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A Family of Spatial Interaction Modellers

Mark Birkin
Director, Leeds Institute for Data Analytics

LEEDS *Institute for
Data Analytics*

The Models...



A statistical theory of spatial distribution models

WILSON, A; (1967) A statistical theory of spatial distribution models. *Transportation Research*, 1 (3) pp. 253-269.

Full text not available from this repository.

Type: Article

Title: A statistical theory of spatial distribution models

Additional information: Also reprinted in Quandt, RE The demand for travel - theory and measurement, Heath Lexington, Boston, 1970, pp 55-82, and reprinted in Angel, S and Hyman GM Urban Fields, Pion, London, 1976, pp 162- 178

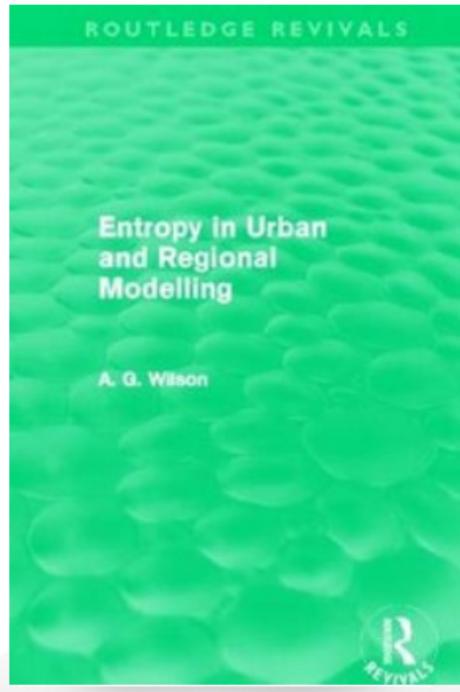
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A Family of Spatial Interaction Models, and Associated Developments

