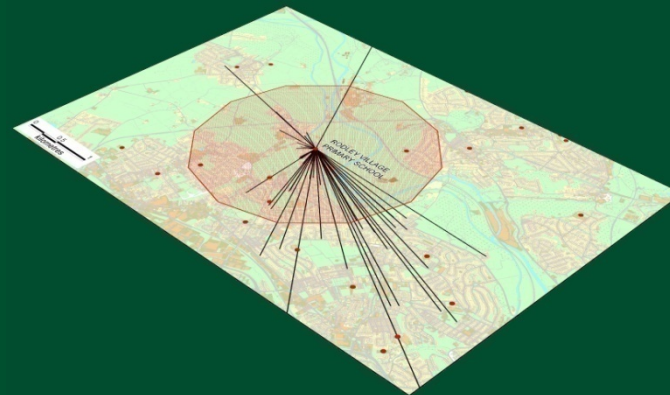


Using Spatial Interaction Models for Education Planning

Kirk Harland



Email: k.harland98@leeds.ac.uk

S4 Conference 9th January 2009

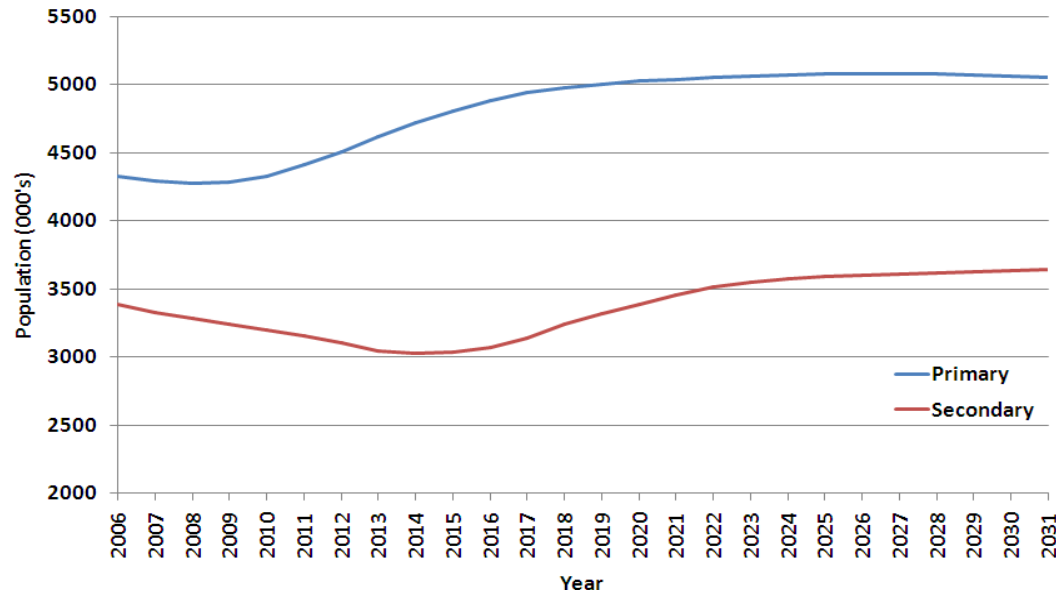


Presentation

- Context
- Modelling Methodology
- Model Structure
- Study Area
- Simulating the Past
- Predicting the Future
- Summary
- Future Research

Context

- 1988 ERA – ‘open market policy’
- 28/02/2007 – new school admissions code
 - Has mandatory provisions
 - **Requires** LAs to provide equitable access to schools for all



2004-based population projections by the Government Actuary, England





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Fighting to rescue rural schools

By Jeremy Cooke
BBC News

Hundreds of people have protested against Shropshire's planned rural school closures in the county town of Shrewsbury.



From small villages across Shropshire they arrived at Shire Hall in Shrewsbury with the same message - "Save our schools."

Hope Primary was one of the schools protesters wanted to protect

VIDEO AND AUDIO NEWS
"We really believe we're going to win this fight."
LISTEN

SEE ALSO

- School closures are put on hold 30 Jan 08 | Shropshire
- 'Muddle' on rural school closures 30 Jan 08 | Education
- Warning on rural school closures 30 Jan 08 | Education
- Schools to plead case on closures 29 Jan 08 | Shropshire
- School cuts 'risk country life'

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Rural school closures in dispute

Ministers are reminding England's local authorities that, by law, they should not be closing rural schools.

A letter is being sent to all councils - amid a public lobbying campaign aimed at stopping small school closures.



Proposed closures often provoke a strong local reaction

The Liberal Democrats accused the government of muddle and hypocrisy because of guidance it has also issued saying surplus places must be closed.

