

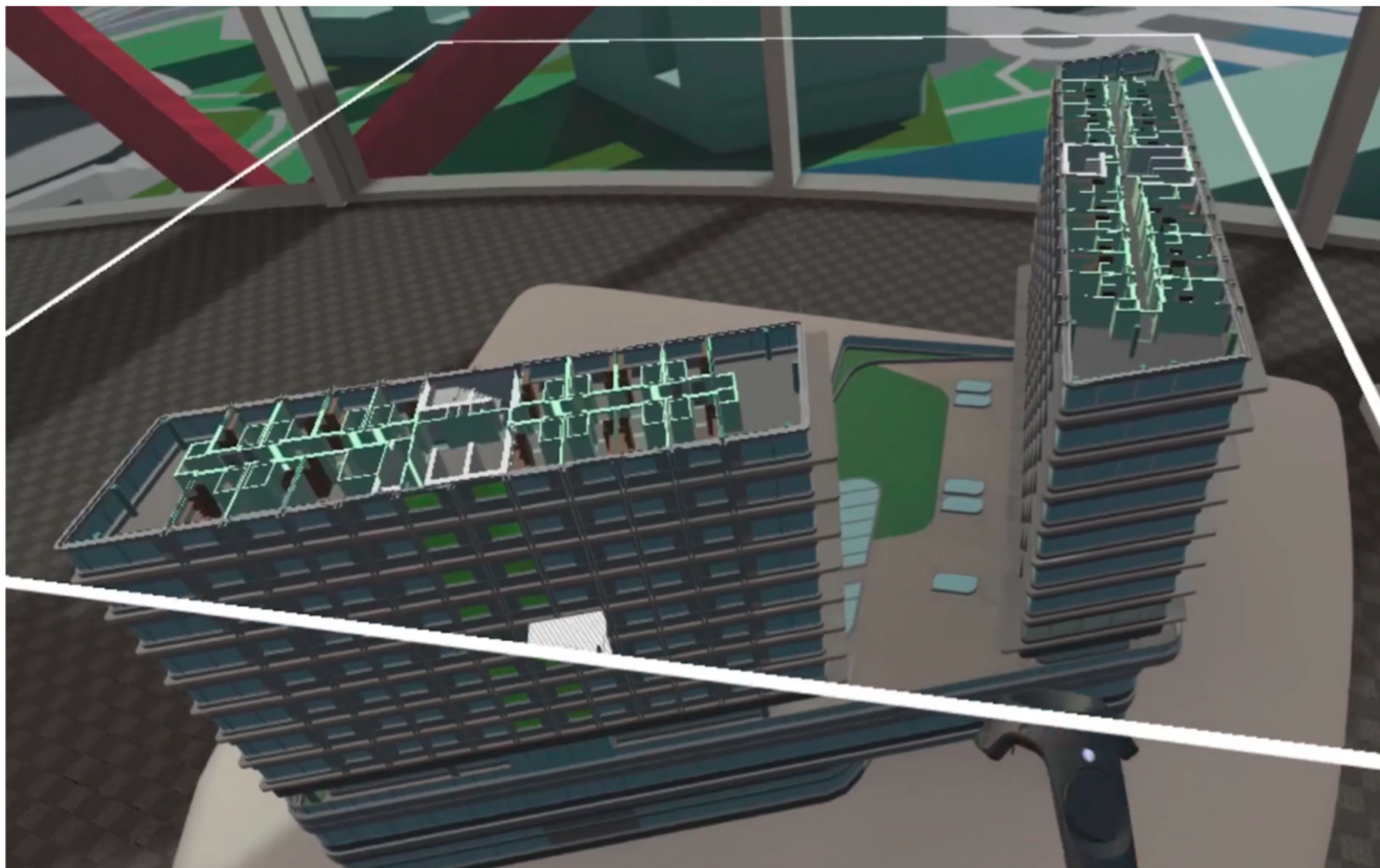


# Digital Twins and Smart Cities – high frequency data for long-term urban policy?

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The Bartlett Centre for Advanced Spatial Analysis (CASA) · University College London  
January 2020