A G Wilson

First Published March 1, 1971 | Research Article

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Article information

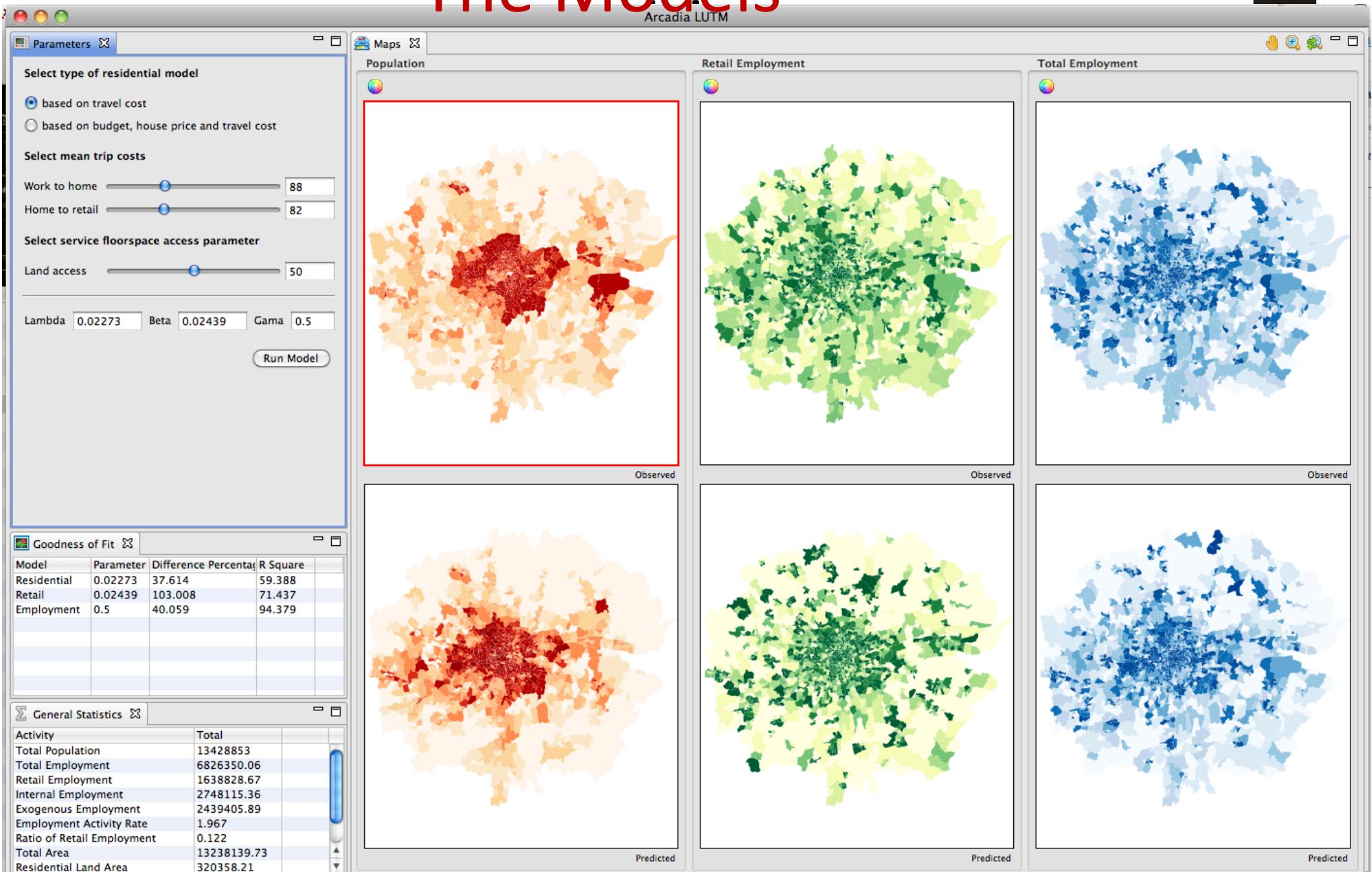


Abstract

This paper shows that the gravity model is not a single model but that there is a whole family of spatial interaction models. The properties of this family are outlined in some detail. Basic concepts of such models can be developed in a variety of ways, and these are illustrated. The paper then outlines a number of other theoretical developments, and is particularly concerned with the disaggregation of such models, with the incorporation of time variables, and with the relation of spatial interaction, to more general, models. Uses of spatial interaction models are outlined briefly and the final section of the paper draws a number of conclusions and presents a summary.



The Models



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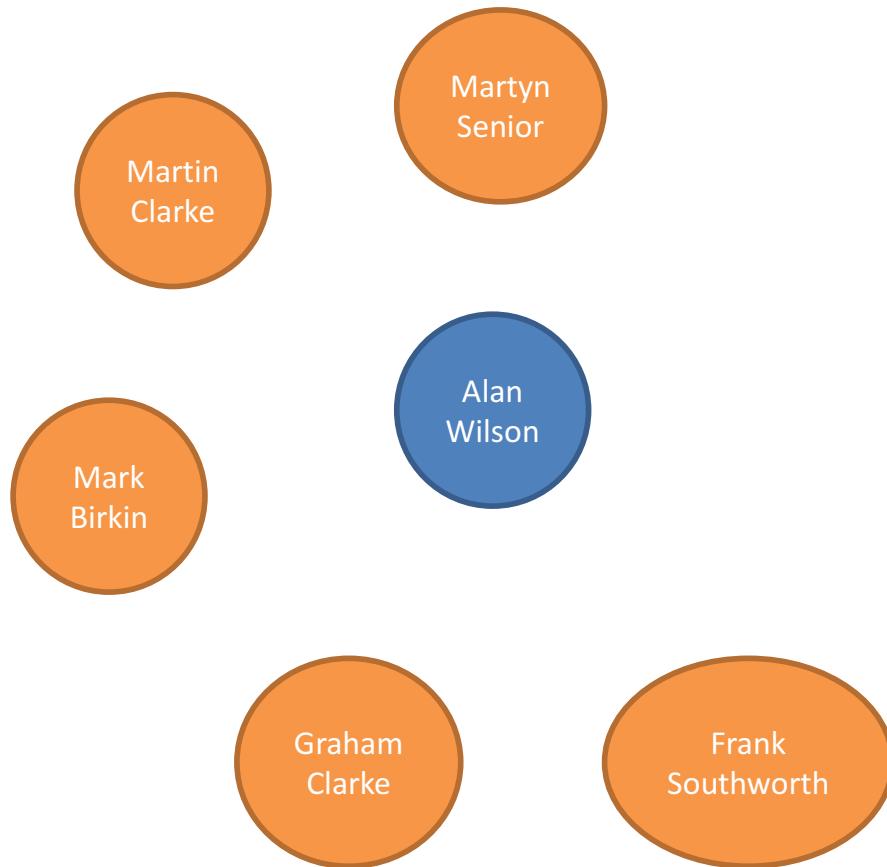
The Modellers!!