VIDEO AND AUDIO NEWS
Protests at one of the schools facing closure
WATCH

SEE ALSO

- School closures are put on hold 30 Jan 08 | Shropshire
- Village schools 'facing closure' 27 Jan 08 | Education
- MP attends at-risk school event 26 Jan 08 | Shropshire
- Closure threat schools revealed 23 Jan 08 | Shropshire
- Hundreds at school closures demo

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School closures are put on hold

Plans to consult on closing 22 Shropshire schools have been put on hold after a protest by hundreds of parents, teachers and pupils.



But Shropshire County Council still intends to press ahead with proposals to merge 16 others.

Large crowds of protesters, many waving placards, and shouting "save our schools", gathered outside the meeting.

Protesters want all school closure proposals reconsidered

VIDEO AND AUDIO NEWS
"We really believe we're going to win this fight."
LISTEN

BBC Shropshire
Travel, weather and more from the BBC Shropshire Website

SEE ALSO

- 'Muddle' on rural school closures 30 Jan 08 | Education

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Family's shock at council spying

A couple have spoken of their shock after their local council spied on them to see if they had been cheating the school catchment system.



Tim Joyce and Jenny Paton and their children were put under surveillance by Poole Borough Council for more than two weeks without their knowledge.

Jenny Paton on the council's 'outrageous' action

Miss Paton said this kind of scrutiny was "hugely disproportionate".

The council has defended its actions, carried out under the Regulation of Investigatory Powers Act (RIPA).

SEE ALSO

- Council admits spying on family 10 Apr 08 | Dorset
- Who watches the watchers? 06 Feb 08 | Politics
- Do you know what they know about you? 23 Nov 07 | Technology
- Cameras installed in school loos 14 Sep 07 | Tees

Context

- Education is a ‘hot topic’ prompting a variety of research:
 - Social and ethnic segregation (Gibson and Asthana 2000a, 2000b; Gorard 1999, 2000, 2004; Johnston *et al.* 2004, 2005, 2006)
 - Qualitative studies on school choice (Pooley *et al.* 2005; Gereluk, 2005)
 - Pupil mobility at non-conventional times of year (Demie 2002; Dobson *et al.* 2000; Dobson and Pooley 2004, Wilson 2008)
 - National Pupil Database (NPD) gateway hosted by the University of Bristol and the Department for Children, Schools and Families
- Limited research on pupil-school interactions and school role forecasting (Sven Muller, Dresden University)

