The Alan Turing Institute

Urban Analytics: Progress and Prospects

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Programme Director: Urban Analytics

What to expect from this talk…

- **Background**
  - Brief introduction to the Turing Institute
- **Definition**
  - The Turing community's view on the scope and content of a current and future programme in Urban Analytics
- **Examples**
  - Two more detailed case studies of the way urban analytics is developing
- **Discussion**
  - About why any of this matters…

Turing university network

UNIVERSITY OF CAMBRIDGE

THE UNIVERSITY of EDINBURGH

UNIVERSITY OF OXFORD

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University of BRISTOL

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MANCHESTER 1824
The University of Manchester

Queen Mary University of London

Newcastle University
UK | Malaysia | Singapore

UNIVERSITY OF Southampton

Turing Programmes

Artificial intelligence (AI) →
Advancing world-class research into artificial intelligence, its applications and its implications for society, building on our academic network's wealth of expertise.

Data science at scale →
Building upon advances in high-performance computer architectures, through algorithm-architecture co-design, with applications including health and life science.

Data-centric engineering →
Bringing together world-leading academic institutions and major industrial partners from across the engineering sector, to address new challenges in data-centric engineering.

Urban analytics →
Developing data science and AI focused on the process, structure, interactions and evolution of agents, technology and infrastructure within and between cities.

Defence and security →
Collaborating with the defence and security community to deliver an ambitious programme of data science research, to deliver impact in real world scenarios.

Finance and economics →
Applying data science and AI techniques to how the financial sector and the economy work, and using these insights to address challenges of national and international importance.

Health and medical sciences →
Accelerating the scientific understanding of human disease and improving human health through data-driven innovation in AI and statistical science.

Public policy →
Working with policy makers on data-driven public services and innovation to solve policy problems, and developing ethical foundations for data science and AI policy-making.

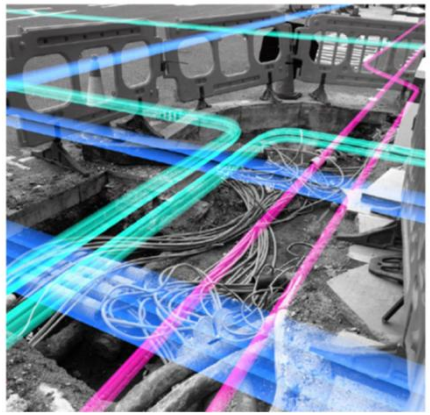
Urban Analytics

To set the ball rolling:

“a set of methods that can be used to explore, understand and predict properties and features of … cities” (Mike Batty, 2019 (editorial in Environment and Planning B))

Ministerial welcome.

“the government seeks to unleash Britain’s potential to lead the world in the data revolution”



CASE STUDY

Mapping the underground.

In 2019, the Geospatial Commission committed £3.9 million for two pilots (one led by the Greater London Authority in London, the other by Ordnance Survey in the North East). These test schemes looked at creating a national data sharing platform on the location and condition of buried pipes, ducts and cables to be used by asset owners and their operators. All major asset owners across gas, water, electricity, telecommunications, transport and local authorities shared data through a test platform, and took part in use case testing, including live testing of the digital tool at excavation sites.

CASE STUDY

Unique Reference Numbers.

Just as everyone has a National Insurance number and every vehicle has a number plate, every address has a Unique Property Reference Number (UPRN) and every street has its own Unique Street Reference Number (USRN).

As well as now being available on an Open Government Licence, UPRNs and USRNs are now a mandated standard across the public sector. By promoting wider use of UPRNs and USRNs, we will significantly improve the interoperability and reusability of data.

CASE STUDY

Satellite data keeps mangrove forests flourishing.

Mangroves are tree species that grow on the coast in equatorial regions, and provide numerous ecosystem services, such as carbon sequestration and natural sea defences. Due to the transitory environments in which they thrive, and because of their rapid growth, mapping mangroves can be a challenge.

In conjunction with Notbinary, the UK Hydrographic Office (UKHO) has developed deep learning algorithms to automatically process large volumes of previously unmanageable data relating to mangrove identification.

