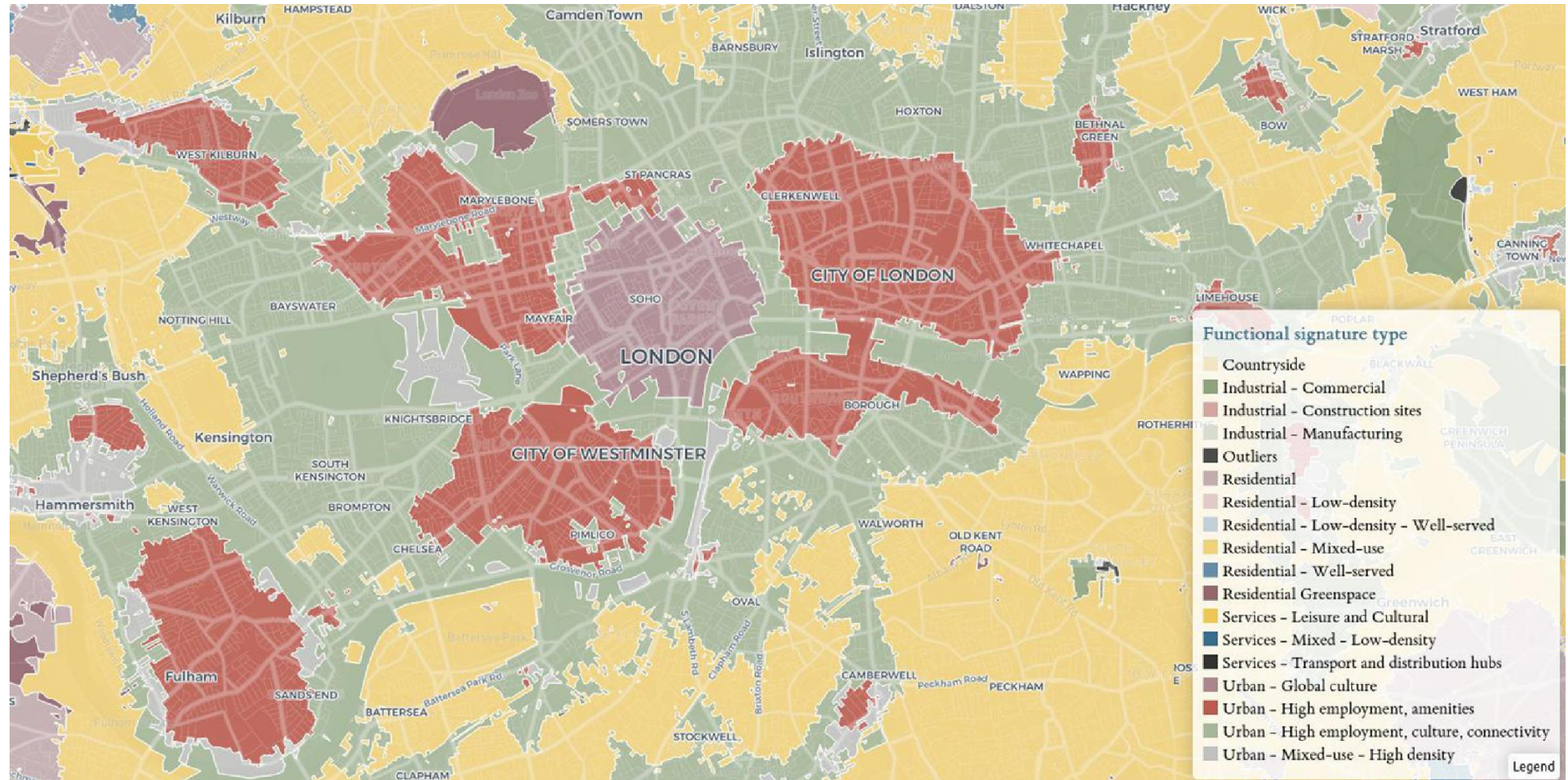
Clustering

3 iterations of k-means

Output

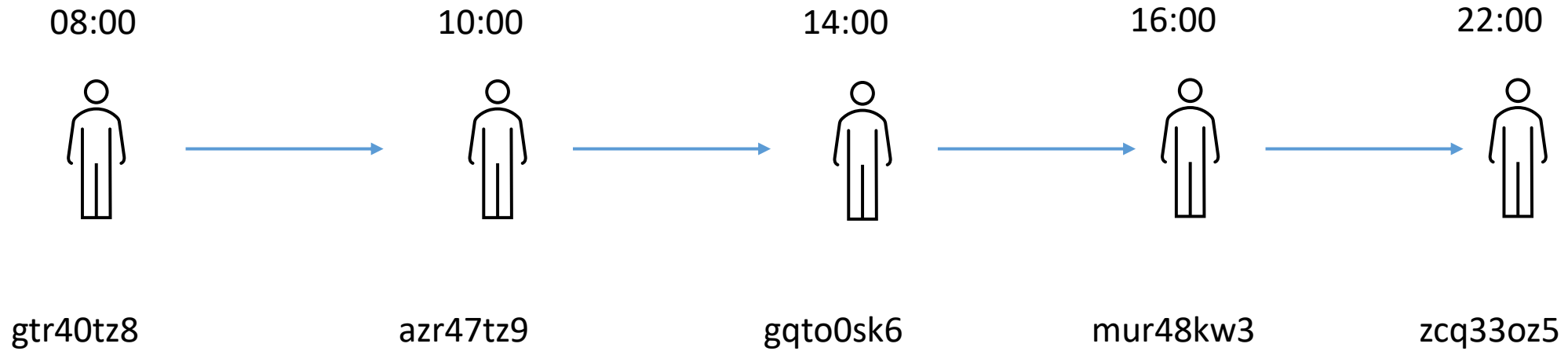
Area-based classification

5 types
16 sub-types



Samardzhiev, K., Fleischmann, M., Arribas-Bel, D., Calafiore, A. and Rowe, F., 2022. Functional signatures in Great Britain: A dataset. *Data in brief*, 43