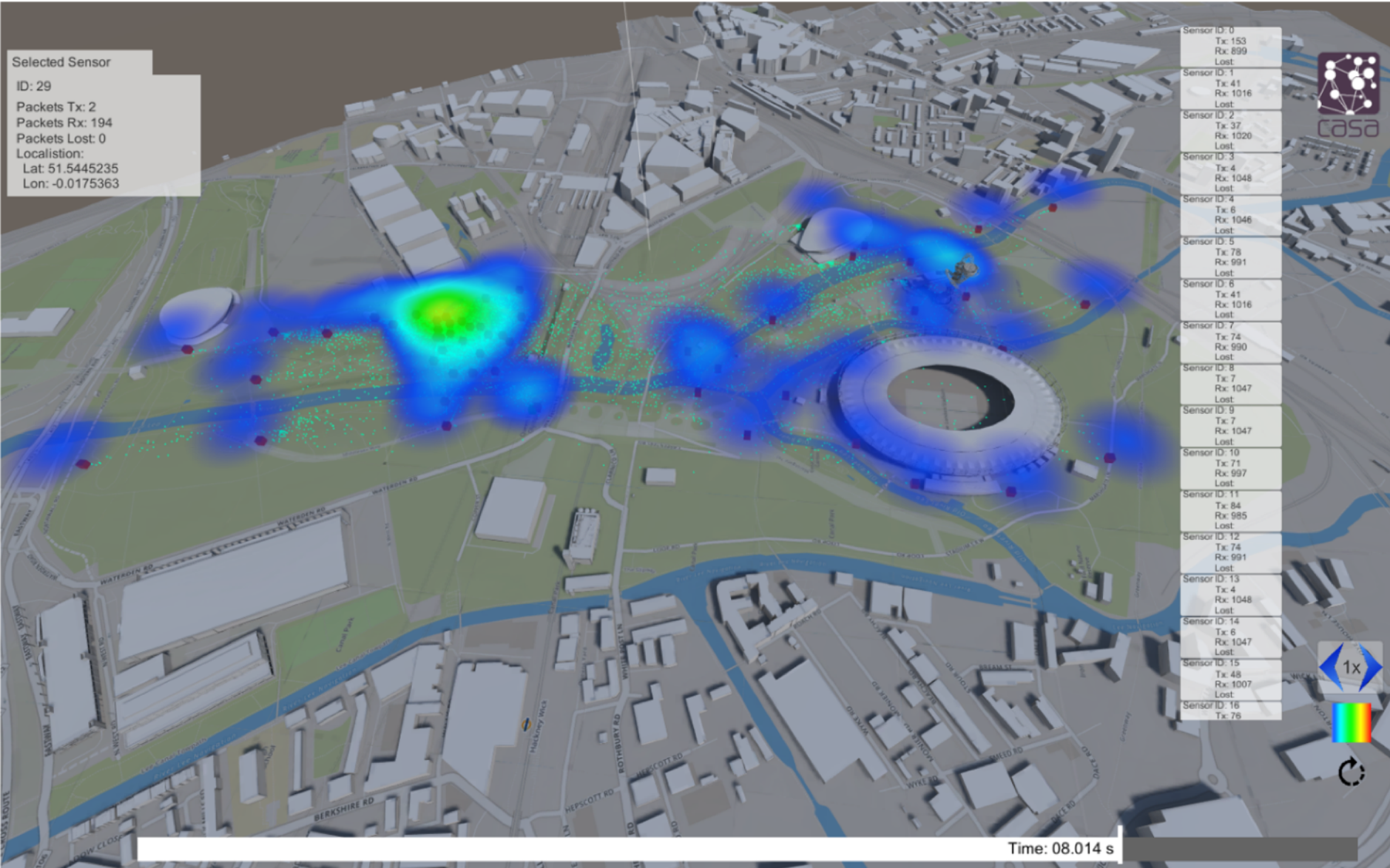
# The Digital Twin



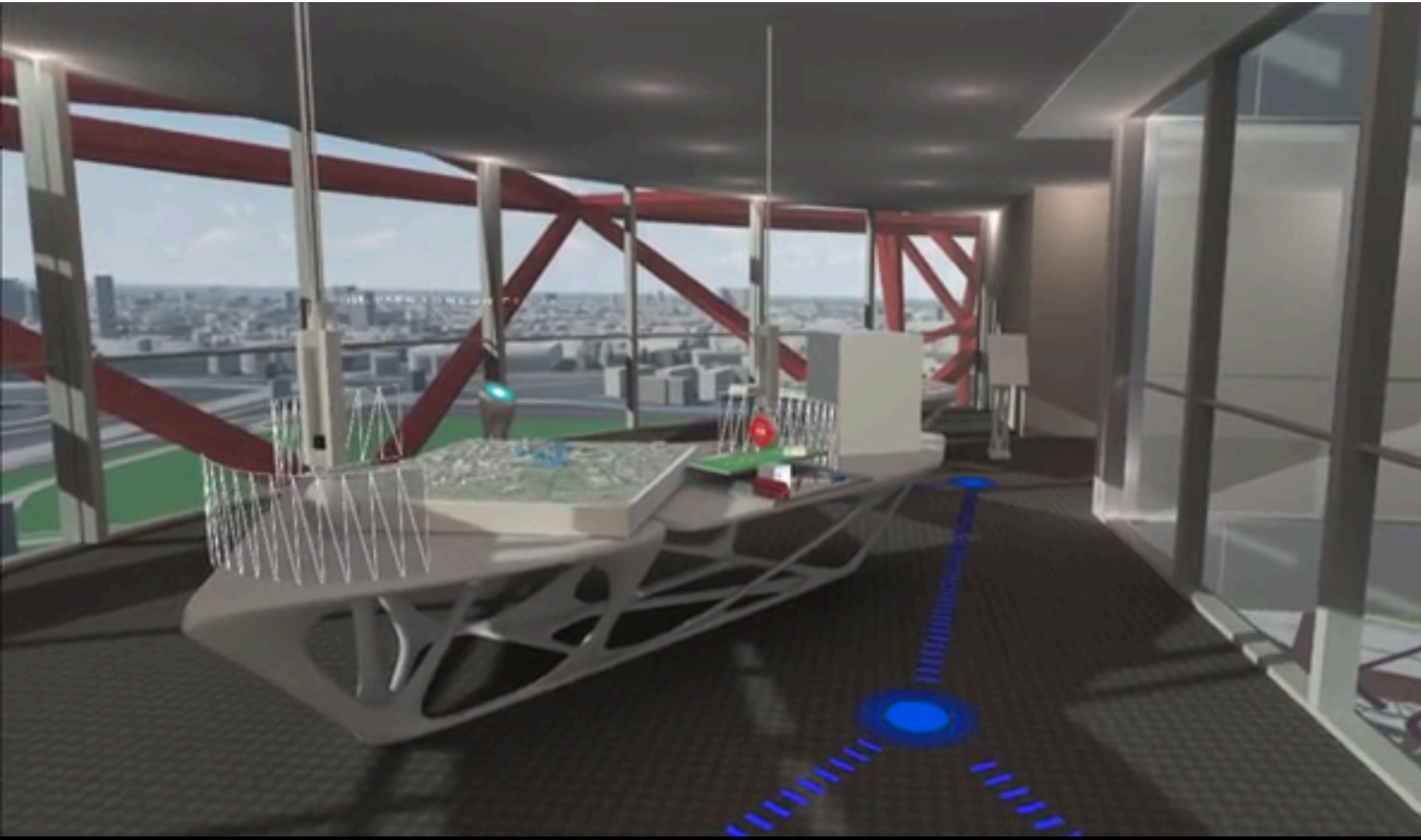
# Virtual London



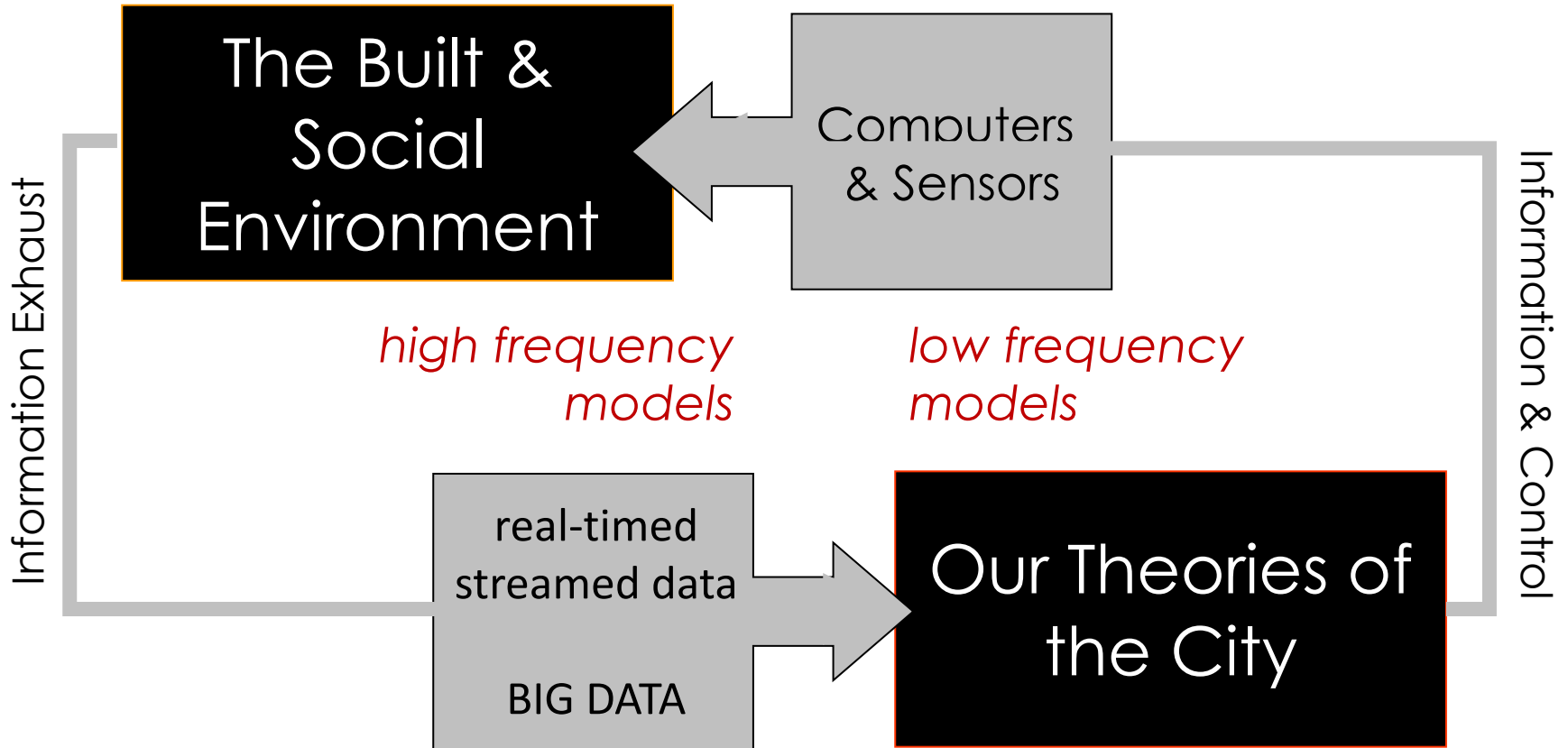
# Virtual London



# Virtual London



# Digital Twins, Urban Models and High Frequency Data



# West Midlands: Bus & Tram Patronage since 2009

under the English National Concessionary Travel Scheme (ENCTS):

**- 25%**

corrected for restrictions in eligibility and changing demographics:

**- 16%**

Passengers age 66+:

**- 10%**

ENCTS patronage adjusted for eligibility				
	Boardings	Pop. (m)	Boarding Rate	% change since 2009
<b>2009</b>	80	0.55	147	
<b>2010</b>	78	0.55	142	- 4
<b>2011</b>	72	0.54	133	- 10
<b>2012</b>	70	0.53	131	- 11
<b>2013</b>	66	0.52	126	- 14
<b>2014</b>	66	0.52	128	- 13
<b>2015</b>	63	0.51	125	- 15
<b>2016</b>	61	0.50	123	<b>- 16</b>