CASE STUDY

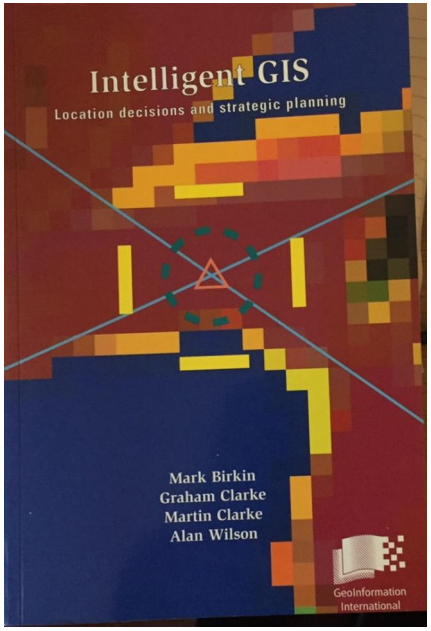
Responding to Covid-19.

From the outbreak of the Covid-19 pandemic, the UK has sought to utilise location data to manage the response to the virus. A few examples are:

Tracking virus spread: Geospatial data is essential to monitoring and predicting the spread of viruses. Public Health England (PHE) presents reported cases of coronavirus across the regions, supporting local and national decision-making.

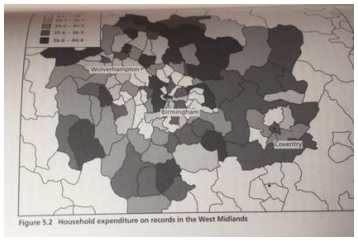
To supplement the official information, voluntarily donated crowdsourced data, collected for example by individuals filling in user-friendly applications, can support longer-term analysis by also including data about individuals not infected.

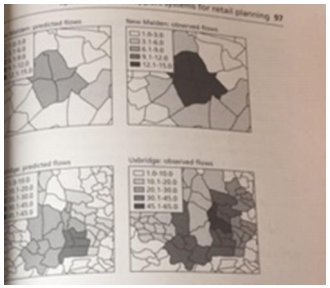
Monitoring social distancing and movement: Innovative applications of geospatial data techniques are being used to monitor aggregate compliance with social distancing guidelines. Anonymised mobile phone data can provide aggregate

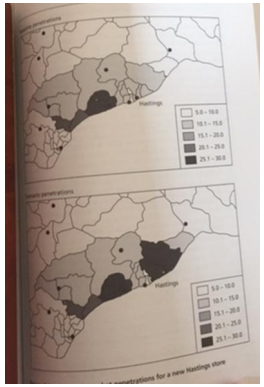


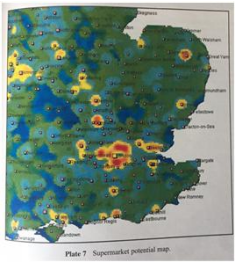
BIRKIN, M., CLARKE, G.P., CLARKE, M., and WILSON, A. G., 1987, Geographical information systems and model-based locational analysis: ships in the night or the beginnings of a relationship? In Working Paper 498 (Leeds: School of Geography).

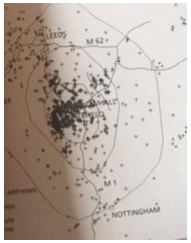
Urban Analytics…











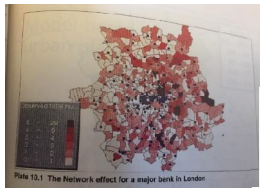
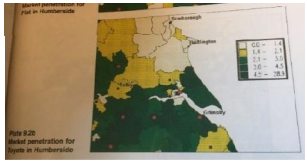


Table 5.2 Model results for 14 stores in south-east England

Centre name	Sales ratio	Model prediction	Errors (%)
Ashgate	200	220	10.0
Bayfield	160	150	6.3
Chetburn	120	118	1.7
Darkridge	105	125	19.0
Eastport	100	102	2.0
Fernley	90	83	7.8
Greenthorpe	80	75	6.2
Holford	60	50	16.6