Context



Countryside

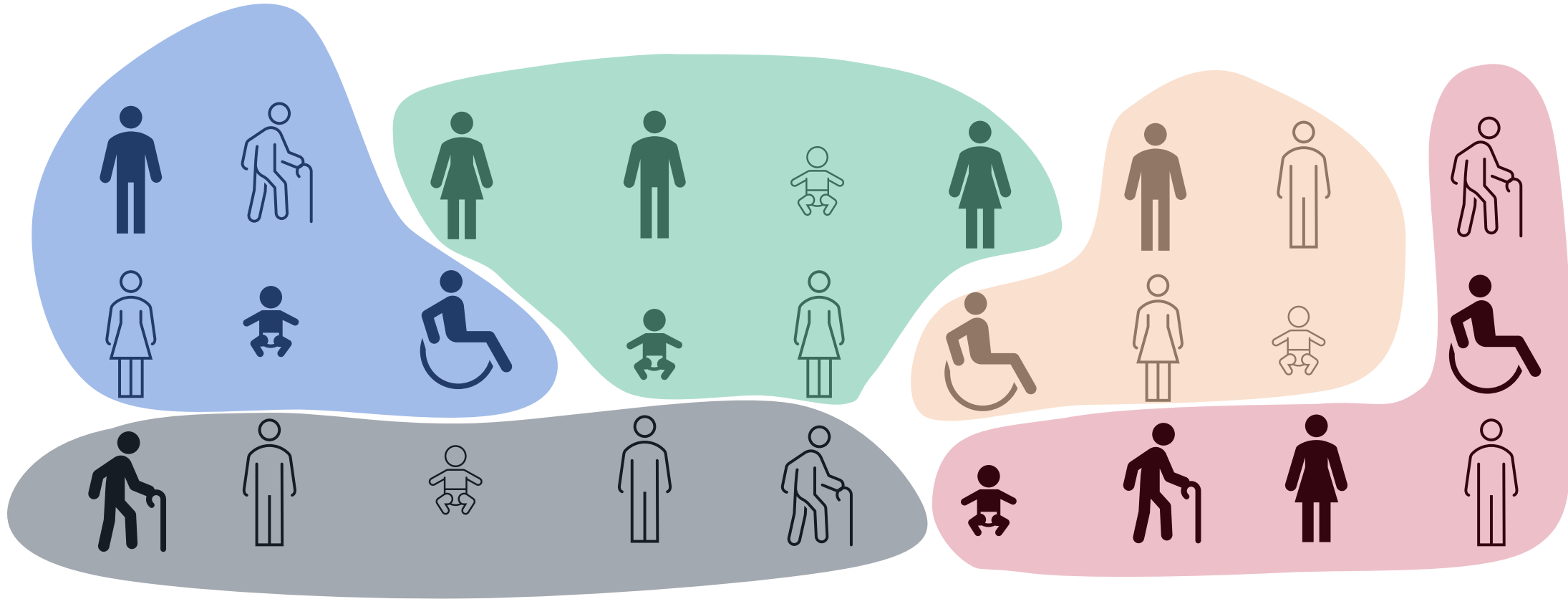
Services
Transport Hub

Urban
Mixed-use
High density

Services
Mixed-use
Low density

Countryside

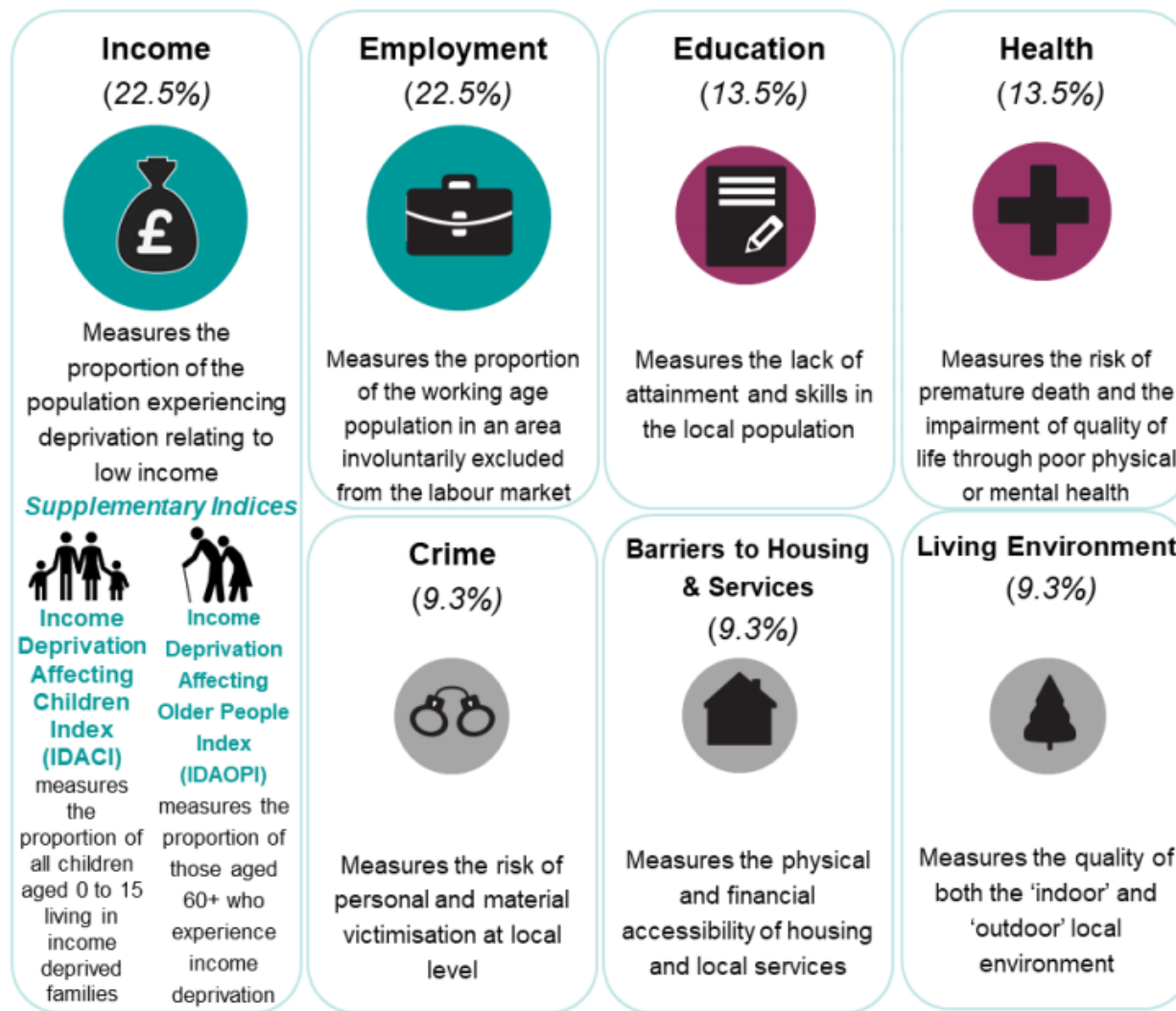
Diversity



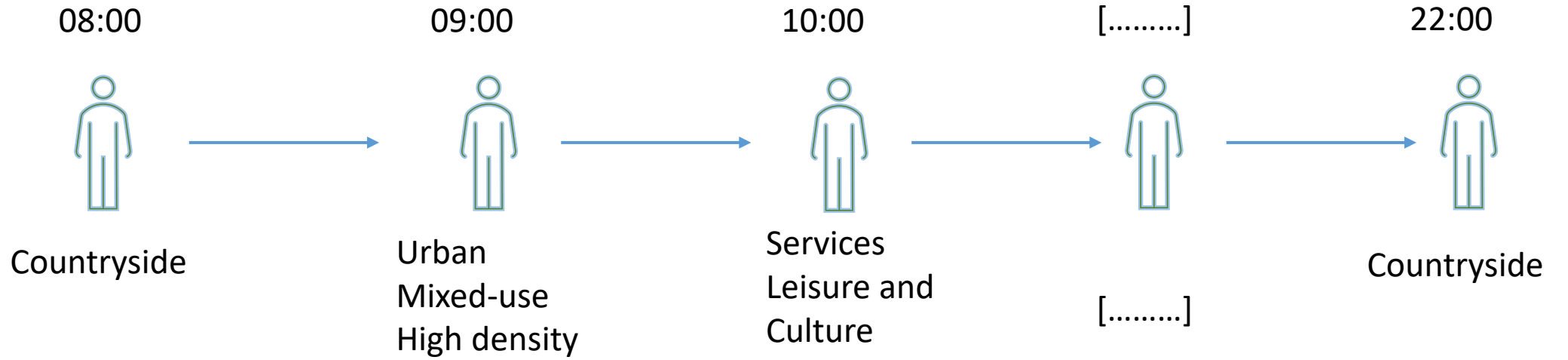
index of multiple deprivation

ranges from 1 [most deprived] to 10 [least deprived]

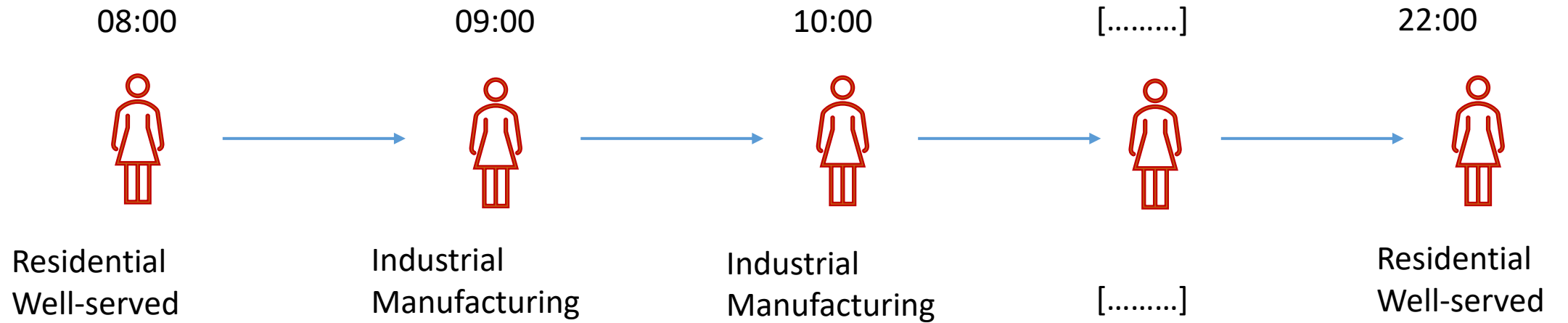
There are 7 domains of deprivation, which combine to create the Index of Multiple Deprivation (IMD2019):