**Data sources:** Transport for West Midlands, ONS mid-year population estimates

# Understanding Inclusive Mobility from Smartcard Data

## West Midlands Combined Authority

population: 2.8m

Wolverhampton

Dudley

Birmingham

Solihull

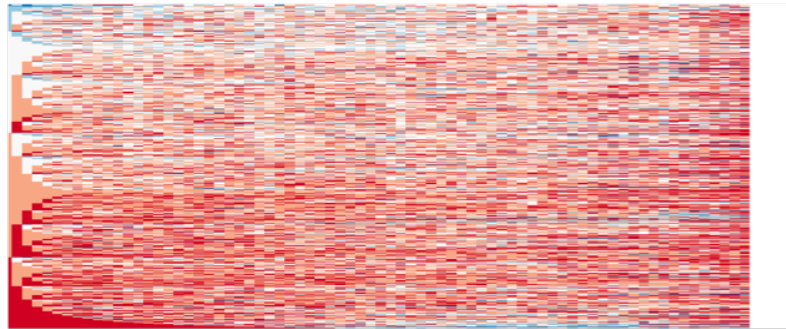
Coventry



**1.5m** transaction per week  
**400k** anonymised accounts  
Nov 2010 – Aug 2016



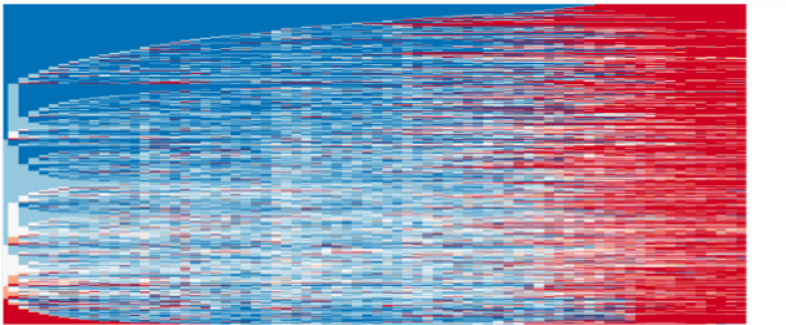
# Temporal Patronage Profiles



**2 – Irregular passengers**

**14%**

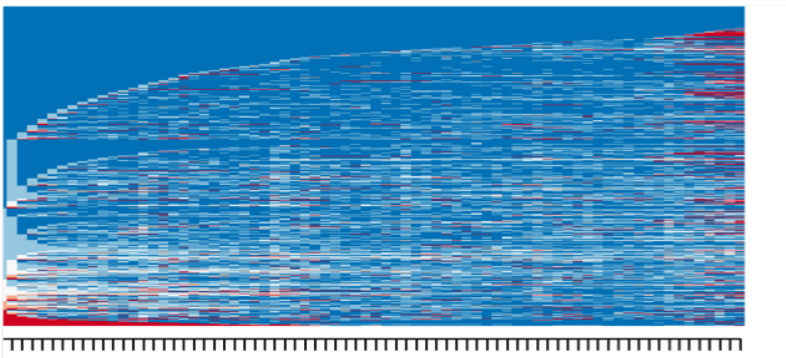
n=55,990