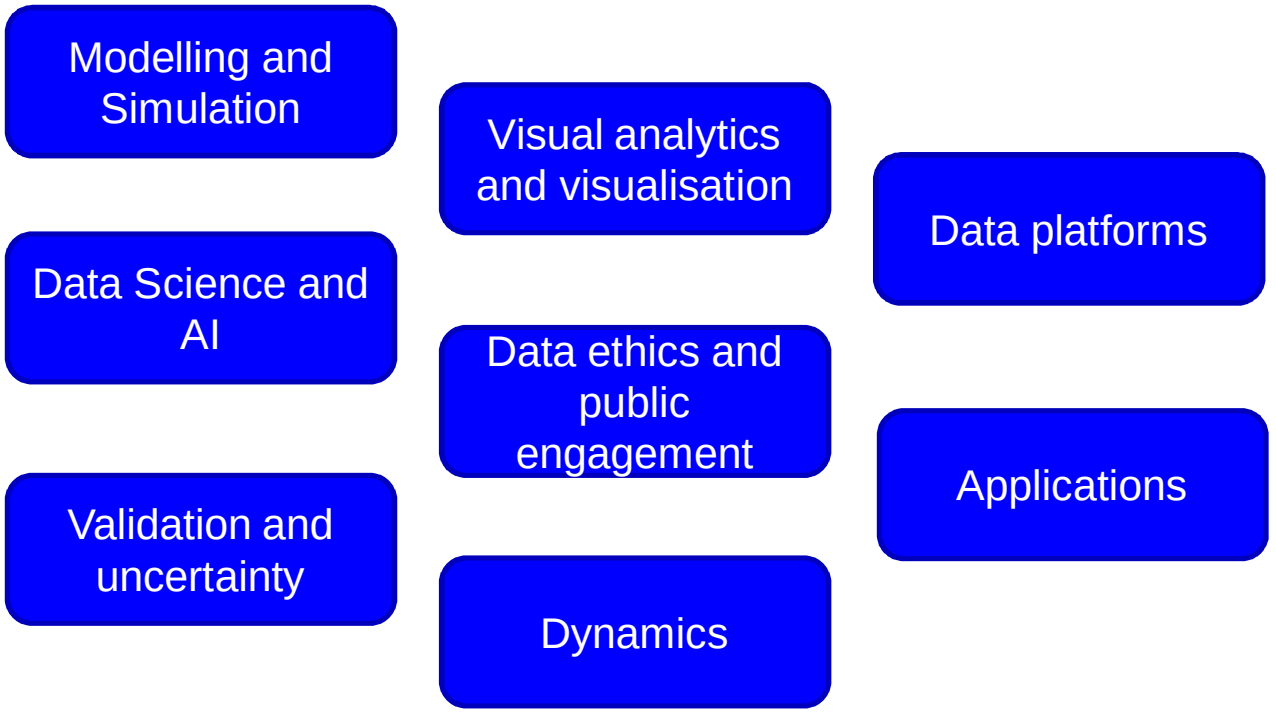
Definitions

- Turing Urban Analytics Programme established September 2018

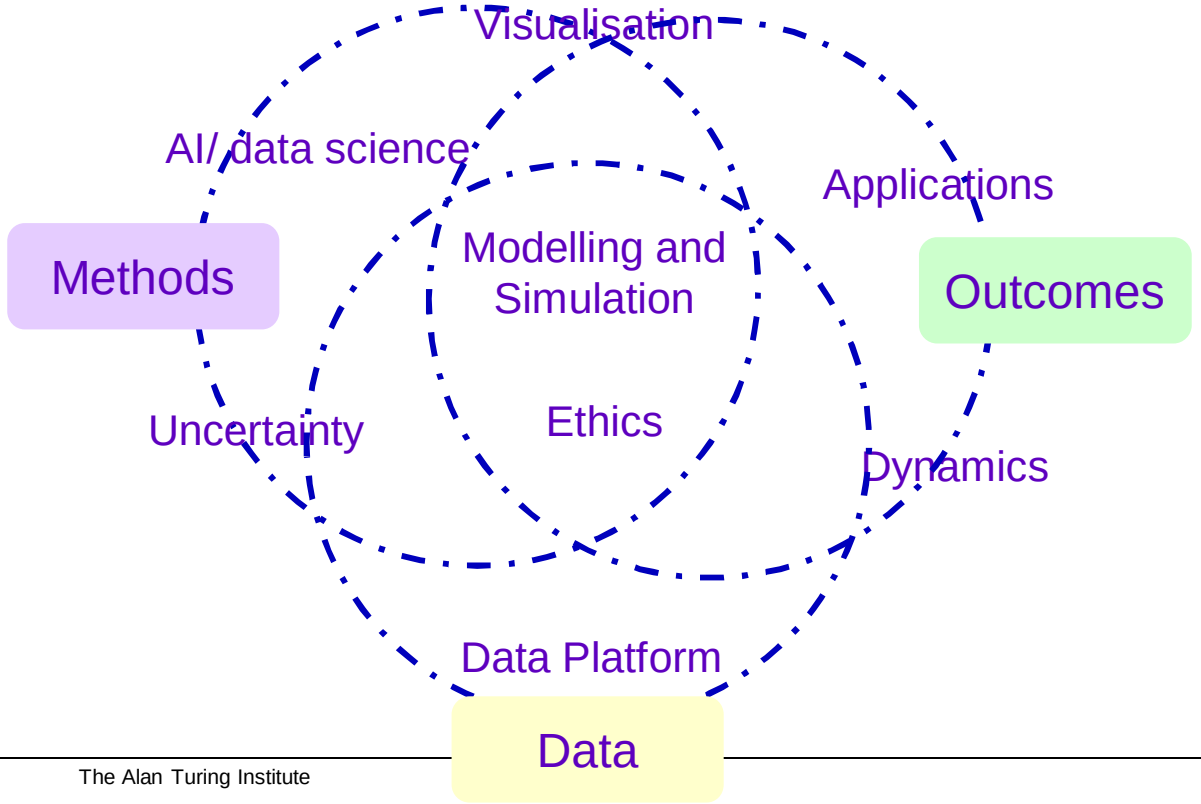
- Two workshops:
  - A blueprint for urban analytics research, Newcastle, 11th-12th April 2019
  - Building a future for the urban analytics blueprint, Bristol, 16-18th Oct 2019

Definitions

Eight priorities identified…

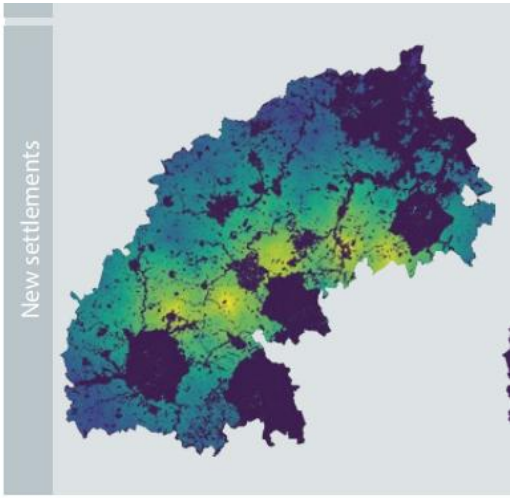


Definitions

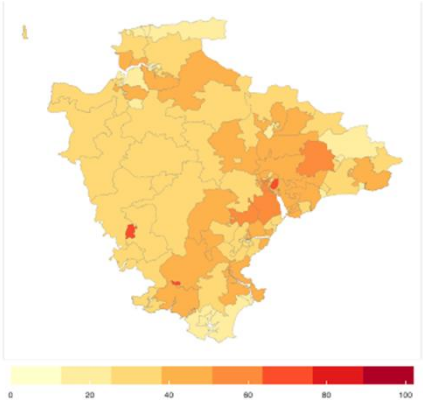


Examples

Digital Twin – Urban Analytics



Rapid Assistance in Modelling the Pandemic (RAMP)



Data for the public good

Andrew Adonis
Chair, National Infrastructure Commission

"(N)ational digital twin: a digital model of our national infrastructure which will be able both to monitor our infrastructure in real-time, and to simulate the impacts of possible events, for example, a natural disaster, or a new train line"

https://www.nic.org.uk/wp-content/uploads/Data-for-the-Public-Good-NIC-Report.pdf

