



MoSeS: Modelling and Simulation of of e-Social Science

Belinda Wu

School of Geography
University of Leeds

Outline

Background

Introduction of MoSeS

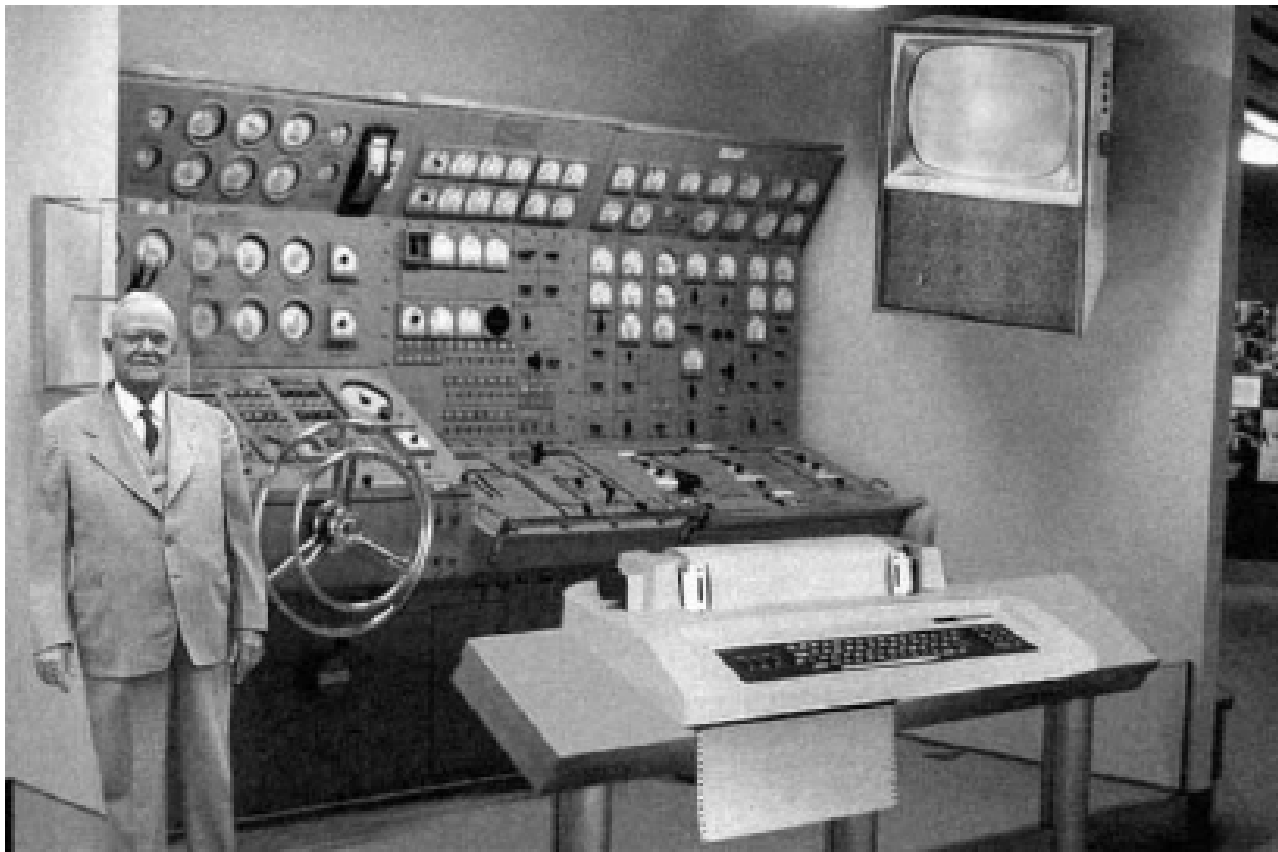
Modelling social systems in MoSeS

MoSeS progress

Conclusion and Future work

Introduction

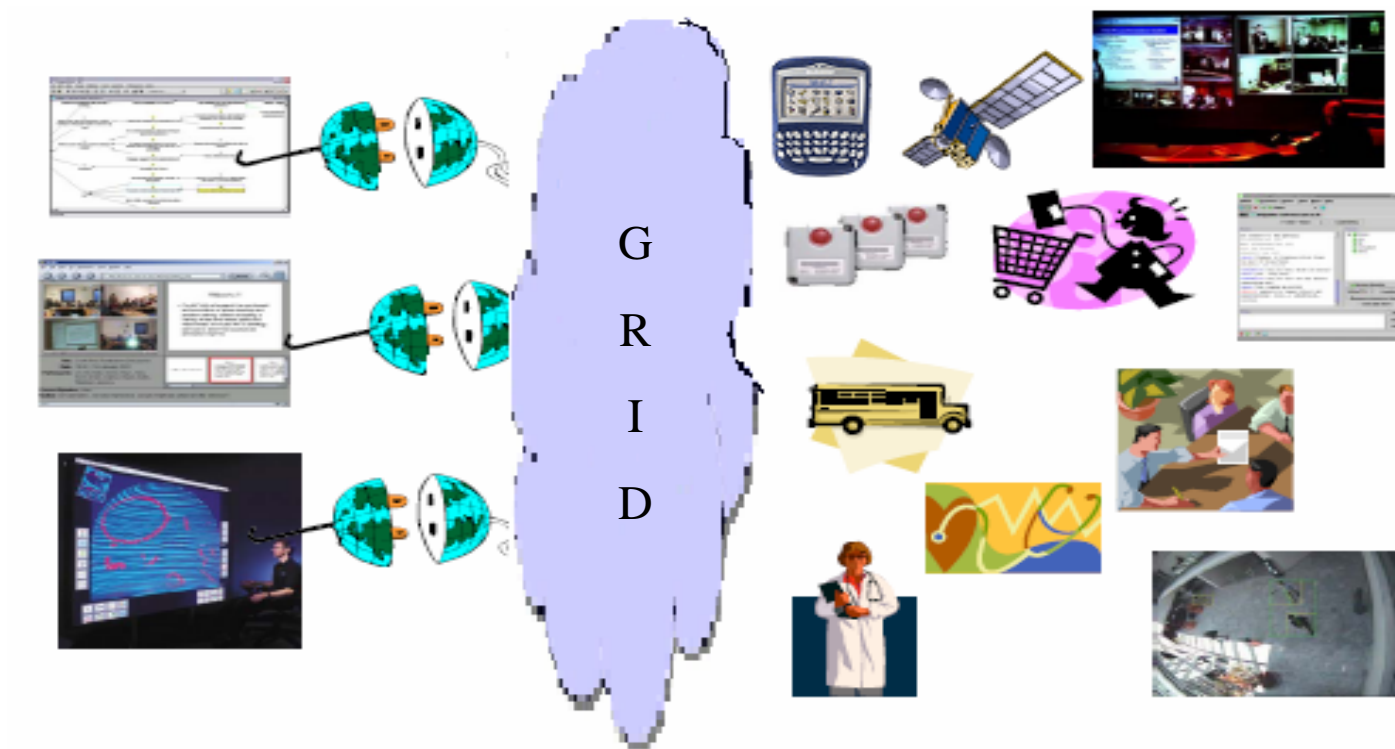
RAND's "Home Computer" for 2004 in 1954



IZ presentation at Bonn, Germany, 25th September, 2006

Background

The social world is digital



Background

e-Social Science

- based on Grid Computing and collaboration
 - ‘[The Grid] intends to make access to computing power, scientific data repositories and experimental facilities as easy as the Web makes access to information.’ (Tony Blair, 2002)
- e-Science targeted and geared for applications more specific to social science

Background

e-Social Science in UK:

The National Grid Service



- Core sites**
- White Rose (Leeds)
 - Manchester
 - Oxford
 - CCLRC
- Partner sites**
- Bristol
 - Cardiff
 - Lancaster



Background

NCESS

- To help social scientists make the best use of e-science technologies to address key social science research challenges;
- To stimulate the uptake of Grid-enabled computing, data infrastructure and collaboration in social science research;
- To provide information, training, advice, support and online resources;
- To advise on the future strategic direction of e-social science.