IMD 10

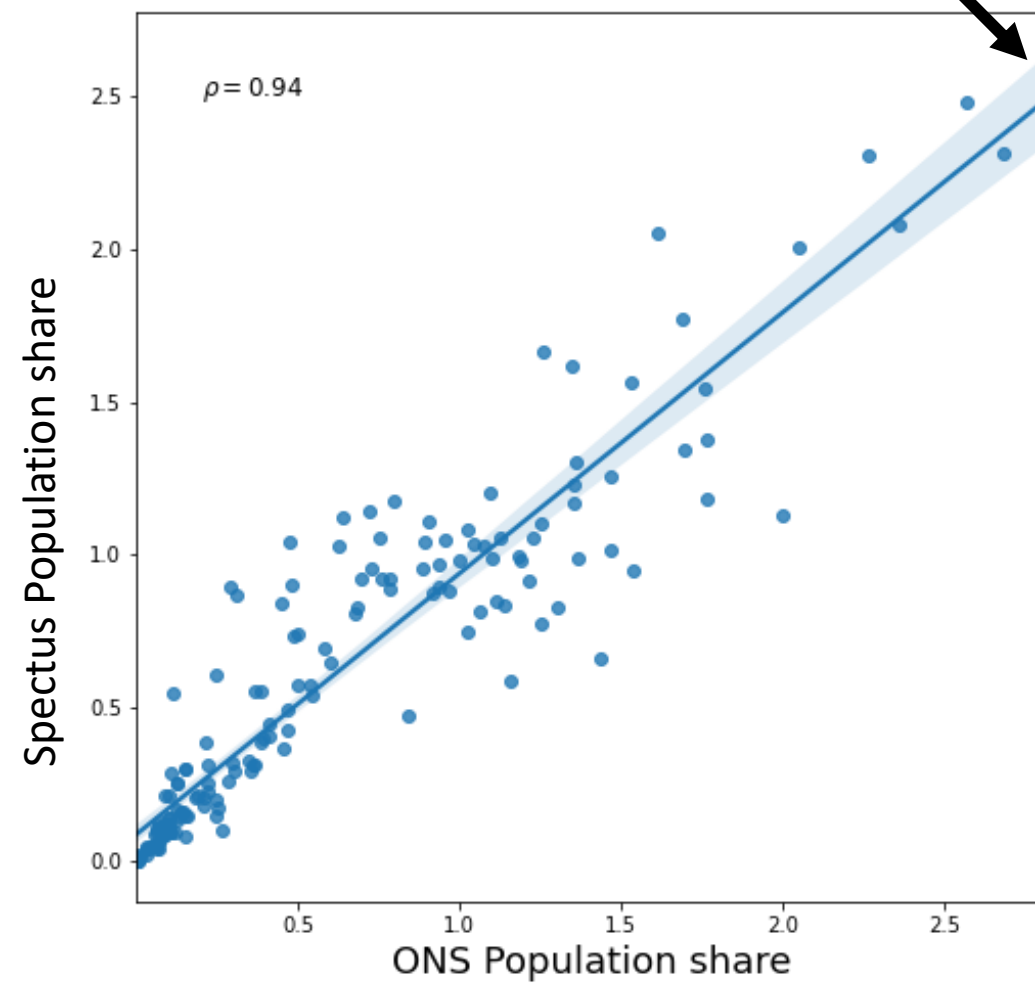


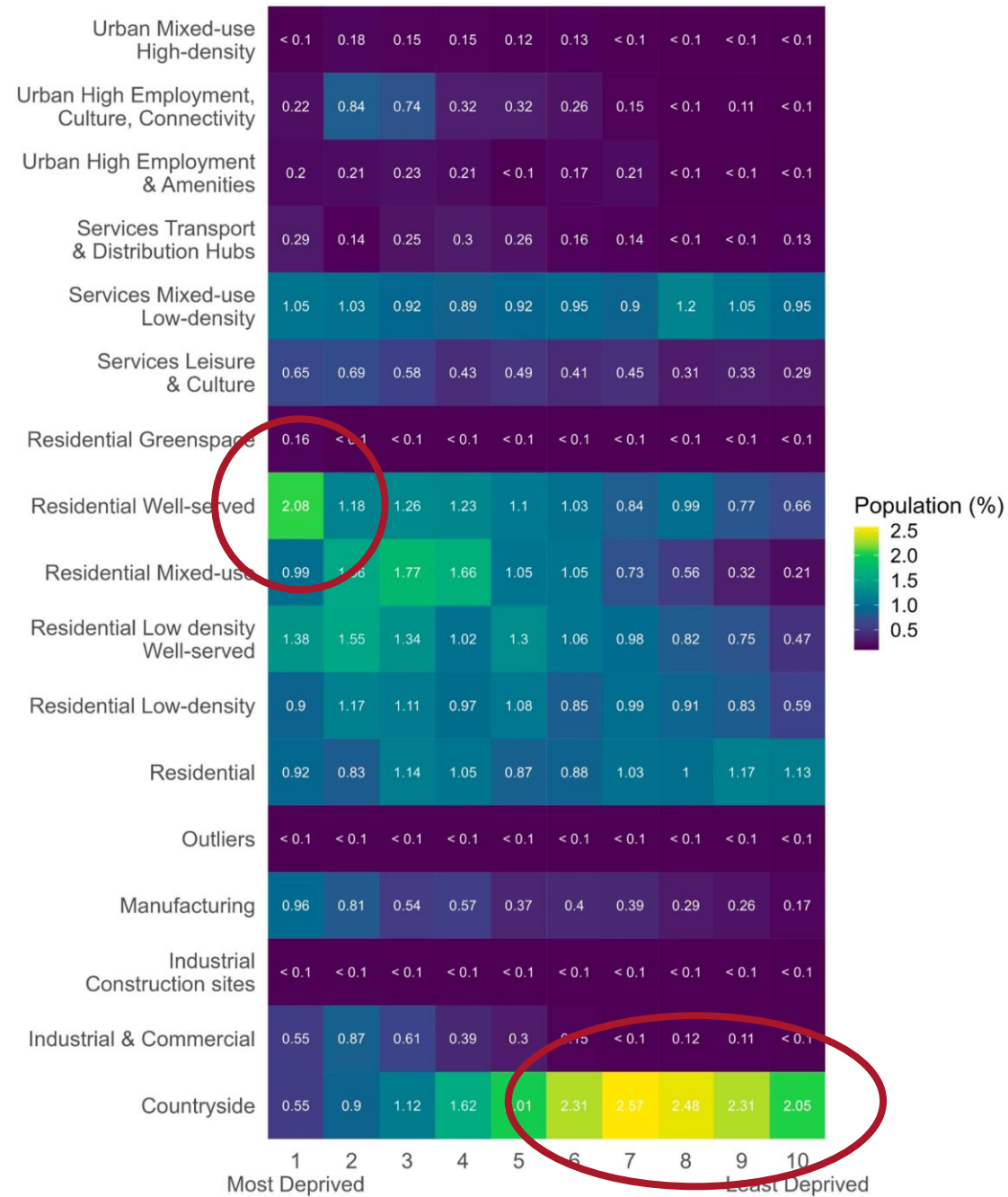
IMD 1



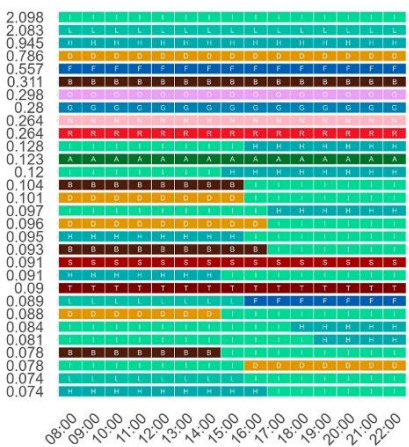


Countryside - IMD 7
(2.8,2.6)