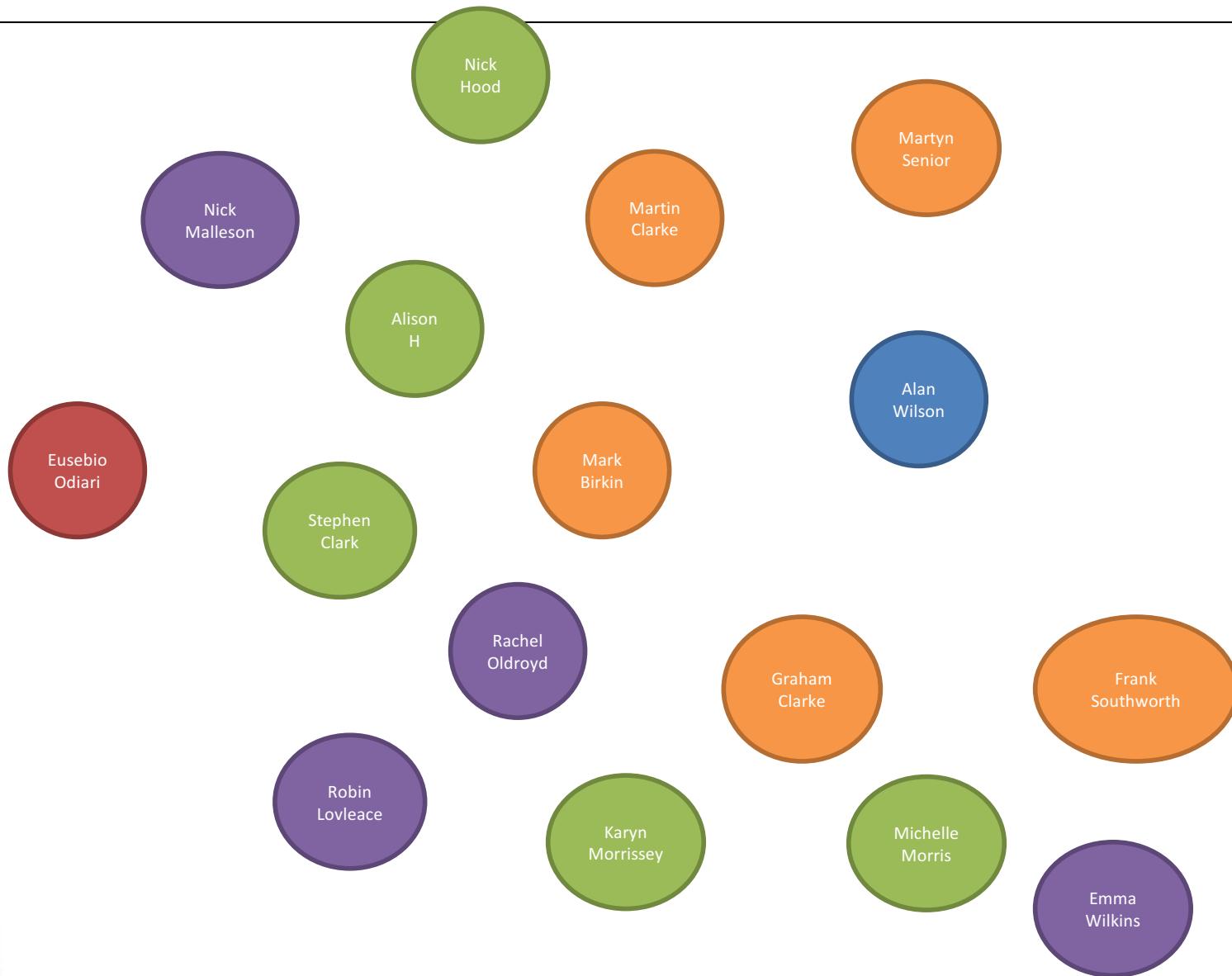
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The Family...