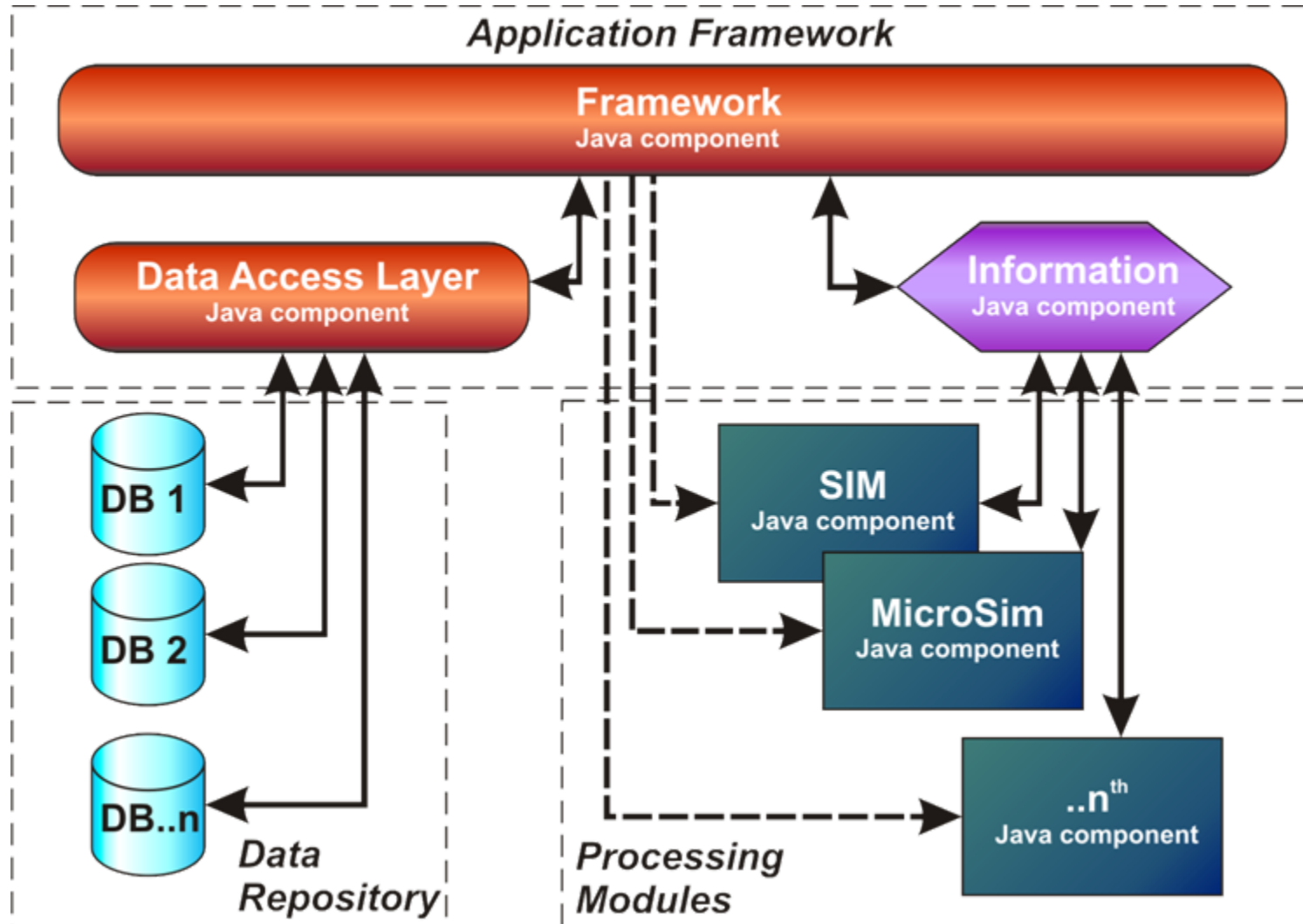
Modelling Methodology: Applications

- Spatial interaction models have been applied successfully in studies of, for example:
 - migration (Stillwell 1978)
 - journey to work (Senior 1979)
 - retail location planning (Fotheringham 1983; Fotheringham and Trew 1993)
 - commercial retail marketing (Birkin *et al.* 2004)
- Peculiarities of each market have demanded model innovations
- Education sector is no different ... it has its own challenges

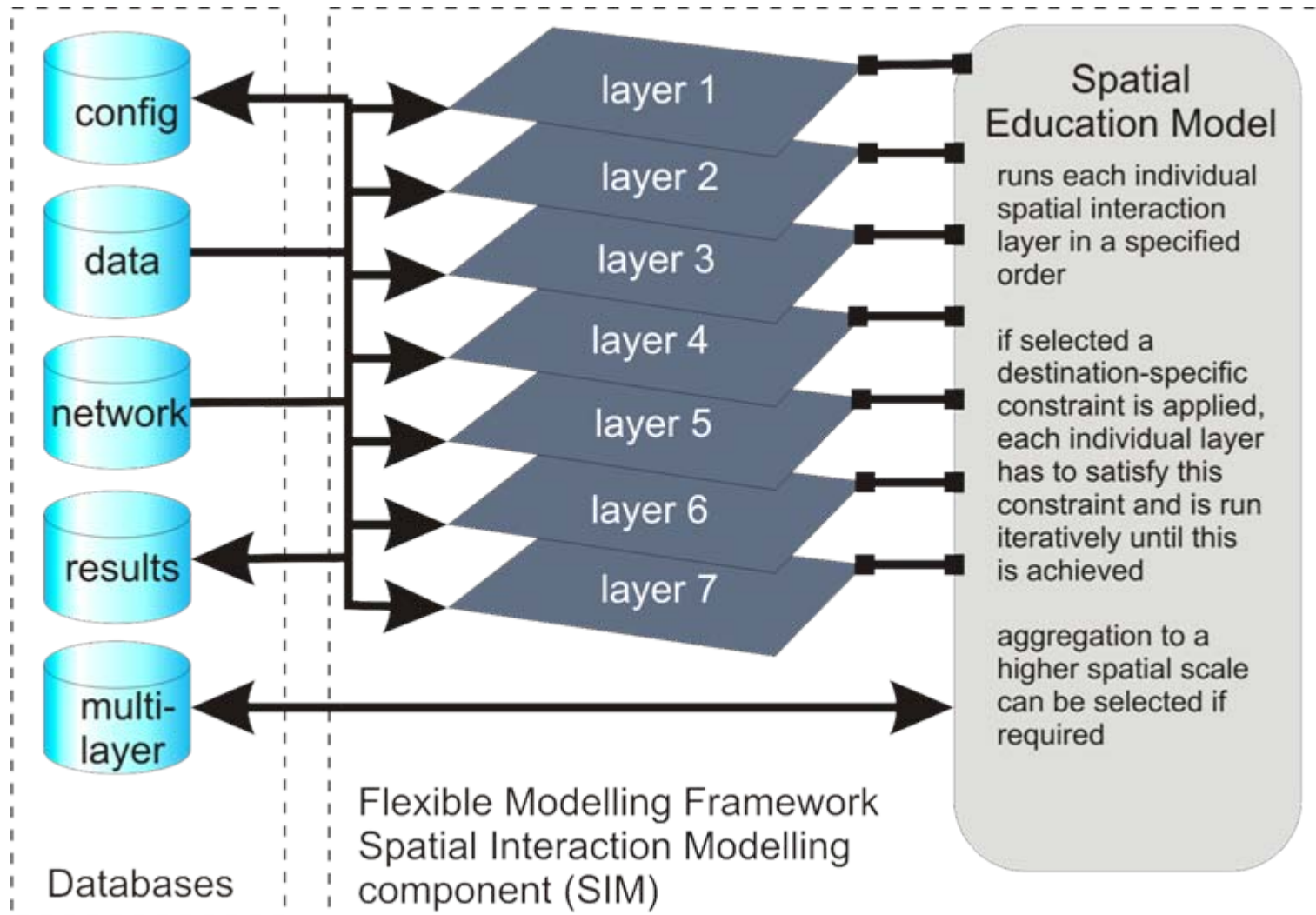
Modelling Methodology: Challenges in the Education Sector