**5 – Rapidly Withdrawing passengers**

**5%**

n=18,620

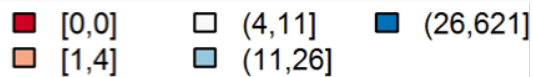


**6 – Daily users**

**12%**

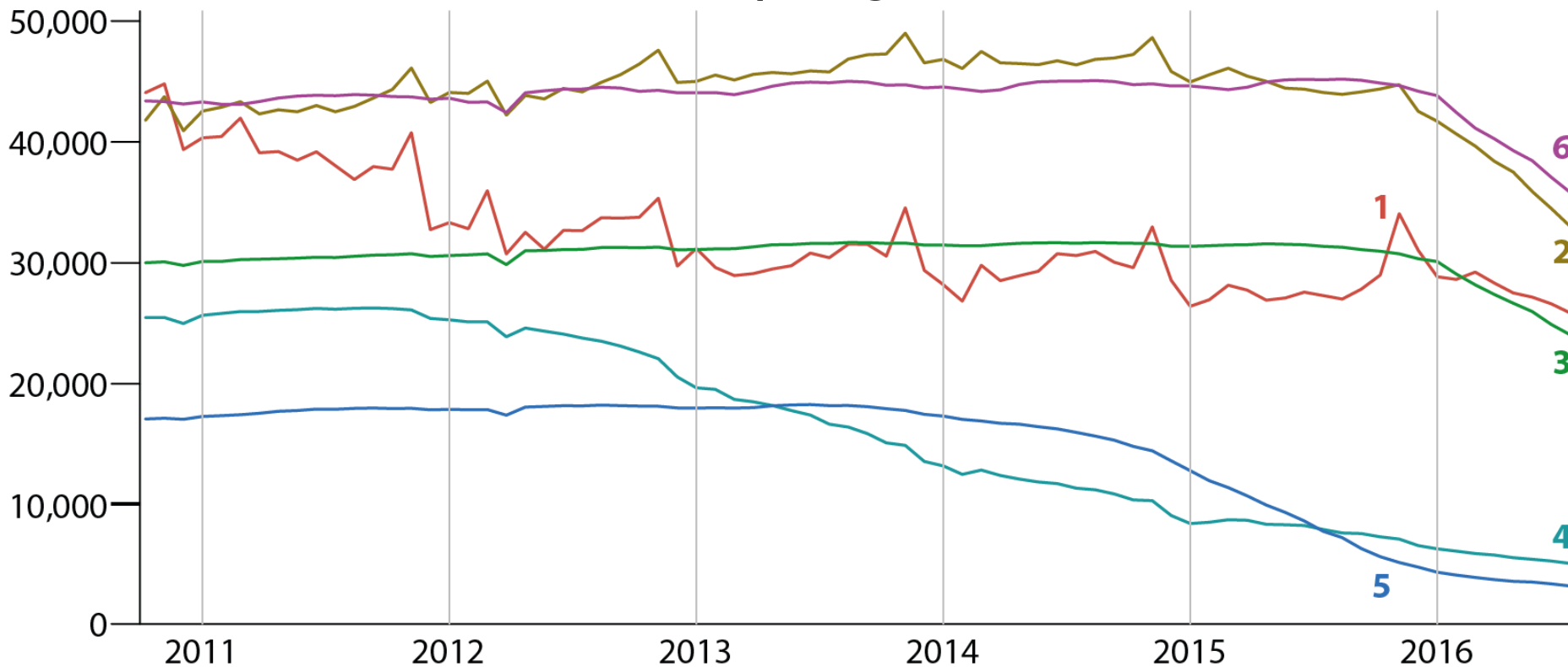
n=45,623

2011 2012 2013 2014 2015 2016



# Trip Generation by Segment

Active passengers



1 – Rarely seen passengers

2 – Irregular passengers