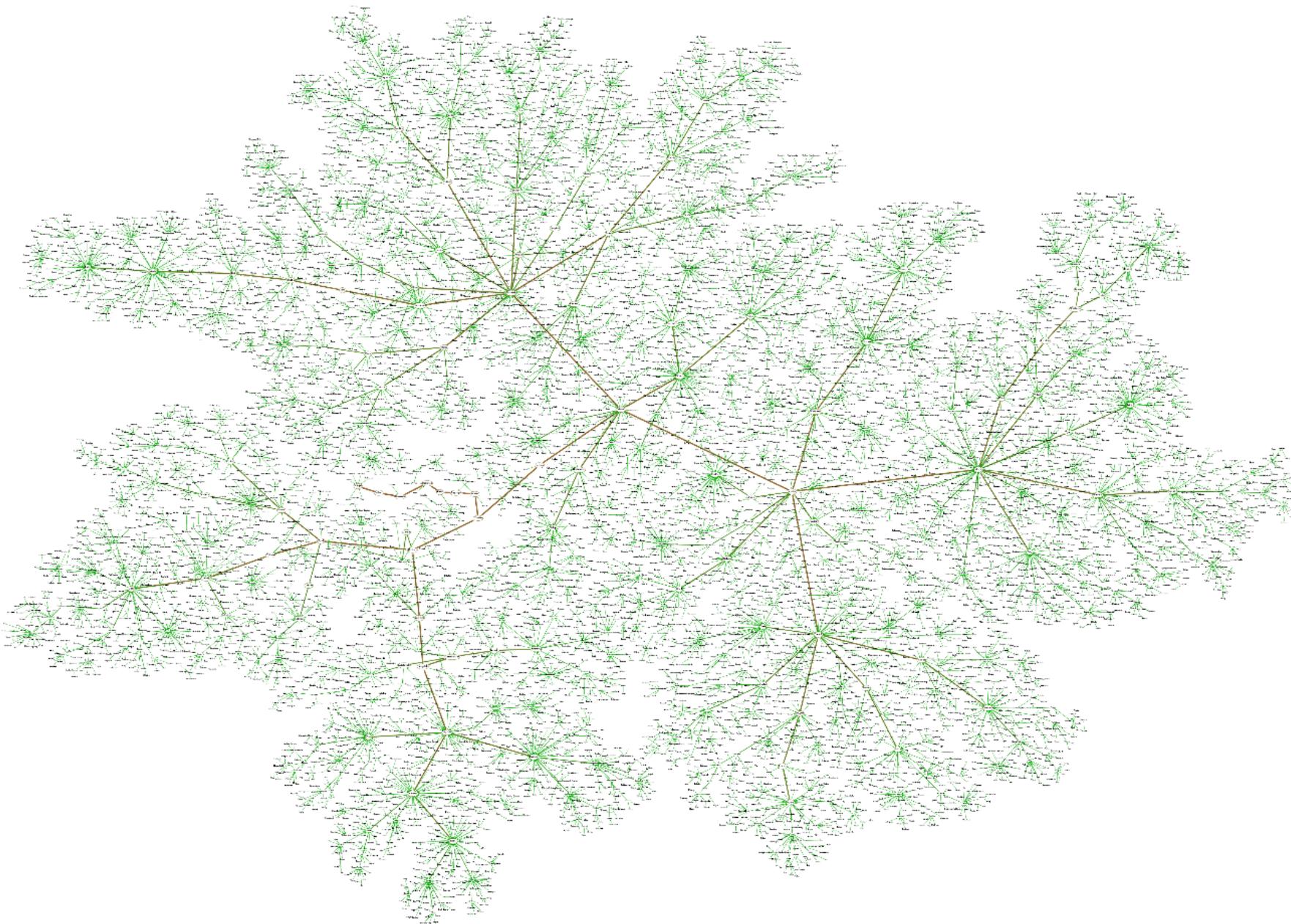


The Family...



The Family...

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Importance of the family...