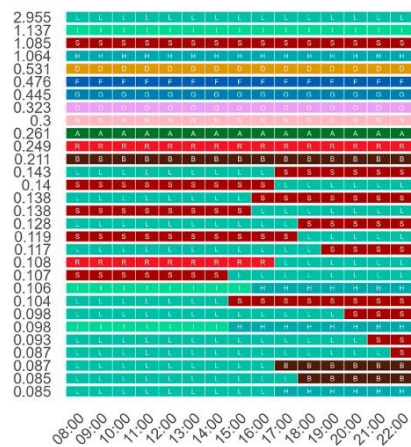




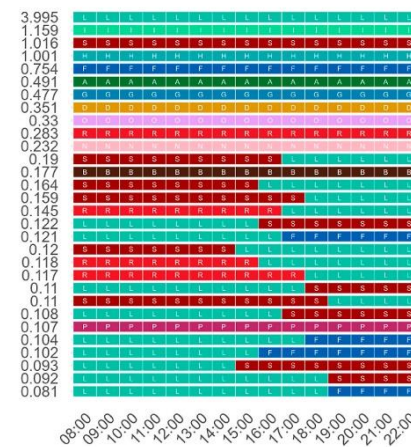
IMD 1 Group



IMD 2 Group



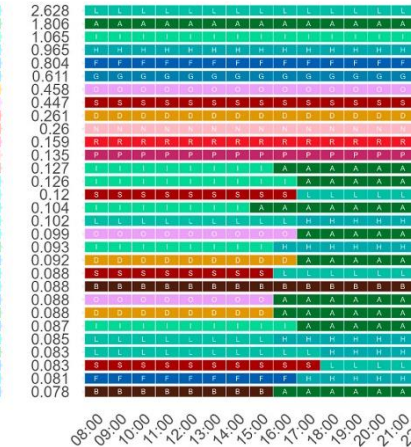
IMD 3 Group



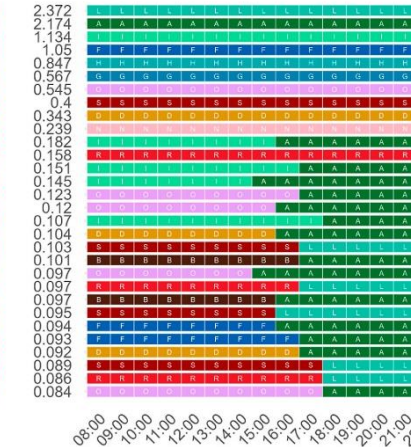
IMD 4 Group



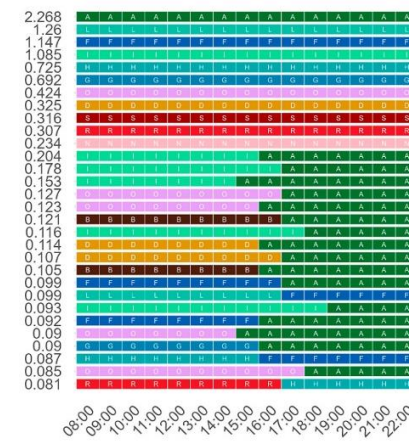
IMD 5 Group



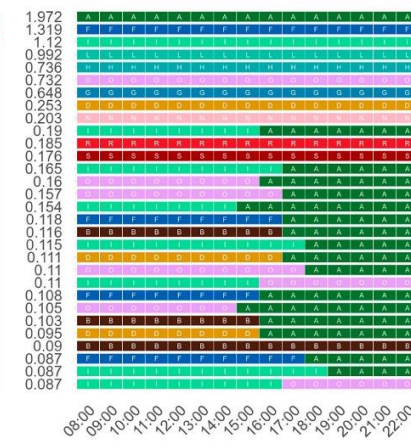
IMD 6 Group



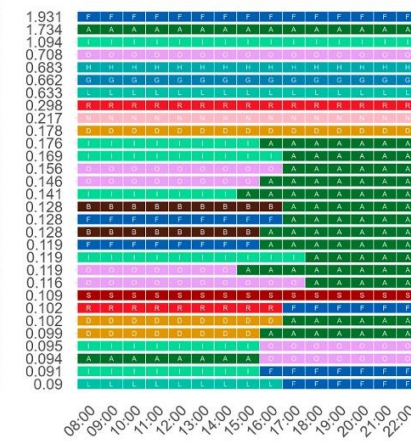
IMD 7 Group



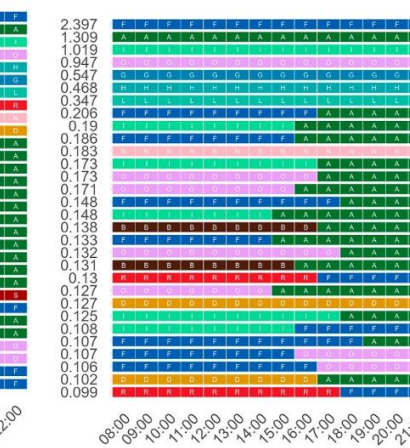
IMD 8 Group



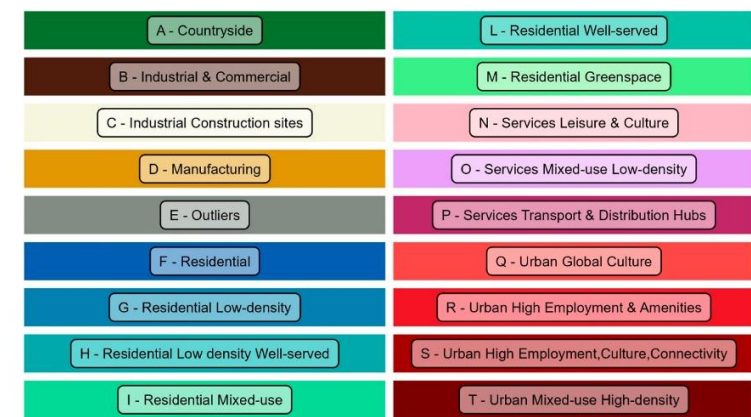
IMD 9 Group

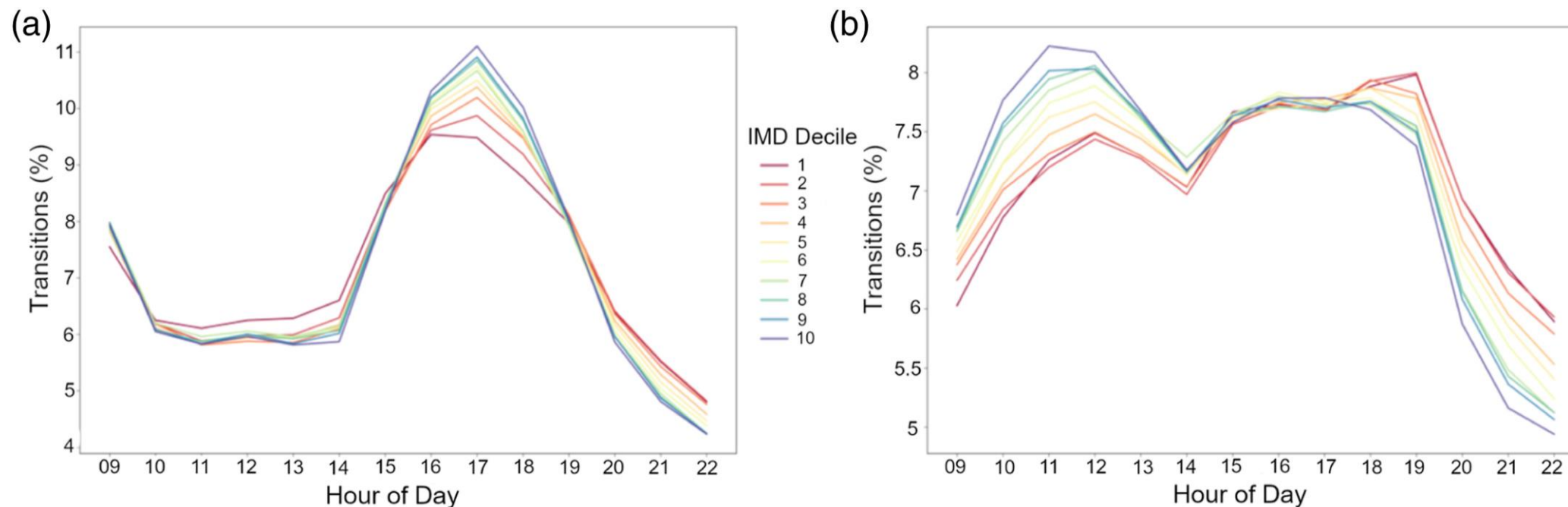


IMD 10 Group

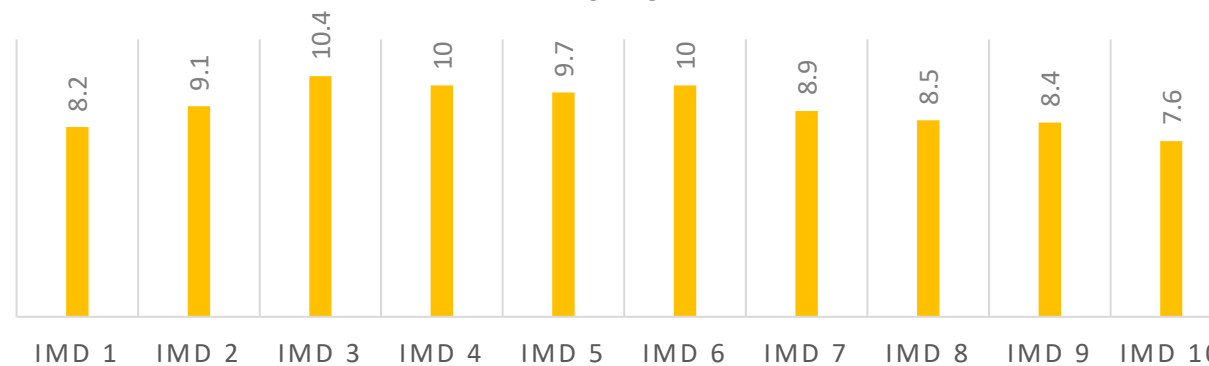


Legend



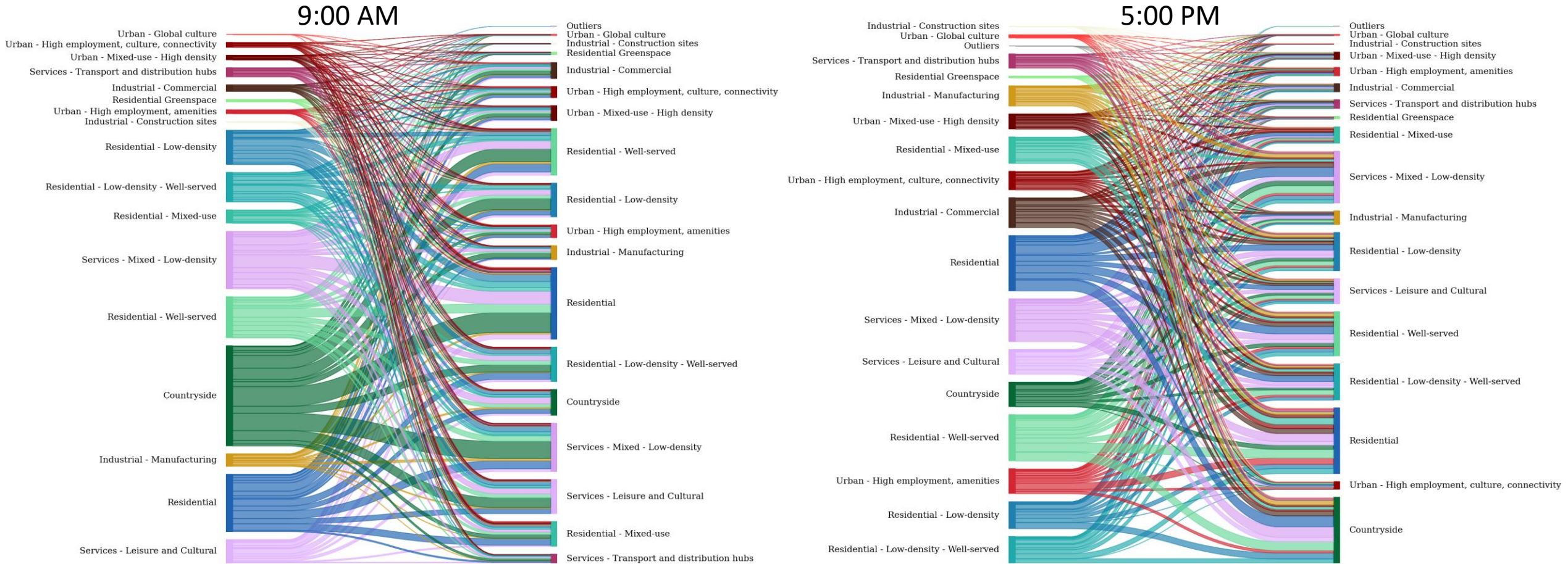


SEQUENCES WITHOUT TRANSITIONS (%)