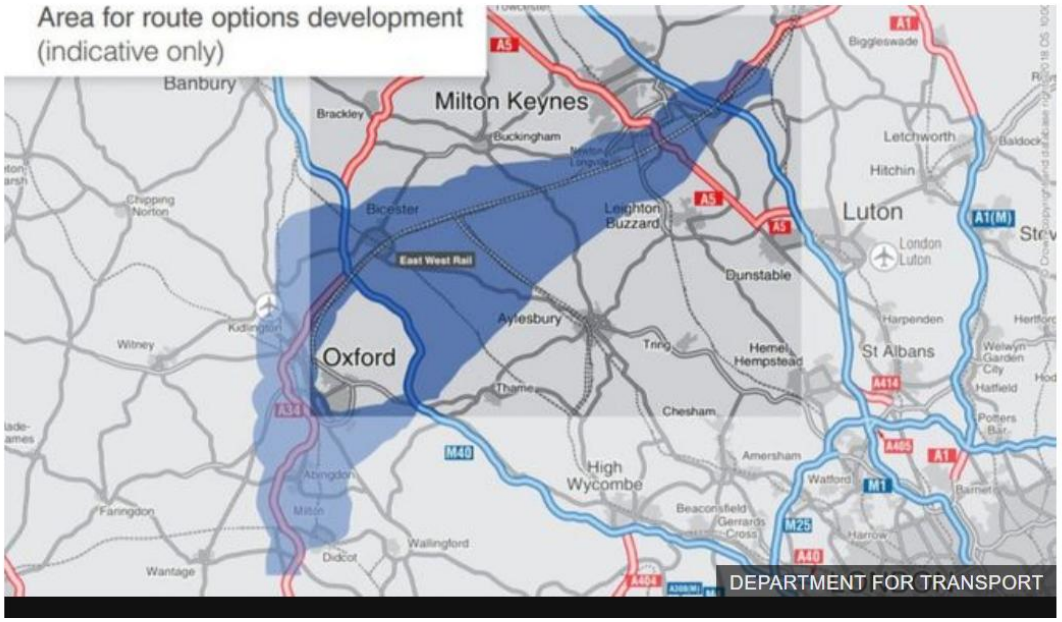
The Urban Analytics Digital Twin

SPENSER:
Synthetic
Population
Estimation and
Scenario
Projection Model

Example 1 – Infrastructure Planning

Oxford-Cambridge Expressway: Preferred route announced

12 September 2018 Share



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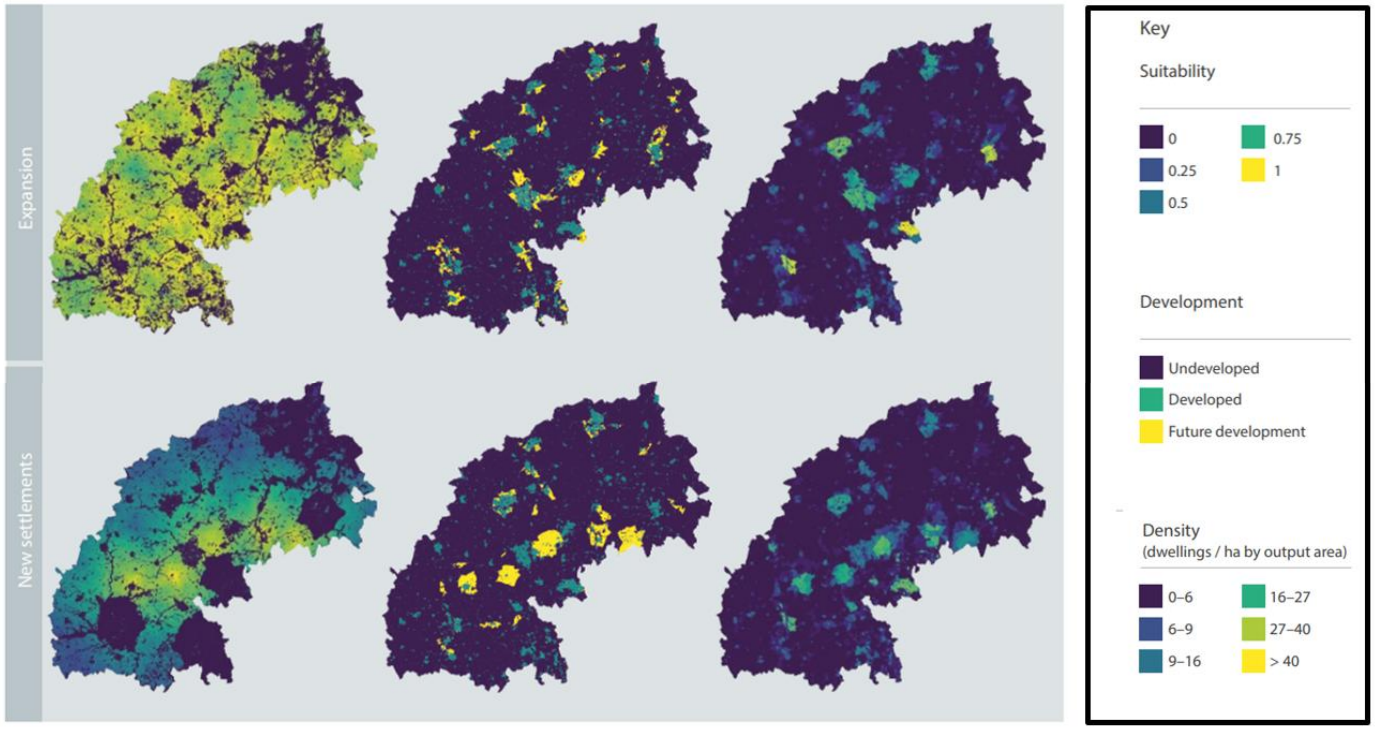