- **School capacities:** Schools have a maximum number of pupils they can accept...BUT these do not have to be met
- **Over-subscription policy:** Can differ between Local Authorities and schools
- **Data rich:** Collection and collation of over eight million individual pupil records each year (Jones and Elias 2006)
- **School selection behaviour:** Differs between primary and secondary phases and also between families with different backgrounds
- **Boundary effects:** Although sector is data rich, some data are not available to education planners when planning projects are undertaken (such as preference data for neighbouring authorities)

Model Structure – Application Framework

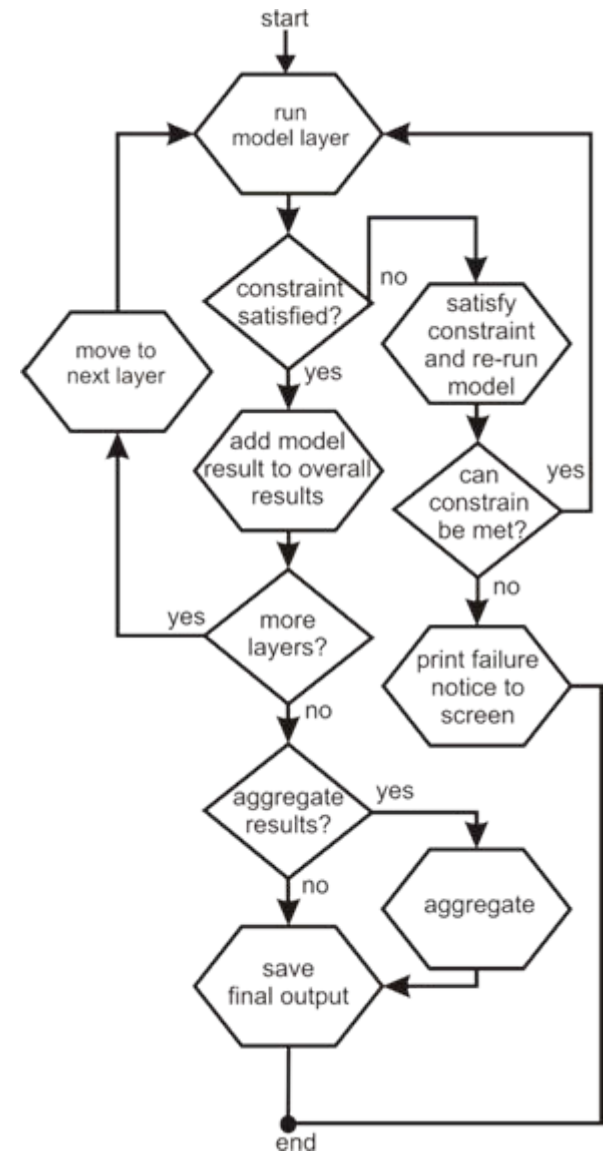