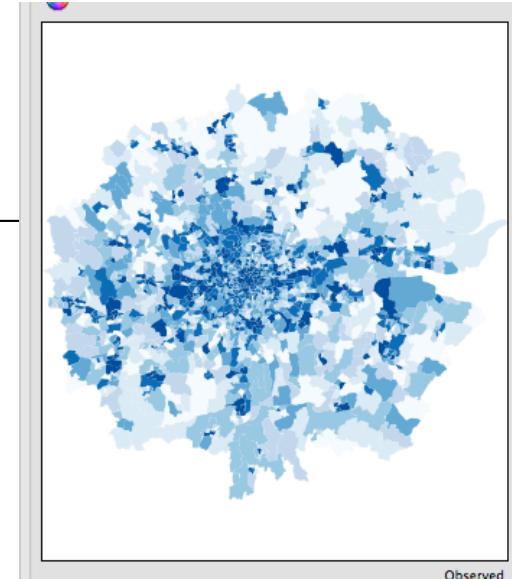
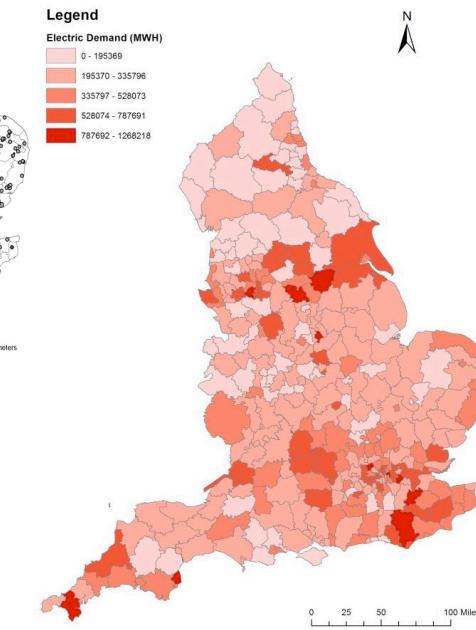
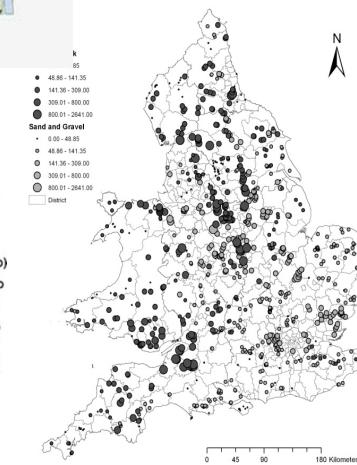
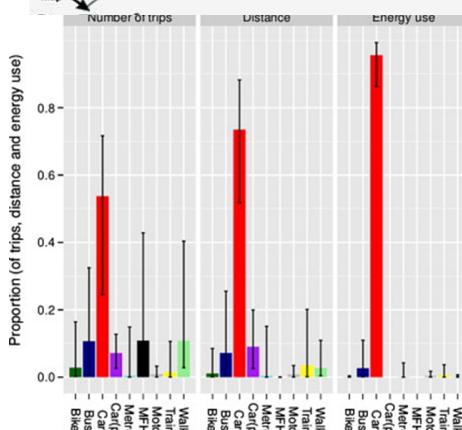
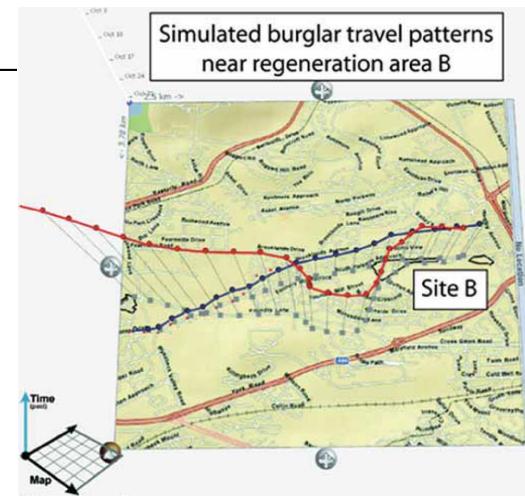
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- Research
- Training & Capacity-Building
- Impact
- Sustainability

LIDA

Research – Models...



DS

WHO CAN AFFORD TO MOVE HOME?

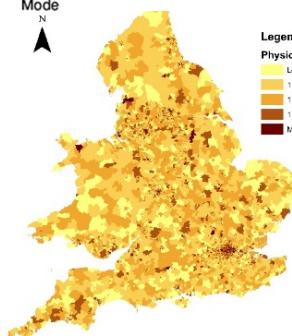
Access is a categorisation of the UK population into demographic types. Each line in the circle represents a household that is moving from one Access category to another. The data is for England and Wales in 2014. The resulting gradient indicates which types are most mobile.