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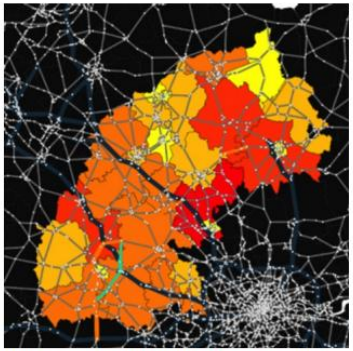


Figure 11: Vehicle-kilometres in Arc zones (Baseline, 2050).

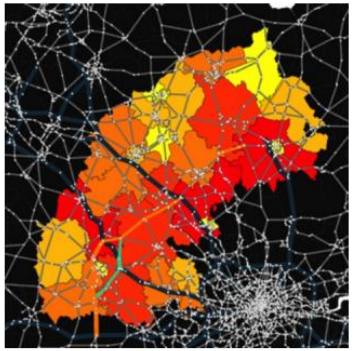


Figure 12: Vehicle-kilometres in Arc zones (Unplanned, 2050).

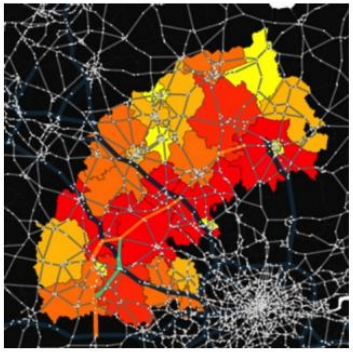


Figure 13: Vehicle-kilometres in Arc zones (New Settlements, 2050).

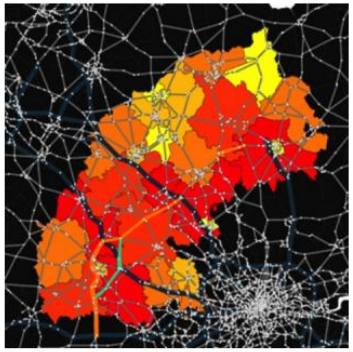


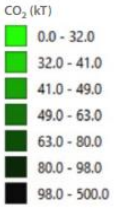
Figure 14: Vehicle-kilometres in Arc zones (Expansion, 2050).

ITRC Mistral available at: https://www.itrc.org.uk/wp-content/uploads/2020/01/arc-main-report.pdf

Example 1 – Infrastructure Planning

Figure 21: CO_2 emissions in Arc zones (Baseline, 2015).

Figure 22: CO_2 emissions in Arc zones (Baseline, 2030).



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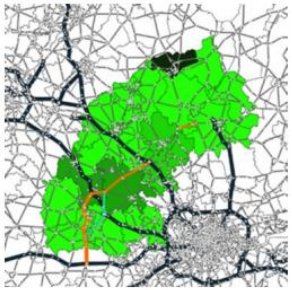


Figure 23: CO_2 emissions in Arc zones (Baseline, 2050).

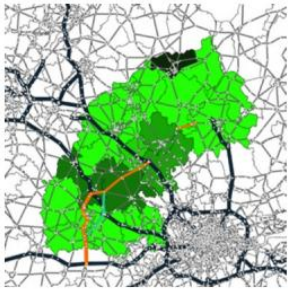


Figure 24: CO_2 emissions in Arc zones (Unplanned, 2050).