Model Structure – Spatial Education Model



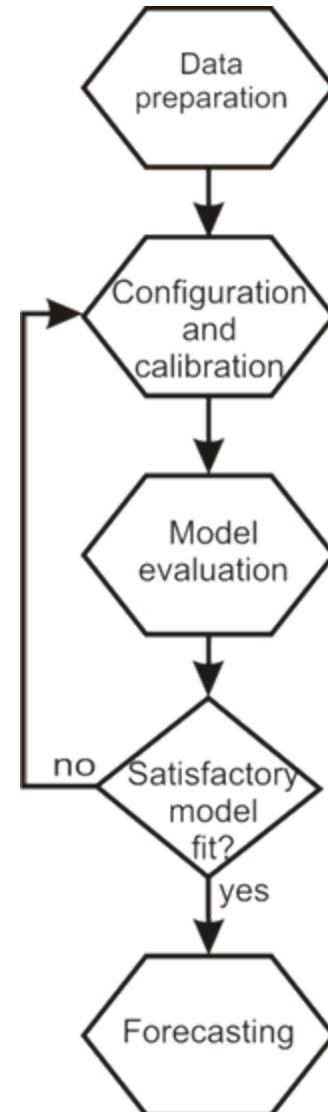
Model Structure – Execution Process

- Overall destination constraint can be turned off
- Results can be generated using detailed information and then aggregated to the desired geographical scale
- Each model 'layer' is an origin constrained spatial interaction model representing a collection of pupils displaying similar school selection behaviour

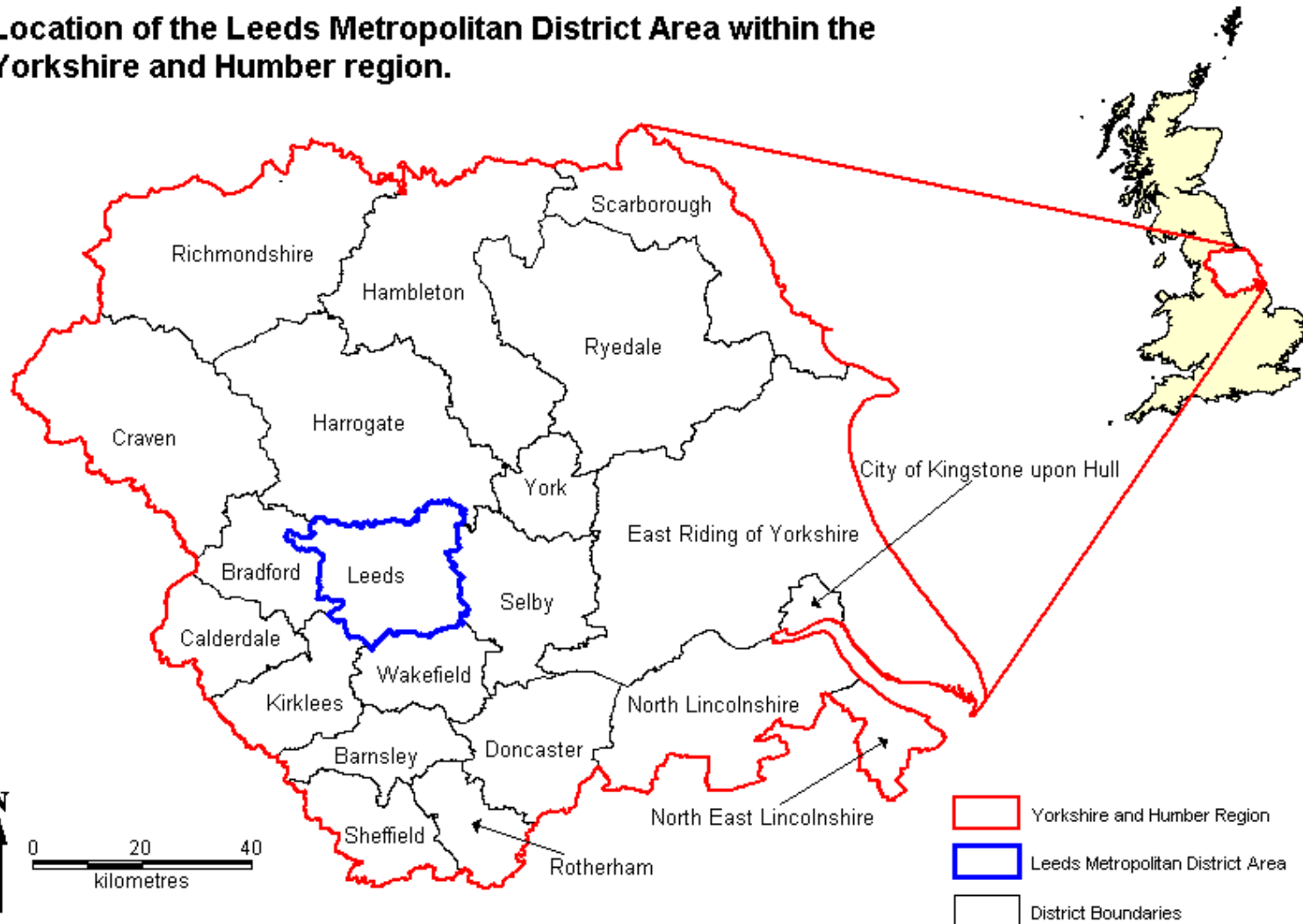


Model Structure – Model Construction

- Data required
 - Preference information to -
 - Enable school attractiveness to be estimated
 - Calibrate each origin constrained spatial interaction model layer
 - Data on known pupil to school interactions
 - Projected data on future pupil numbers