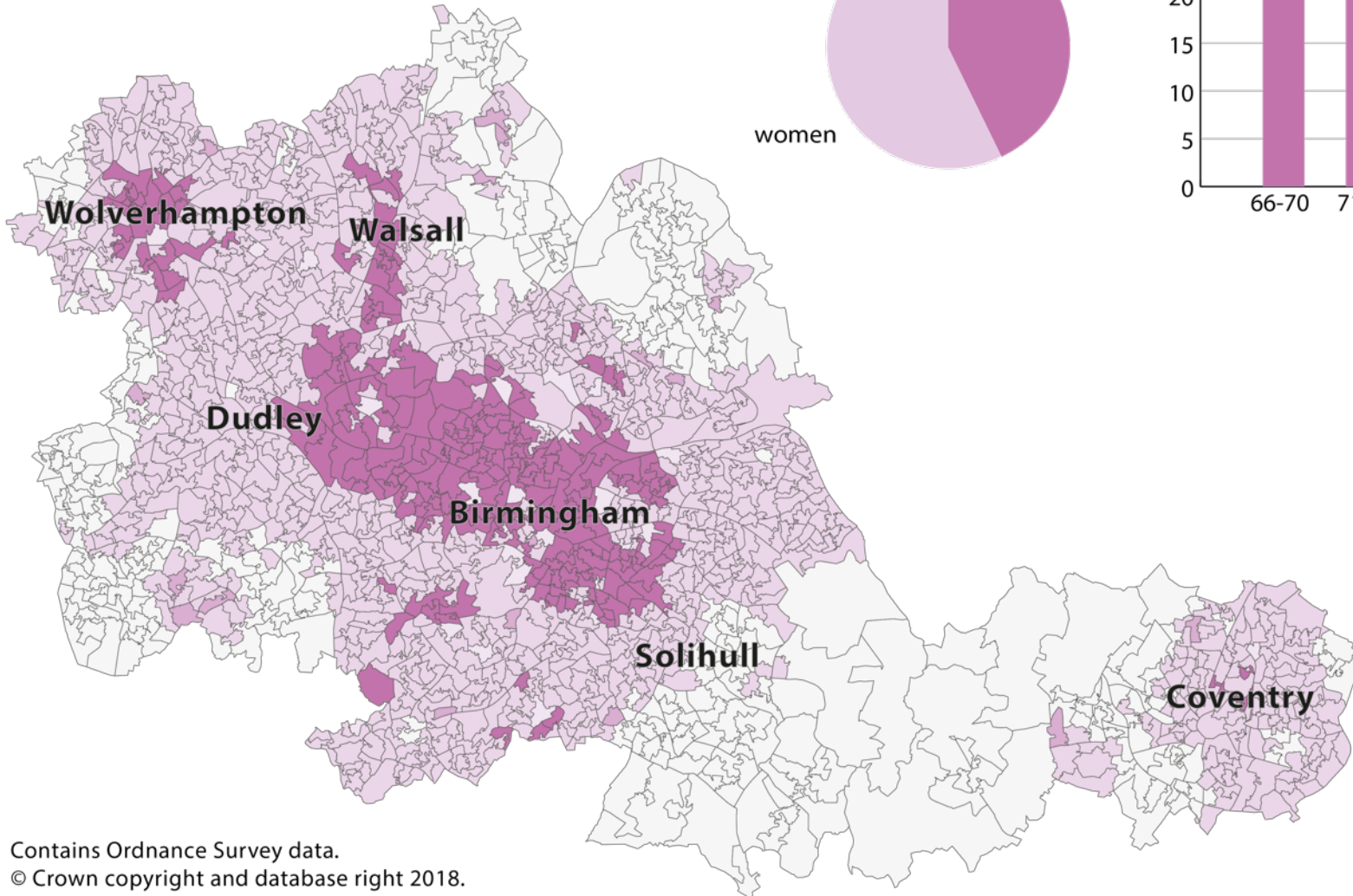
3 – Regularly seen passengers

4 – Gradually withdrawing passengers

5 – Rapidly Withdrawing passengers

6 – Daily users

# Group 6 – Daily users (12%)

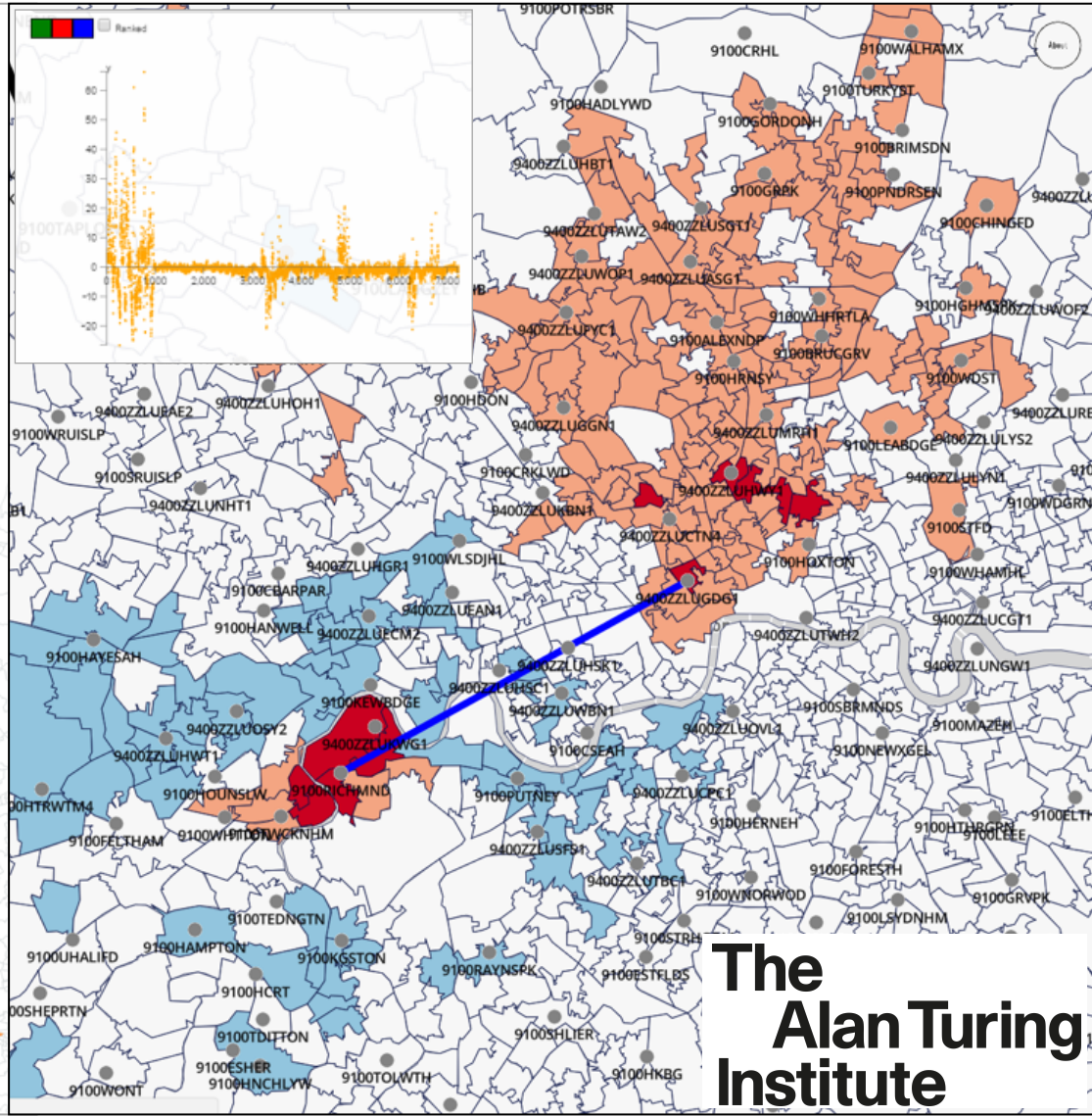
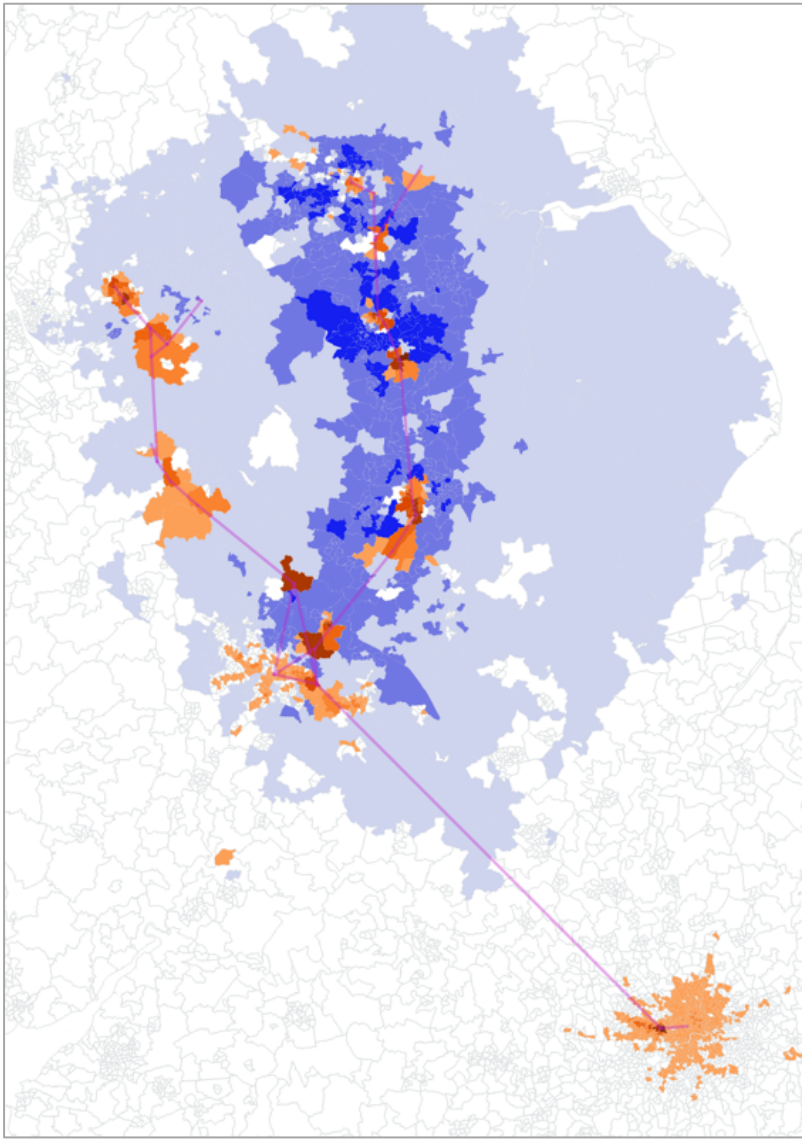