weekdays

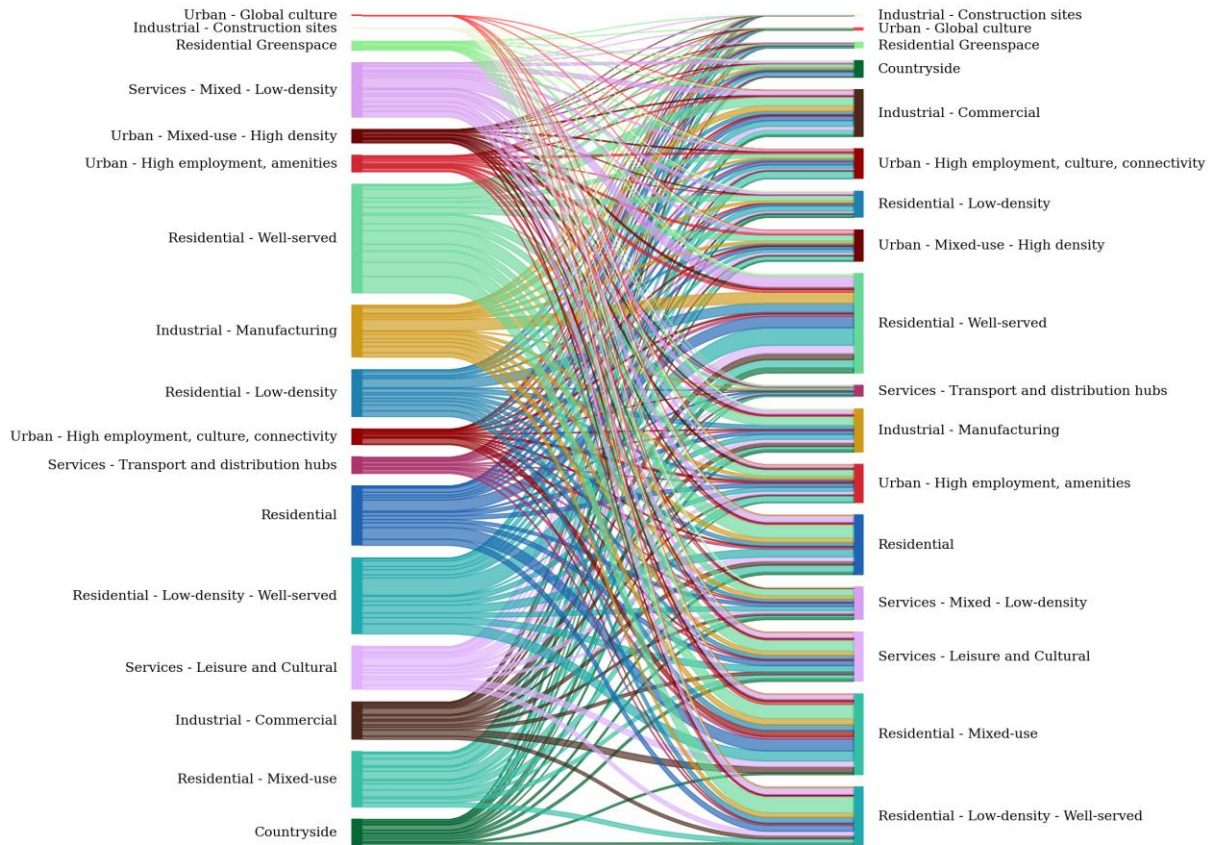
least deprived group



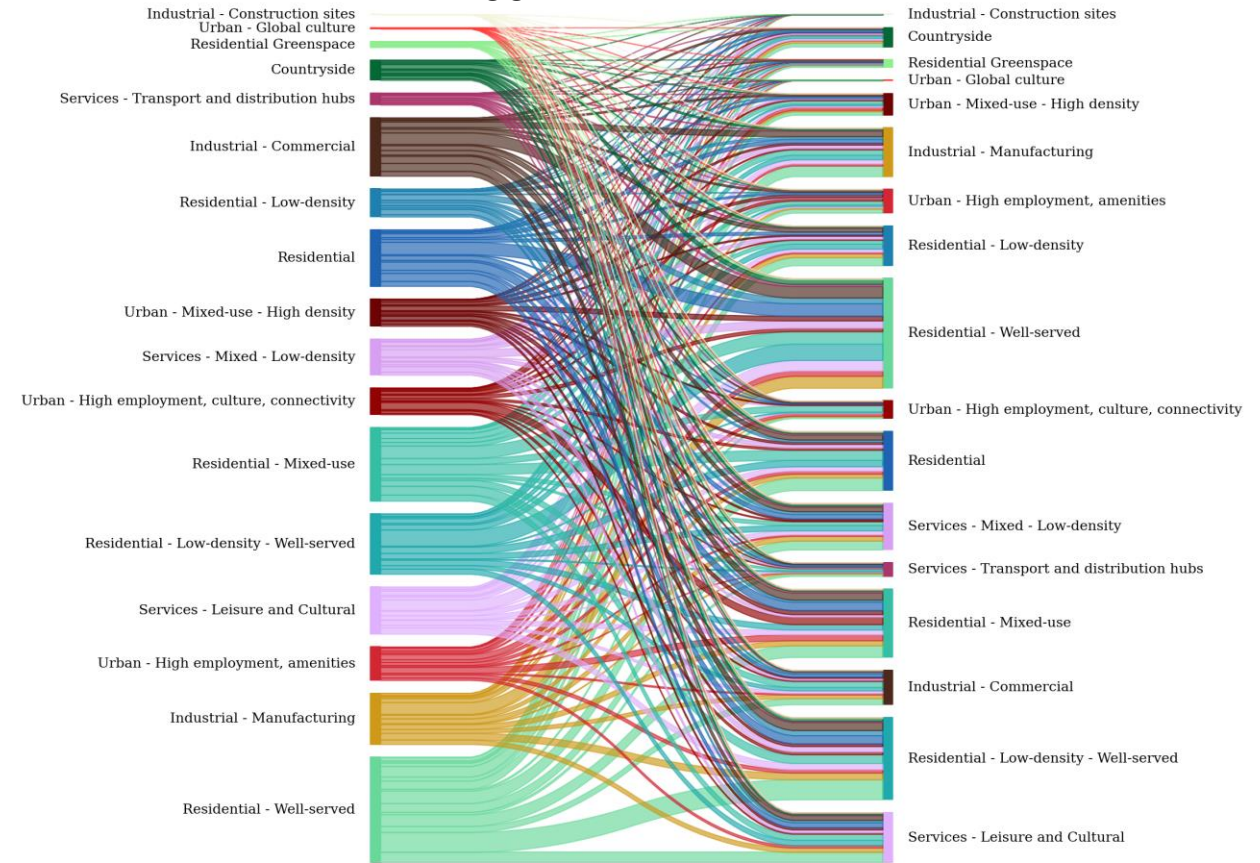
weekdays

most deprived group

9:00 AM



4:00 PM





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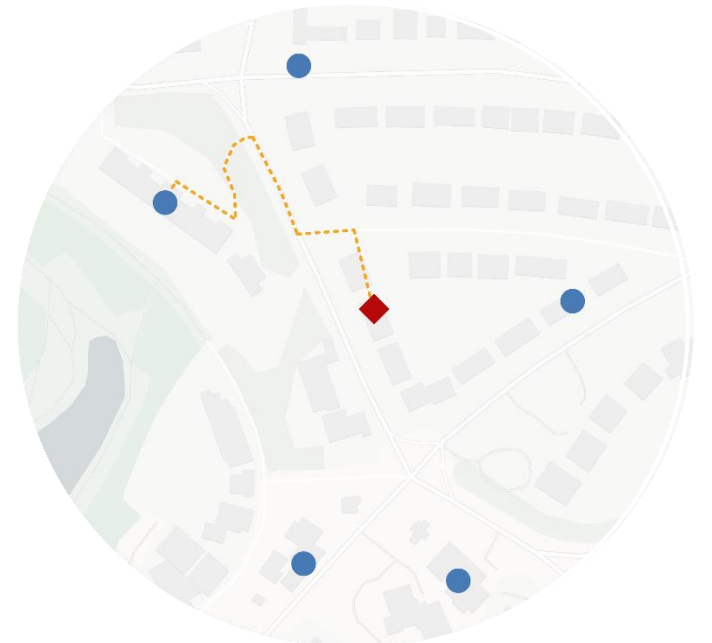
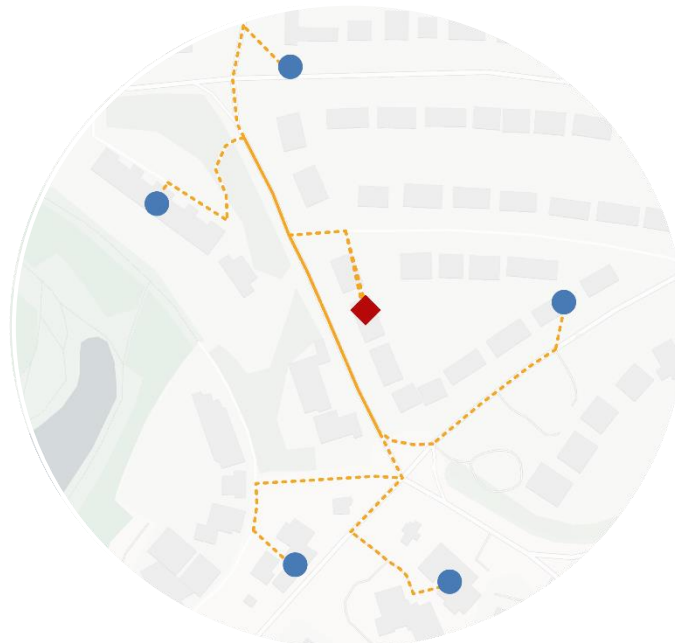
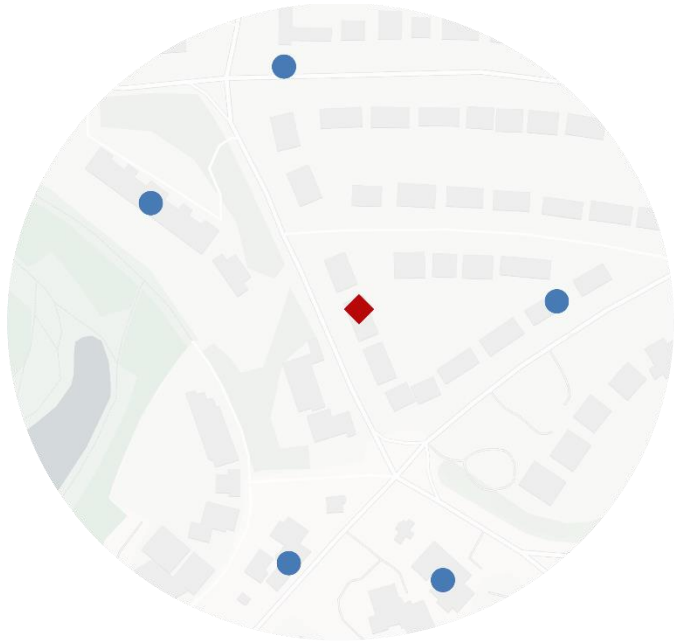
Accessibility, Air Pollution and Car dependence