Introduction of MoSeS

MoSeS:

- a node of NCeSS
- an interdisciplinary team

From:

- Computing
- Geography
- Transport
- Health

Led by:

Dr. Mark Birkin

Introduction of MoSeS

MoSeS

Modelling and Simulation of e-Social Science

MoSeS Objectives:

- To develop a complete **representation** of the UK population at a fine spatial scale
- To produce rich, detailed and robust **forecasts** of the future population of the UK
- To investigate **scenarios** which relate demographics to service provision - emphasis on policy applications within the health and transport policy sectors

Modelling social systems in MoSeS

Social Systems are “messy”

- boundaries
- large and
- complex (Moss, 2000)

Modelling social systems in MoSeS

Table 1: Types of Social Models

simple	complex
small	large
qualitative	quantitative
static	dynamic
deterministic	stochastic
non-behavioural	behavioural
non-spatial	spatial

(Citro and Hanushek, 1991)

Modelling social systems in MoSeS

Individual Based Models (IBM):

- MSM (Microsimulation Model)
- CA (Cellular Automata)
- ABM (Agent Based Model)

Modelling social systems in MoSeS

MSM:

A statistical procedure for estimating the characteristics of individuals from knowledge of the aggregate characteristics of the population to which they belong (Johnston, 2000).

Spatial MSM:

A special type of MSMs that simulate virtual populations in given geographical areas (Ballas et al, 2005).

Modelling social systems in MoSeS

Spatial dimension in social system

“One can not be at two places at the same time.”
(Hägerstrand, 1967)

“Means are to be employed somewhere.”
(De Man, 1998)

People have to live in a local area and they are affected by local environment.

Modelling social systems in MoSeS

Agent based technology:

- CA

discrete dynamic system where behaviours are completely specified in terms of a local relation (Dijkstra, 2000).

- ABM

multiple agents working together to solve a given problem that is beyond individual capability or knowledge (Jennings, 2000).

Modelling social systems in MoSeS

Proposed hybrid approach using MSM and ABM

Geography provides a perspective to help unify ABM and MSM.

MSM can benefit from ABM:

- Modelling the intelligent behaviour of individuals by itself or in society;
- Improving efficiency by distributing the control of the computation by multiple simpler units evolving through their interactions (Jennings, 2000).