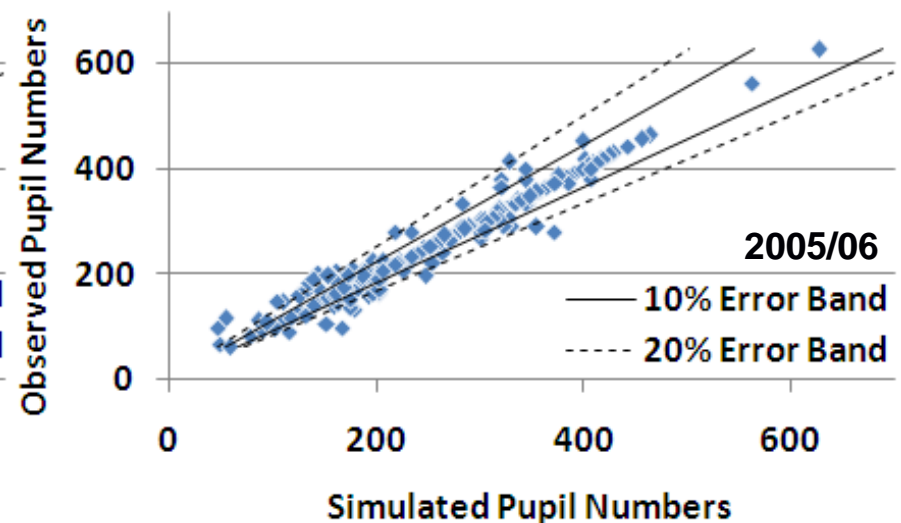
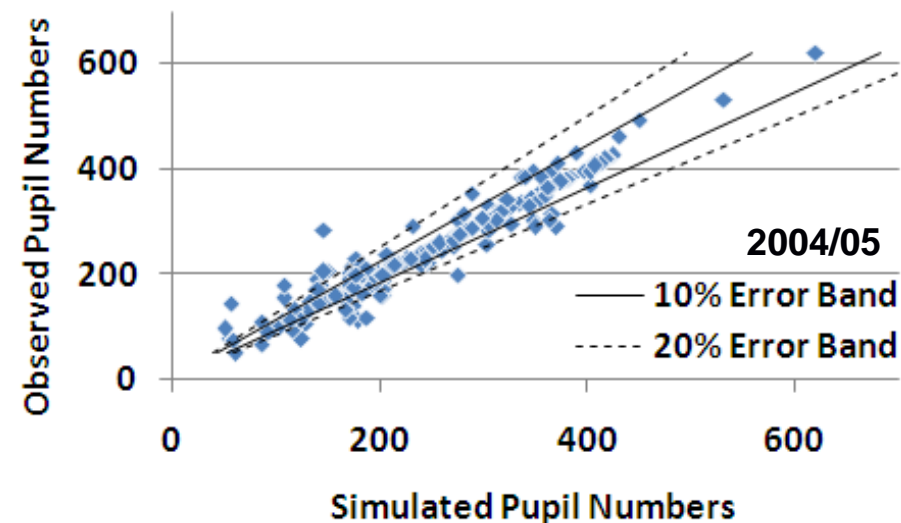


Location of the Leeds Metropolitan District Area within the Yorkshire and Humber region.