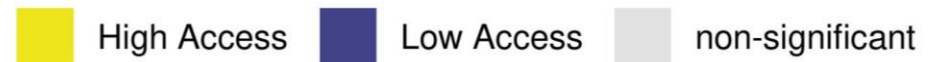
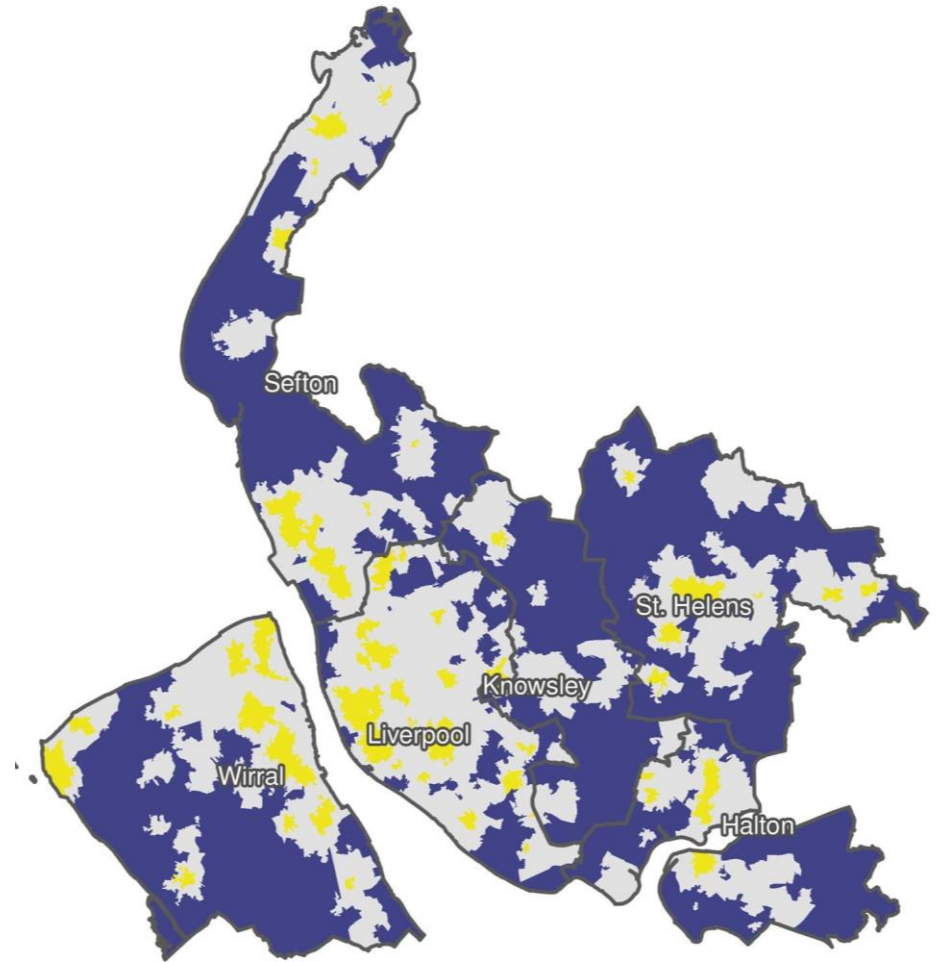
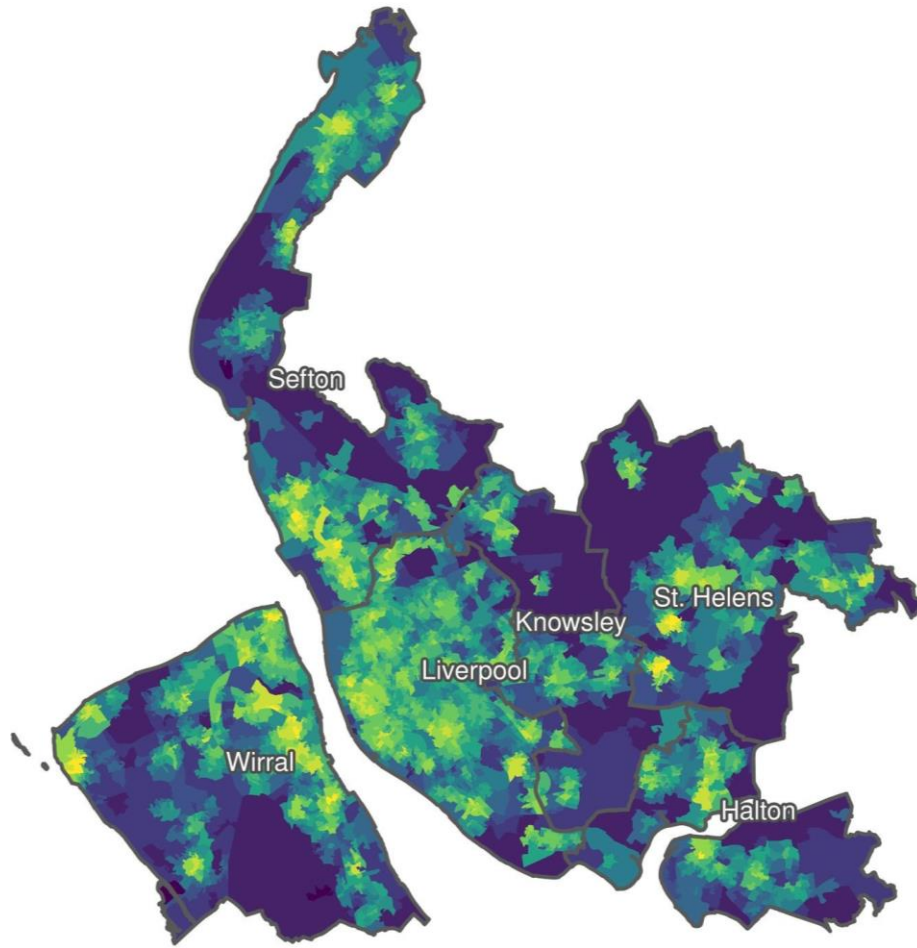


**Residents' most basic needs can be met
within a 20-minute round trip from home
with sustainable transportation modes
(walk, cycle, public transit)**