Contains Ordnance Survey data.  
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## Hypotheses

hypotheses	pro	contra	evidence
<b>health-related</b>			
1 Preventable mortality is increasing.	4, 5	ONS	-
2 Earlier onset of mobility-limiting disability	4, 5	(ONS)	○
<b>structural</b>			
3 Cuts in bus routes / reduction in accessibility	2, 3	1, 6	-
4 Competition by tram and rail	6, DfT	(6)	+
5 Emergence of new ride-sharing and e-hailing modes	2, 3, 5, 6	5, 6	○
<b>social</b>			
6 Emergence of online shopping	4, 5, ONS	4, 5	○
7 Greater access to car among women	2	1, 3	○
8 Greater poverty among pensioners	5, 6, ONS	-	+

# QUANT – Modelling Long-term Urban Change



**The Alan Turing Institute**

## **Conclusions: High-frequency data for long-term urban policy**

- 1 – Digital Twins promise powerful urban experiences.**
- 2 – Cities are open systems.**
- 3 – High-frequency data are powerful hypothesis generators.**
- 4 – Digital Twins call for social theories about cities and ourselves.**



THE BARTLETT CENTRE FOR  
ADVANCED SPATIAL ANALYSIS

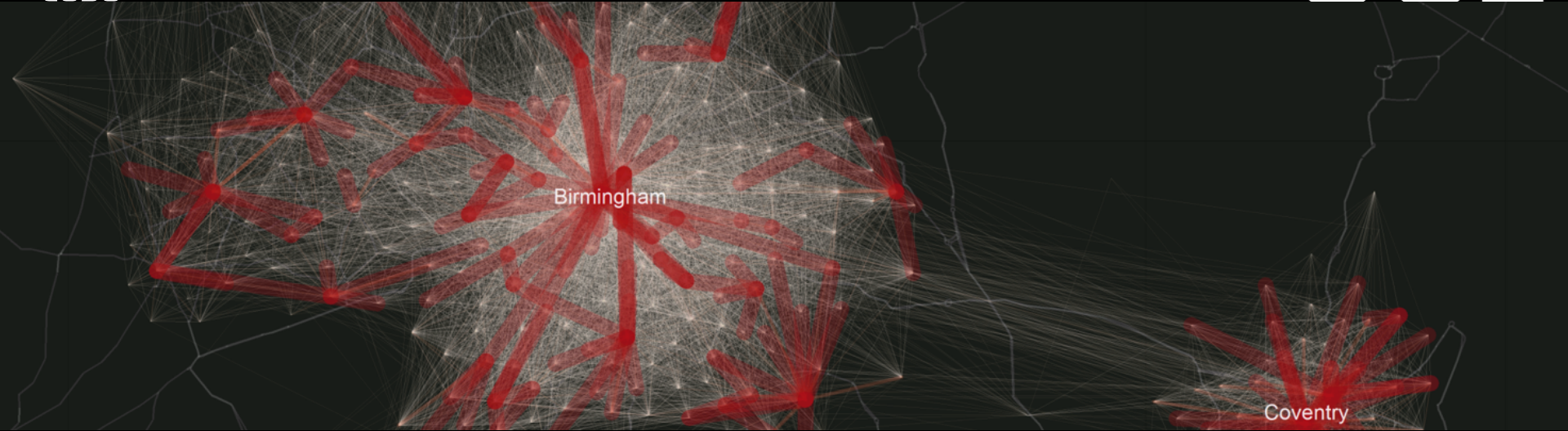


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and Innovation

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Alan Turing  
Institute



UCL



**Thank you!**

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