source: <http://www.massivesoftware.com>

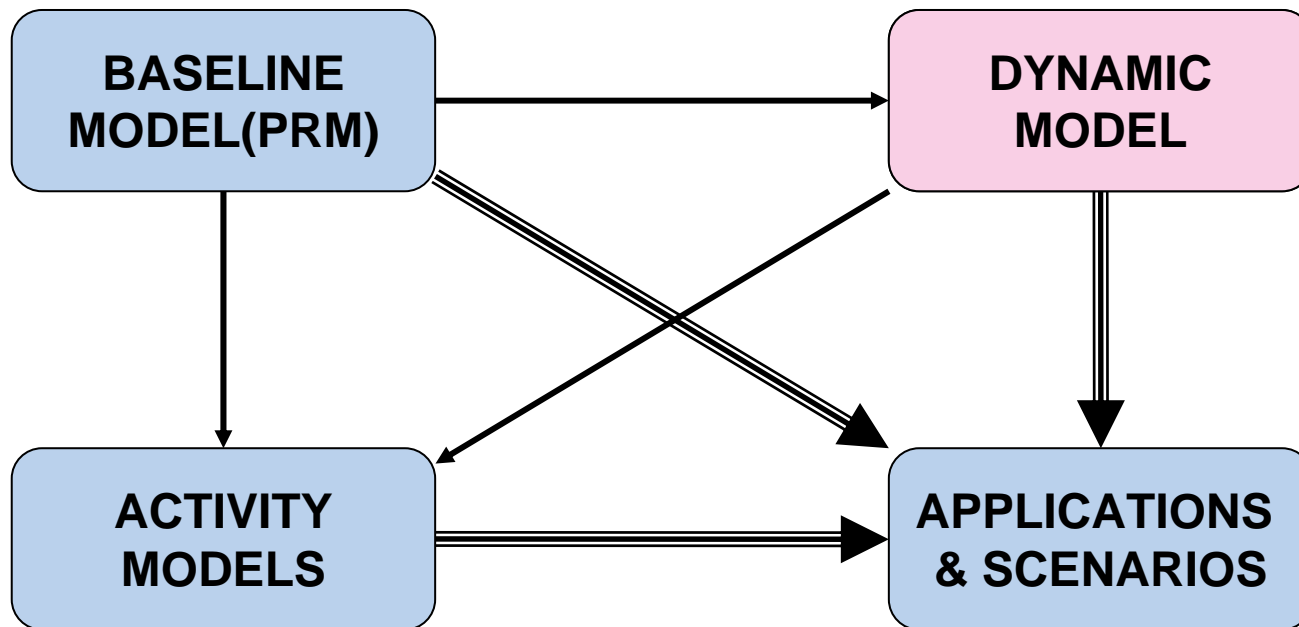
Modelling social systems in MoSeS

Our hybrid approach gives new angle to classical problems:

- consistency with the world outside a defined core system boundary;
- simultaneous processes on different spatial and temporal scales;
- concurrent internal and external rules for agents and
- integration of endogenous emergence and observable /postulated behaviour (Boman and Holm, 2004).