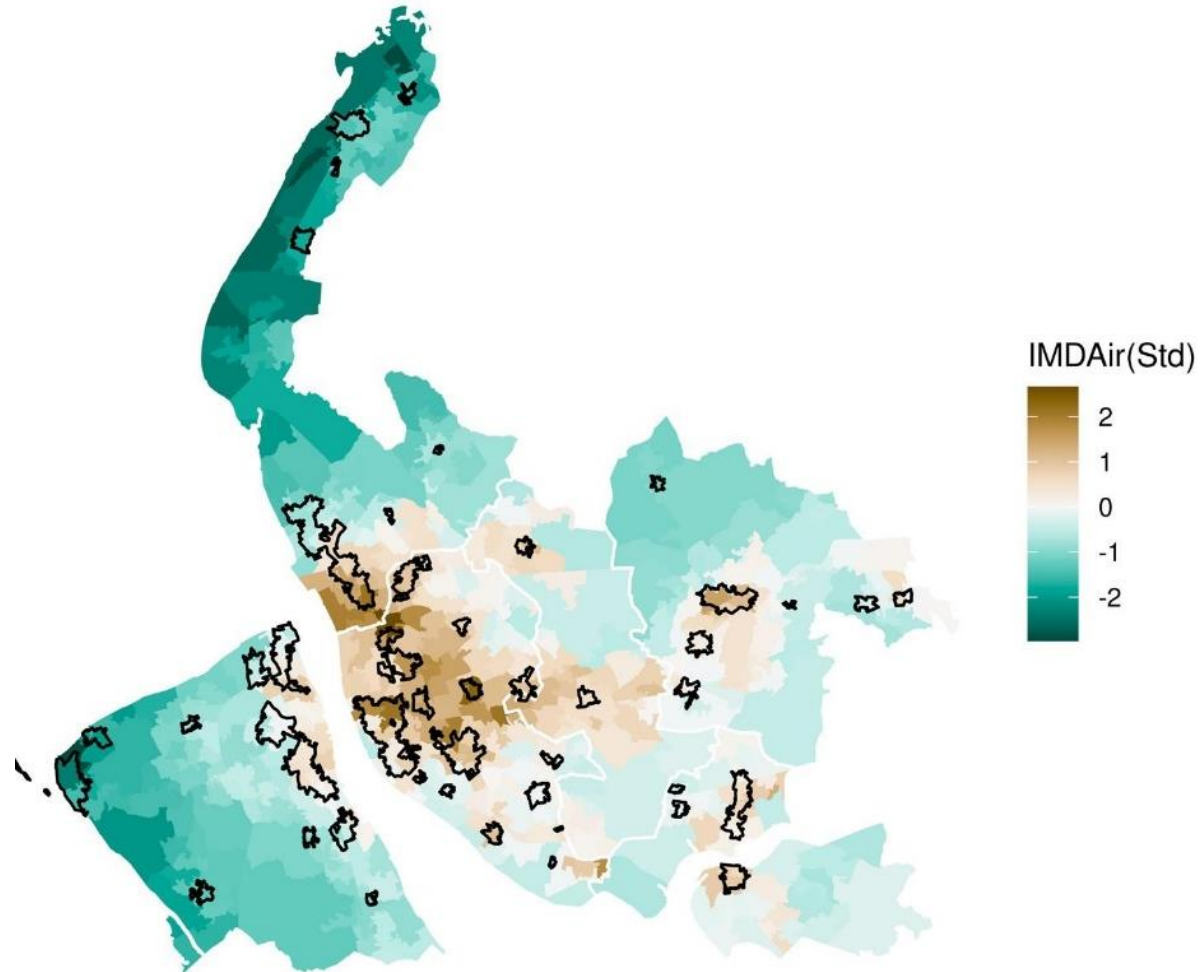


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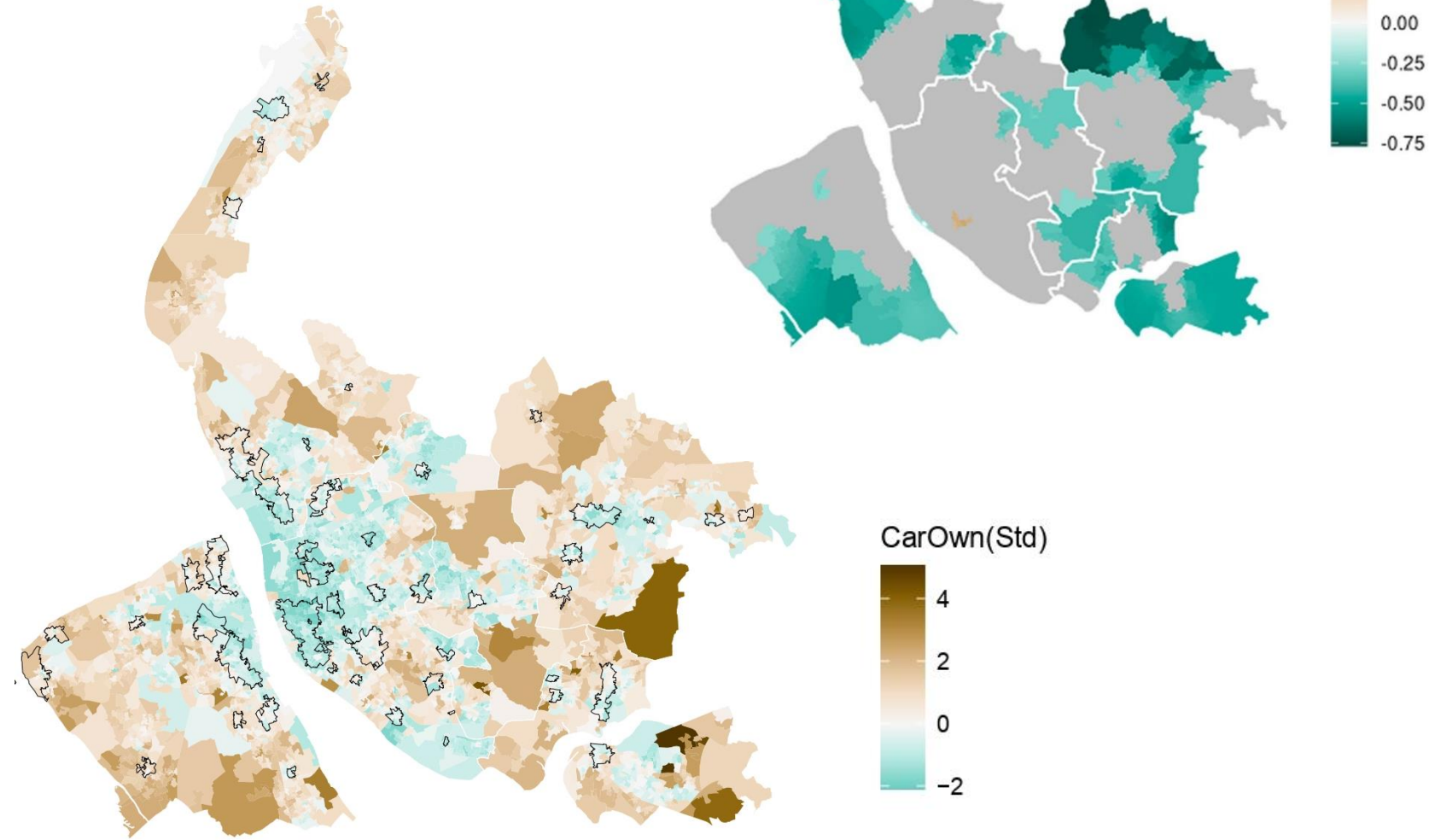




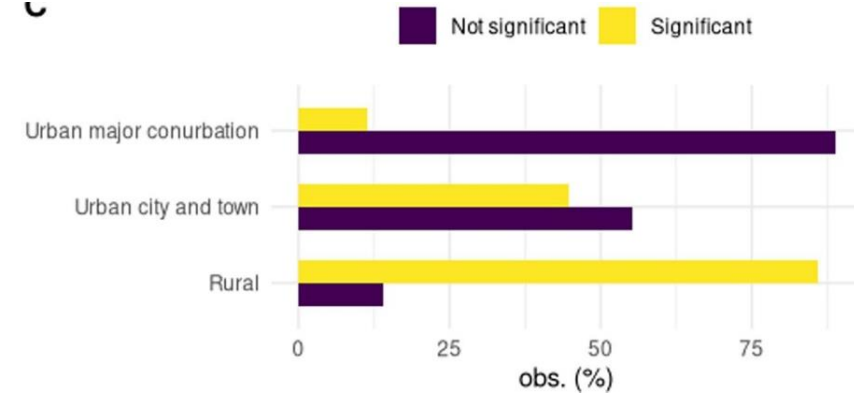
Air Pollution



Car Ownership



c



Car Dependence

- **Less deprived** groups tend to live and commute from and to the **countryside/low-density** signatures
- **Rural areas** have **higher car-ownership** and **car dependence**

Rural-Urban connections with sustainable transportation modes, i.e. mass transit



Work from home ?

- **More deprived** groups tend to live and be more exposed to **urban/well served** signatures throughout the day
- **Air pollution** tends to concentrate in **urban and well served** areas

Role of urban green and Low-traffic Zones



New measures integrating mobility and accessibility



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To conclude...



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**The
Alan Turing
Institute**

MNERANT Team



Geographic
Data Science
Lab



Dani
Arribas-Bel



Alessia
Calafiore



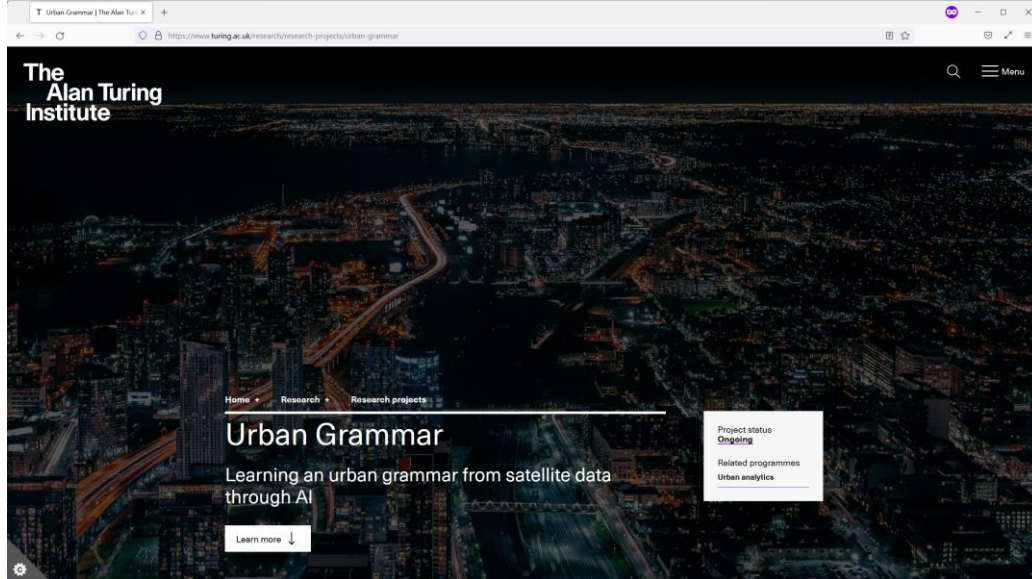
Martin
Fleischmann



Krasen
Samardzhiev



Francisco
Rowe



Data in Brief
Volume 43, August 2022, 108335



Data Article

Functional signatures in Great Britain: A dataset

Krasen Samardzhiev ^a  , Martin Fleischmann ^a , Daniel Arribas-Bel ^{a b} ,
Alessia Calafiore ^a , Francisco Rowe ^a 