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Household mobility data provided by Great Britain Household Survey.



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Research – Modellers!!



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 - *Eusebio Odiari, Mark Birkin, Susan Grant-Muller and Nick Malleson*
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 - Estimating the UKs referendum on EU
 - *Frank Southworth*
 - A Look at **Freight Demand Modeling** in the United States
-
- *Martin Clarke*
 - Numerical Experiments: exploring the properties of spatial interaction models using real and imaginary data
 - *Mark Birkin*
 - A family of spatial interaction modellers
 - *Paul Williamson; Xin Gu; Karyn Morrissey; Ferran Espuny-Pujol*
 - **Small-area estimation of comorbidity**: an indirect survey calibration approach
 - *Emma Wilkins; Michelle Morris; Duncan Radley; Claire Griffiths*
 - Geographic variation in the validity of two sources of secondary **food environment data**
 - *Nik Lomax; Michelle Morris*
 - Assessing **activity levels** of individuals in a large, self-selecting dataset
 - *Rachel Oldroyd; Mark Birkin; Michelle Morris*
 - The use of non-traditional data for monitoring **foodborne illness**: methodological recommendations and considerations
 - *Robin Lovelace*
 - Implementing **spatial interaction models**: from prototype to globally scalable tools

Training and Capacity Building



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	Nawaf Alatobi
	Rui Yu
	Eusebio Odiari
	Nabati Ray
	Emily Sheard
	Tom Waddington
	Rachel Oldroyd
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	Charlotte Sturley
	L. Xiang
	Kelly Arnold
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	John Gadd
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	Jennie Gray
	Annabel Whipp
	Victoria Litherland
	Hannah Wooller
	Ian Urquhart
	Eugenio Vidal Tortosa
	Keiran Suckak
	Francesca Pontin
Using community cohesion to link crime analysis	Nick Addis
Socio-inequalities in the provision of education in Peckham.	Eusebio Odiari
Causal Inference Modelling and	Stephen Clark
Understanding bike mobility through Big Data	Mark Birkin
Crime and Agent-based modelling	Alan Wilson
Longitudinal Data	Rachel Oldroyd
Retail consumer behaviour modelling	Graham Clarke
Predictive geodemographics	Frank Southworth
Predictive Data Analytics for Urban Dynamics	Robin Lovelace
Evaluation of consumer transactions as a source of dietary information and its implications for public health	Karyn Morrissey
Examining judicial sentencing using court transcripts and natural language processing techniques	Michelle Morris
Incorporating e-commerce (home delivery and 'click and collect') in grocery sector retail location modelling.	Emma Wilkins
The social and geographical correlates of transport modal split: identifying choice and (potential for) change	
Agent-Based Modelling and Dynamic Data Assimilation for Modelling Urban Dynamics	
Bounts	

Business Impact: GMAP Limited



A screenshot of a Google search results page for the query "gmap logo". The top result is a large image of the GMAP logo, followed by several smaller images related to GMAP, such as a scales of justice icon, a globe icon, and a DNA helix icon.



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Google Maps



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Business Impact: GMAP Limited



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Government Impact

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Sir Alan Wilson

Sir Alan Wilson FBA FAcSS FRS is CEO of The Alan Turing Institute and Professor of Urban and Regional Systems in the Centre for Advanced Spatial Analysis at University College London. He is Chair of the Home Office Science Advisory Council.

He is a Cambridge Mathematics graduate and began his research career in elementary particle physics at the Rutherford Laboratory. He turned to the social sciences, working on cities, with posts in Oxford and London before becoming Professor of Urban and Regional Geography in Leeds in 1970. He was a member of Oxford City Council from 1964-1967. In the late 1980s, he was the co-founder of GMAP Ltd, a University spin-out company. He was Vice-Chancellor of the University of Leeds from 1991 to 2004 when he became Director-General for Higher Education in the then DfES. After a brief spell in Cambridge, he joined UCL in 2007. From 2007-2013 he was Chair of the Arts and Humanities Research Council; and from 2013-2015, he was Chair of the Lead Expert Group for the Government Office for Science Foresight Project on The Future of Cities. He is a Member of Academia Europaea, an FBA, an FAcSS and an FRS. He was knighted in 2001. In August 2017, he received an honorary degree from the School of Advanced Study, University of London in recognition of his outstanding contributions to higher education.