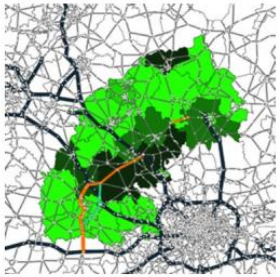


Figure 25: CO_2 emissions in Arc zones (New Settlements, 2050).

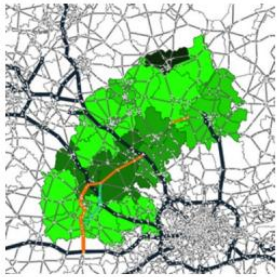
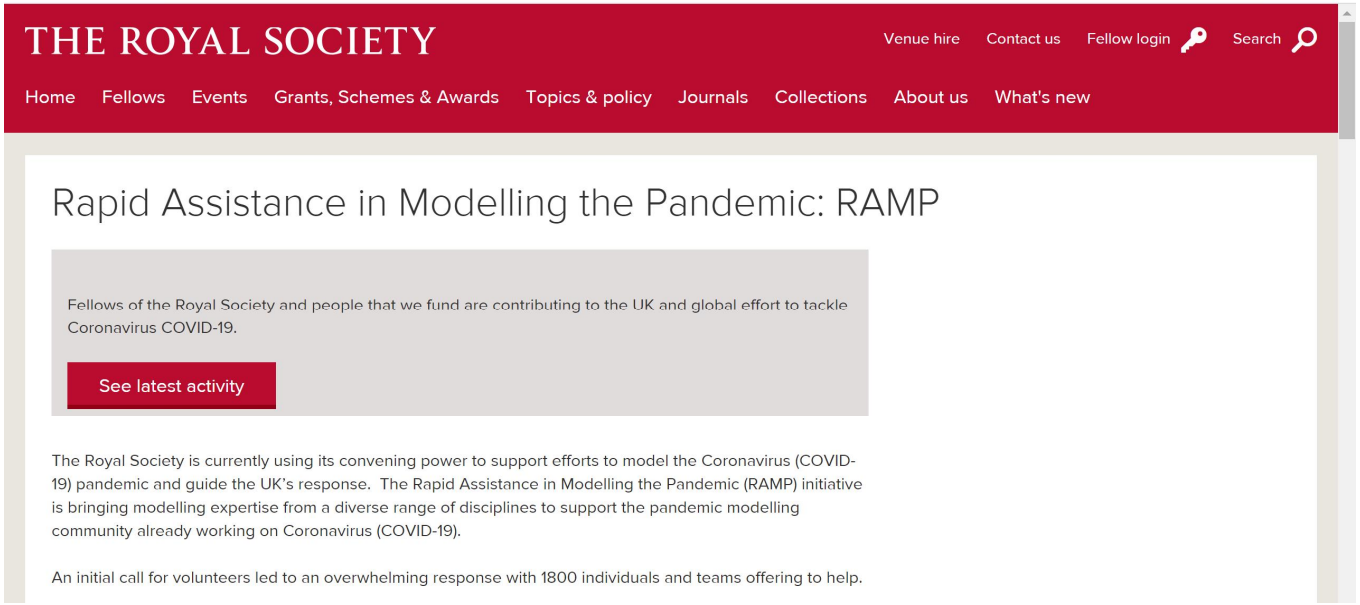
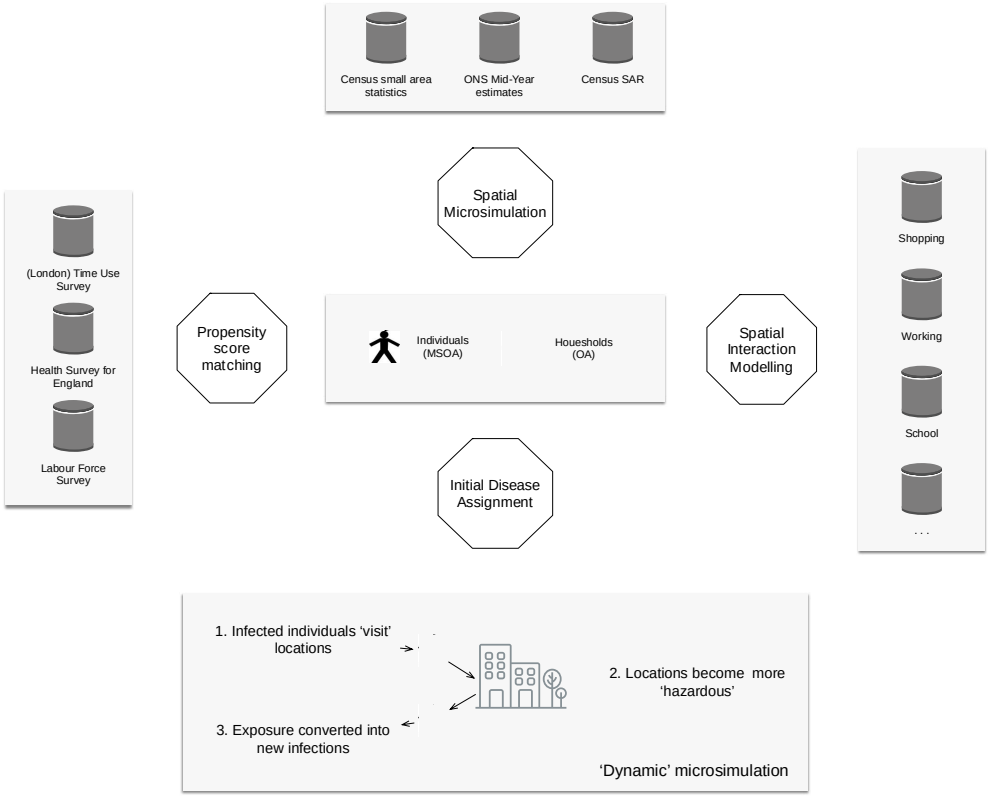