Simulating the Past

- School role simulation errors

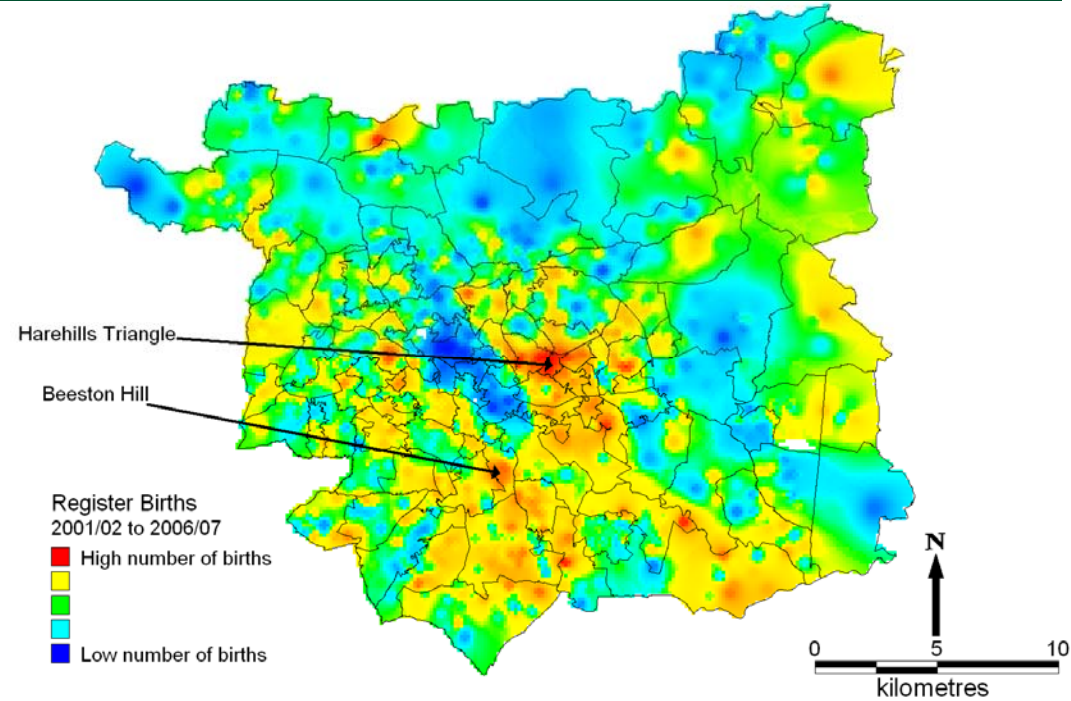
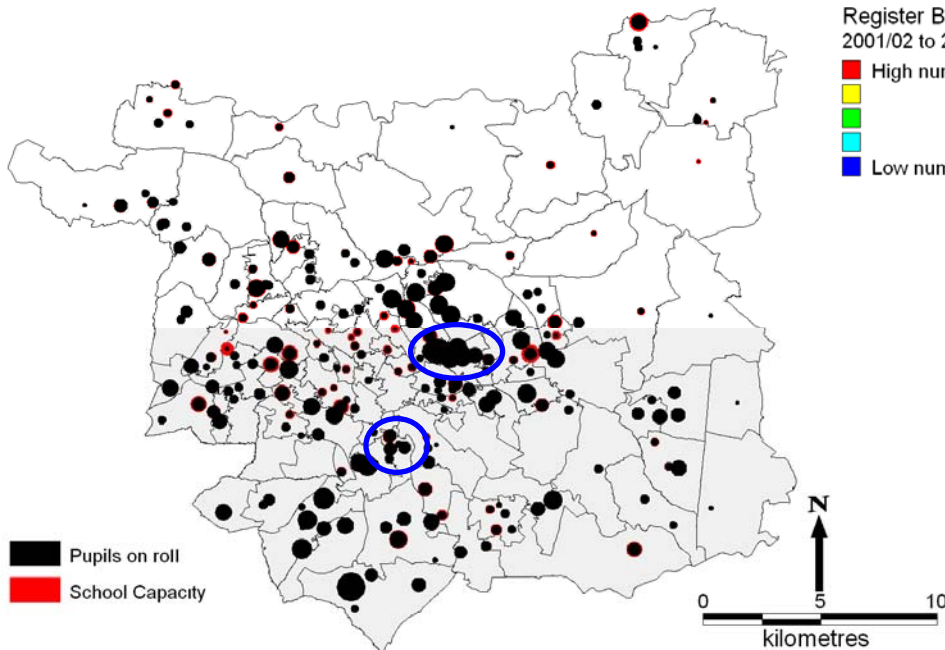


- Goodness of fit statistics

Year	Output Areas		LLSOA		MLSOA	
	SRMSE	R ²	SRMSE	R ²	SRMSE	R ²
2004/05	5.77	0.75	3.79	0.88	2.43	0.94
2005/06	5.64	0.76	3.66	0.88	2.28	0.95

Predicting the Future

- High proportions of births can be seen in the Harehills Triangle and Beeston Hill areas