His research field covers many aspects of mathematical modelling of cities and the use of these models in planning. These techniques are now in common use internationally – including the use of the concept of entropy in building spatial interaction models – summarised in Entropy in urban and regional modelling (re-issued in 2011 by Routledge). These models have been widely used in areas such as transport planning, demography and economic modelling. His recent research is on the applications of dynamical systems theory in relation to modelling the evolution of urban structure in both historical and contemporary settings. This led to the laying of the foundations of a comprehensive theory of urban dynamics described in Complex spatial systems (2000). He has published over 200 papers and his recent books include The science of cities and regions (2012), his five volume Urban modelling (2012, edited), Explorations in urban and regional dynamics (2015, with Joel Dearden), Global dynamics (2016, edited) and Geo-mathematical modelling (2016, edited). He has a particular interest in interdisciplinarity and published Knowledge power in 2010; he writes the quaestio blog (www.quaestio.blogweb.casa.ucl.ac.uk).

Academic Impact

Faculty of Environment

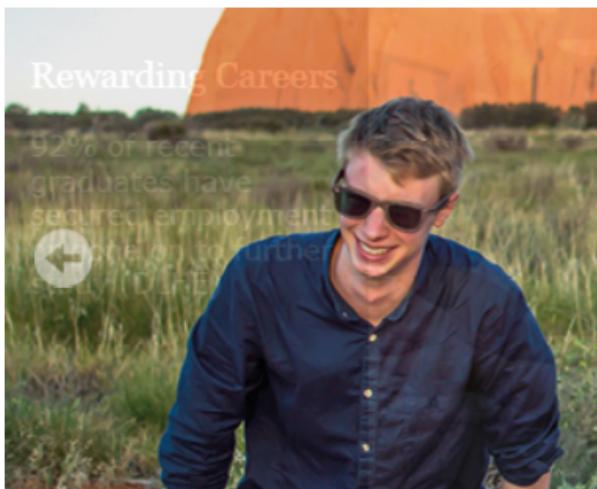
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Sustainability



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The Alan Turing Institute is the national institute for data science, headquartered at the British Library.

Five founding universities – Cambridge, Edinburgh, Oxford, UCL and Warwick – and the UK Engineering and Physical Sciences Research Council created The Alan Turing Institute in 2015.

Our mission

Our mission is to make great leaps in data science research in order to change the world for the better.

Research excellence is the foundation of the Institute: the sharpest minds from the data science community investigating the hardest questions. We work with integrity and dedication.

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Sustainability

A screenshot of the Leeds Institute for Data Analytics (LIDA) website. The header features the LIDA logo and the University of Leeds logo. The main navigation menu includes links for HOME, ABOUT, LATEST, DATA, RESEARCH, PARTNERSHIPS, and STUDY & TRAINING. A yellow banner at the top says "Leeds Institute for Data Analytics". The main content area on the left shows a news item about Dr. Nick Malleson's ERC grant award, with a "MORE >" link. To the right is a large image of a futuristic cityscape with glowing nodes and connections, and a portrait of Dr. Nick Malleson. Below the main content are four smaller cards: "DR NICK MALLESON AWARDED ERC GRANT", "UNDERSTANDING POLITICAL SENTIMENT", "RETHINKING HEART ATTACK TREATMENT", and "UNLOCKING CYCLING POTENTIAL".

Leeds Institute for Data Analytics

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Dr Nick Malleson awarded ERC Grant

Congratulations to Dr Nick Malleson who has been awarded a €1.4 million ECR grant to further his research in using big data to react to civil emergencies.

MORE >

DR NICK MALLESON AWARDED ERC GRANT

UNDERSTANDING POLITICAL SENTIMENT

RETHINKING HEART ATTACK TREATMENT

UNLOCKING CYCLING POTENTIAL

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Conclusion

OS

"We kept a field going that was embryonic..."
"on the basis of about two ideas!"



Conclusion



- Don't say: "Kept an embryonic field going with two ideas"
- Do say: "Gave birth to a **family of (spatial interaction modellers)** who have collectively shaped **research** in spatial analysis with real world **impact**, building **skills and capability** for a **sustainable** long-term future!"