Figure 26: CO_2 emissions in Arc zones (Expansion, 2050).



"Is there a pre-existing model of human social behaviour and contacts into which new SEIR type labels for disease state can be introduced, with appropriate statistics for changing these labels?"

Example 2: Digital Twin for COVID-19



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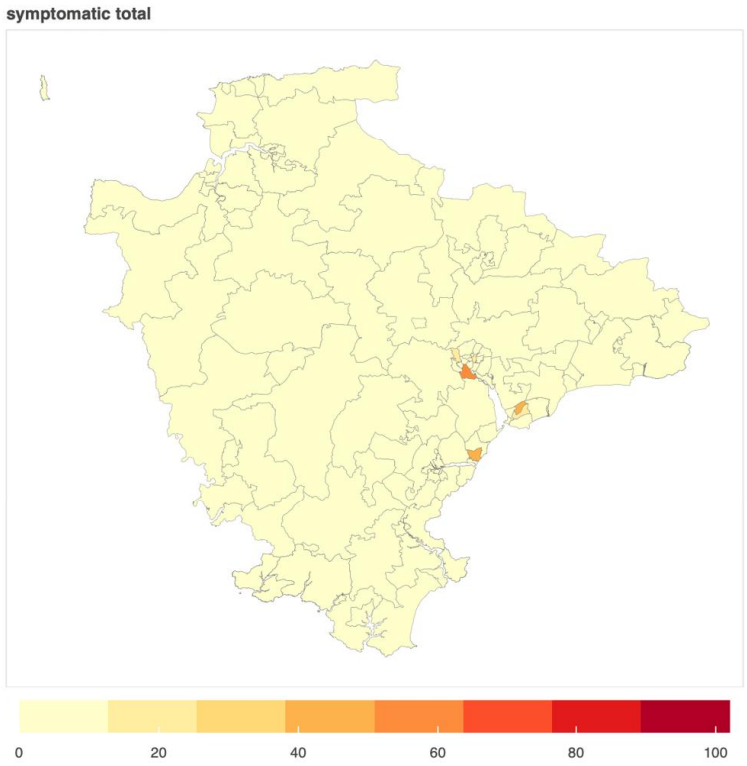

THE ROYAL SOCIETY

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Conclusion

- What is Urban Analytics?
- A set of methods, approaches and theories which converts (big) data into real world understanding and policy support
- The world is receptive to these approaches and arguments as never before…
- But still needs ambition, intelligence, creativity and effort to reach new levels of relevance and impact