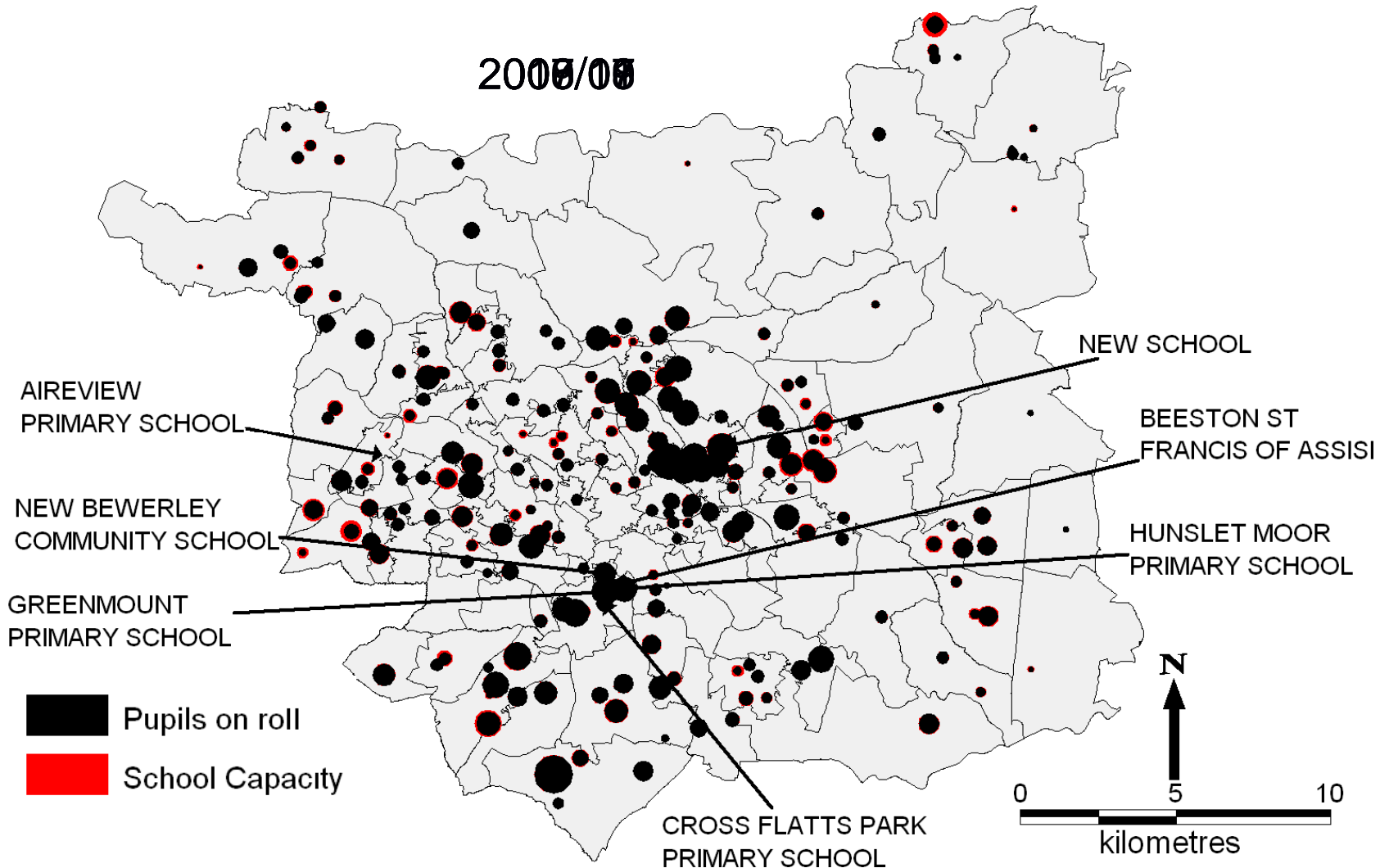


- These two areas have low numbers of surplus school places

Predicting the Future – Scenario Setup

- Births data includes areas outside of Leeds which traditionally have pupils attending Leeds primary schools
- Survival ratios calculated for the births data
- Without alteration to the 2005/06 school network demand for school places outstrips supply by 2010/11
- Surplus school places are not geographically aligned with demand
- Proposed network alterations
 - Close Aireview Primary School
 - Open new school in Harehills Triangle
 - Increase capacity in Beeston Hill area

Predicting the Future



Predicting the Future – Scenario Summary

- Births in and around Leeds have increased dramatically in recent years – but in line with national projections
- The increasing demand for school places is not geographically aligned to surplus school places
- Harehills Triangle and Beeston Hill are both areas with high proportions of ethnic minority groups with fertility rates higher than the national average
- The schools in these areas are operating at or near capacity
- Even after increases in school capacity and the creation of a new ‘super’ primary school demand for school places outstrips supply by 2011/12

Summary

- Forecasting pupil numbers is becoming increasingly important
- Changing population numbers, complexion and distributions demands more sophisticated methods for planning education
- Use of a series of spatial interaction models wrapped within a broader rule-based model controlling for specific features of each destination/school provides a useful model for supporting the education planning process
- Preference data is required to calibrate models, but not easily accessible
- A fully calibrated Spatial Education Model can be used to provide insights into future school network issues

Future Research Possibilities

- The SEM relies on a demographic classification to disaggregate the pupils into 'layers', could an education specific classification system be developed at an appropriate geographical scale?
- The education sector is data rich. Could the application of multi-agent model to this sector provide more accurate results?
- Would the application of a multi-agent model allow more representative school selection behaviour and make the requirement of preference data redundant?
- Can an education model be incorporated into a planning support system specifically designed for the education sector



Thank you for listening

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