Environment and Planning B: Urban Analytics and City Science

Impact Factor: 3.5
5-Year Impact Factor: 3.9

JOURNAL HOMEPAGE

SUBMIT PAPER

 Open access |   | Research article | First published online November 7, 2023

Inequalities in experiencing urban functions. An exploration of human digital (geo-)footprints

Alessia Calafiore  , Krasen Samardzhiev, [...], and Daniel Arribas-Bel   [View all authors and affiliations](#)

[OnlineFirst](#) | <https://doi.org/10.1177/23998083231208507>

 Contents

 PDF / ePub



RESEARCH ARTICLE |  Open Access |  

Urban exodus? Understanding human mobility in Britain during the COVID-19 pandemic using Meta-Facebook data

Francisco Rowe  Alessia Calafiore, Daniel Arribas-Bel, Krasen Samardzhiev, Martin Fleischmann

First published: 07 December 2022 | <https://doi.org/10.1002/psp.2637> | Citations: 2

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Transportation Research Part D: Transport and Environment

Volume 102, January 2022, 103111



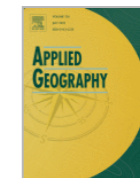
The 20-minute city: An equity analysis of Liverpool City Region

Alessia Calafiore   , Richard Dunning, Alex Nurse, Alex Singleton



Applied Geography

Volume 156, July 2023, 103005



Age and the 20-min city: Accounting for variation in mobility

Richard James Dunning^a   , Les Dolega^a  , Andrea Nasuto^a  , Alexander Nurse^a  ,
Alessia Calafiore^b 

Thanks for listening

Contacts

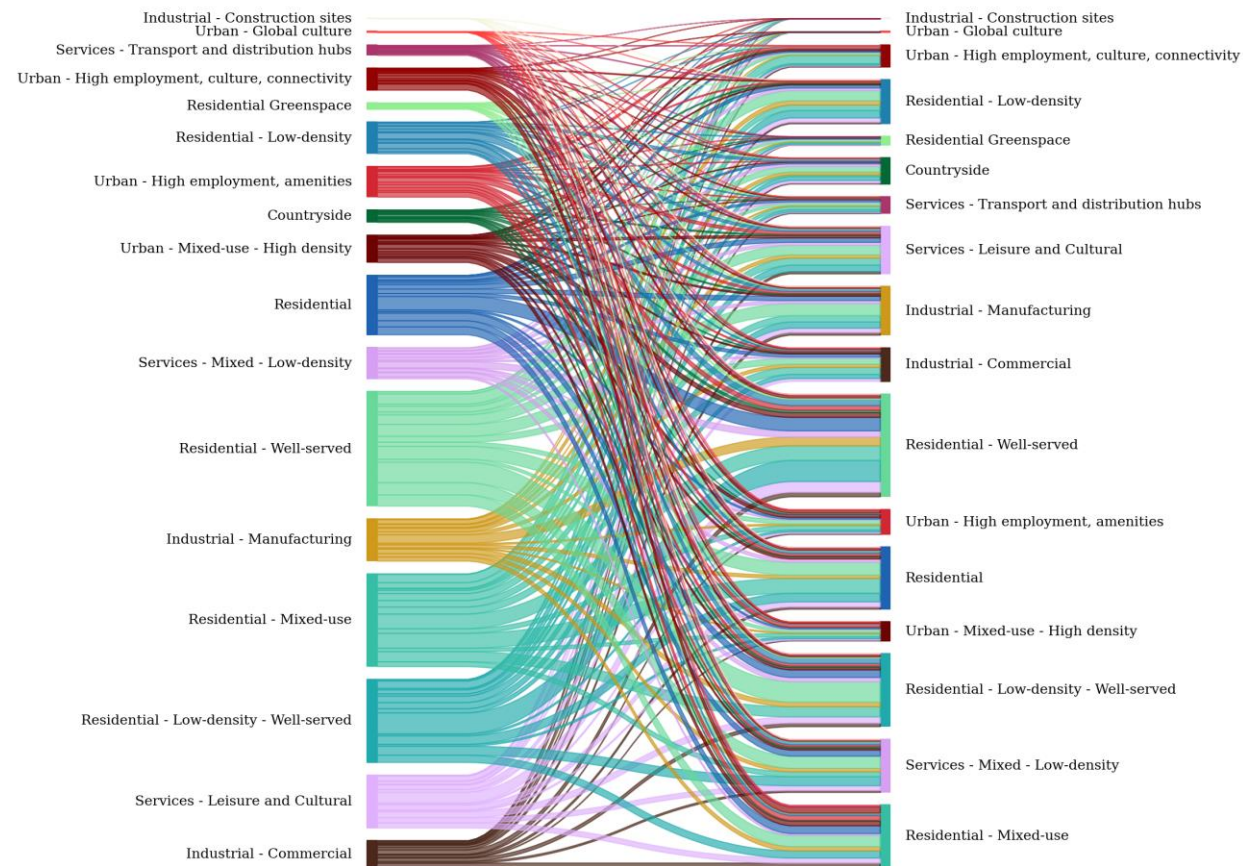
acalafio@ed.ac.uk

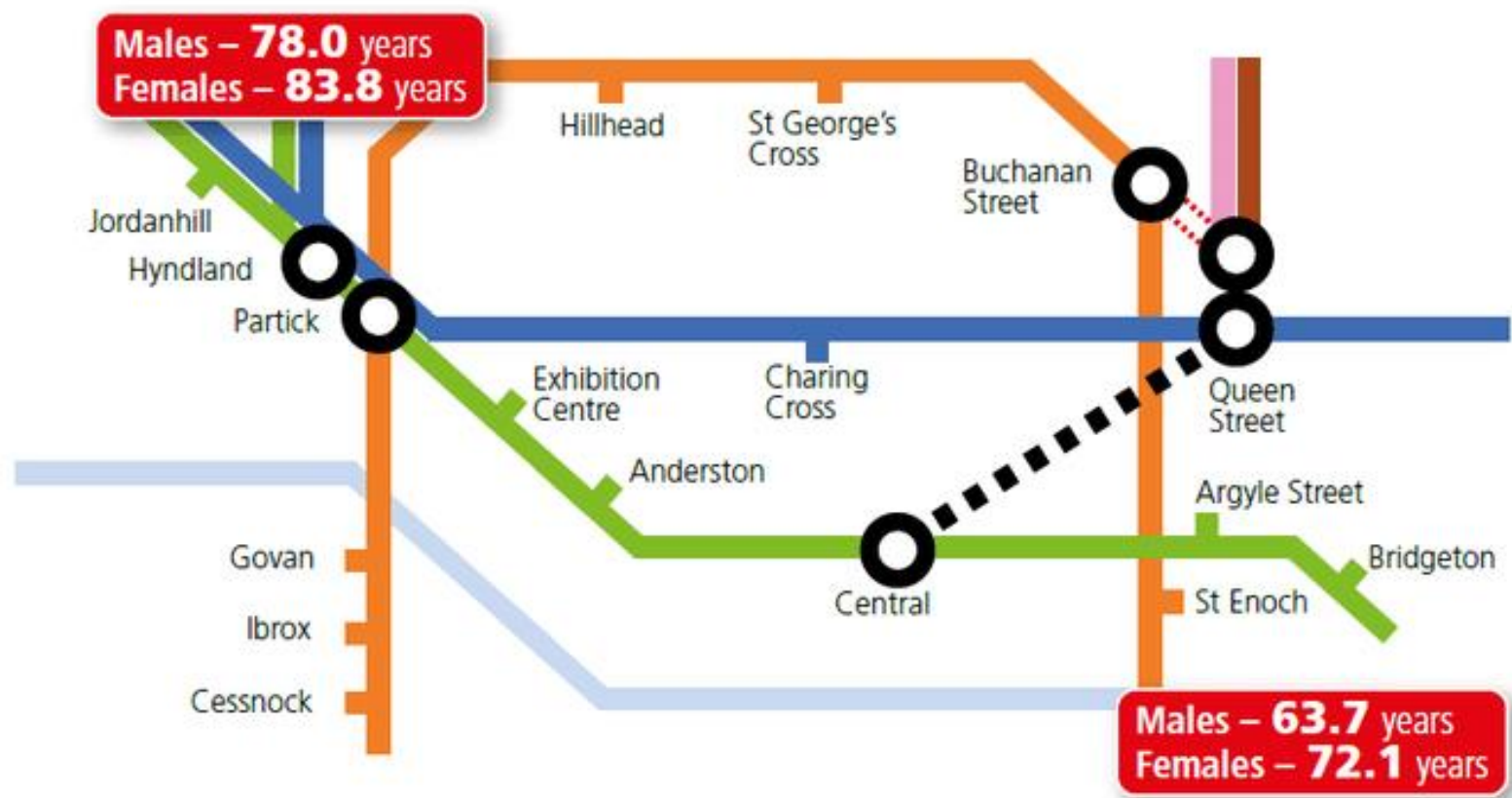
[@alel_domi](#)

[@alel@datasci.social](#)

least deprived group
late morning

most deprived group
late afternoon





Molony, E. and Duncan, C., 2016. Income, wealth and health inequalities—A Scottish social justice perspective. *AIMS Public Health*, 3(2), p.255.