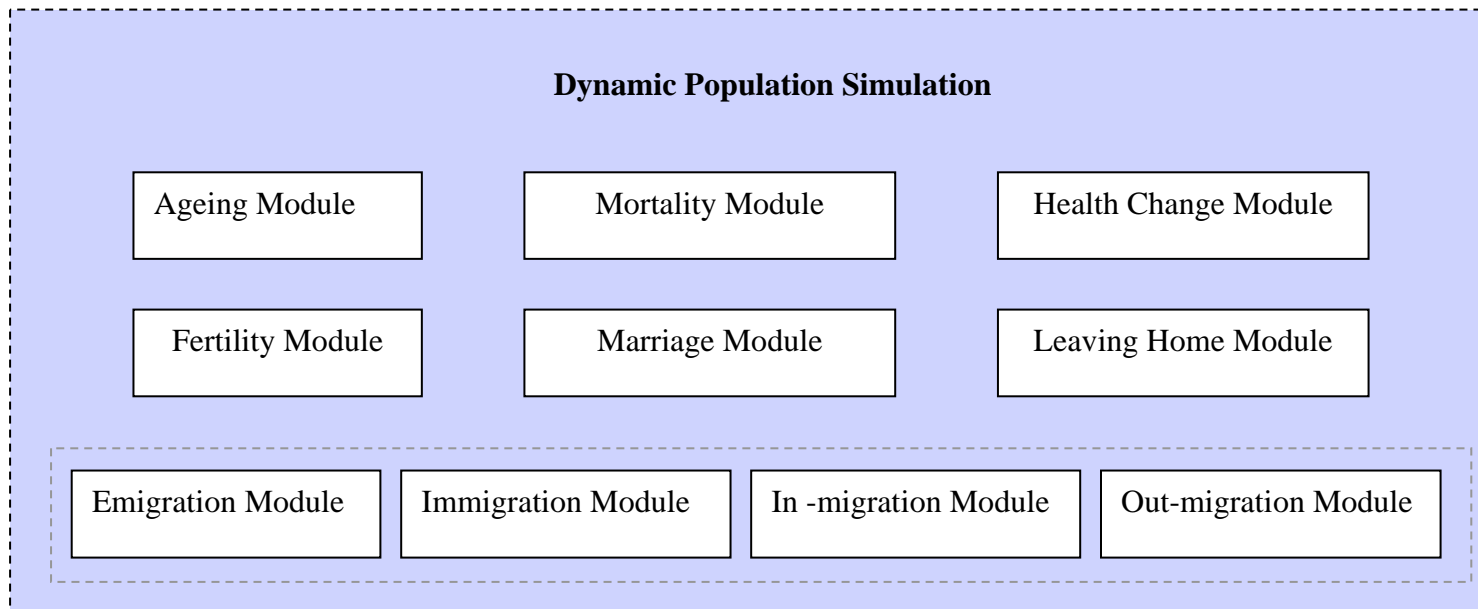
Modelling progress in MoSeS

Figure 1. System Components



Modelling Progress in MoSeS

Figure 2. Simulation Module



Modelling Progress in MoSeS

MSM vs ABM

1. Mortality

- Death?
 - $>$ Survival probability: die
 - \leq Survival probability: live
- Update
- Intention?
- Consideration?
- Decision?
- Action?

Modelling Progress in MoSeS

MSM vs ABM

2. Policy interaction

What if...

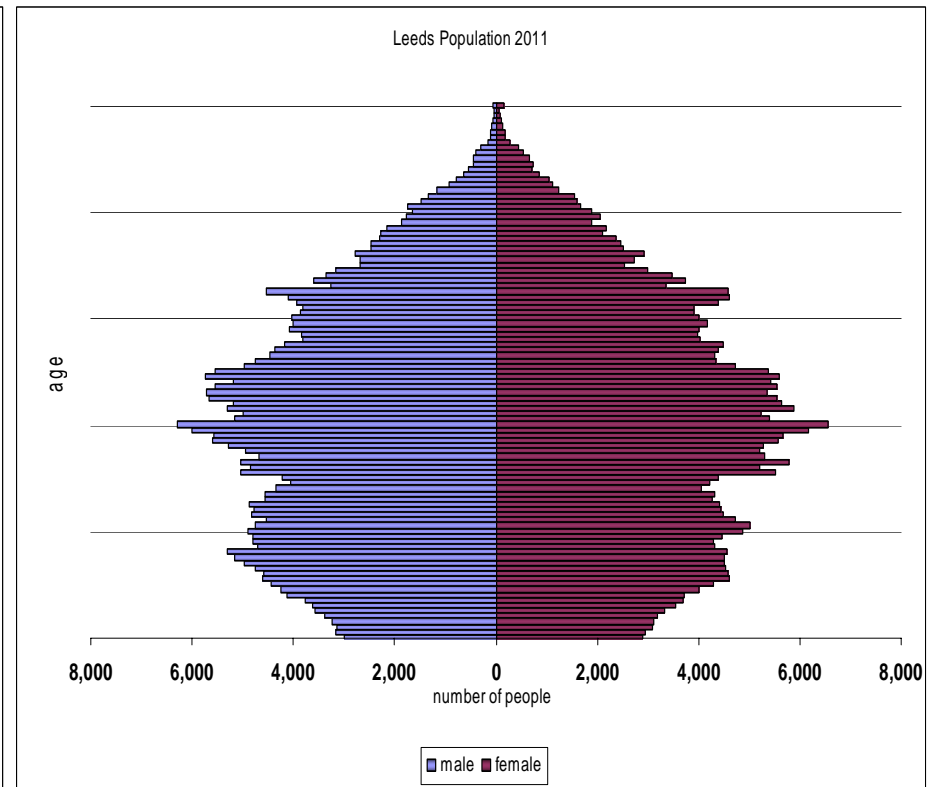
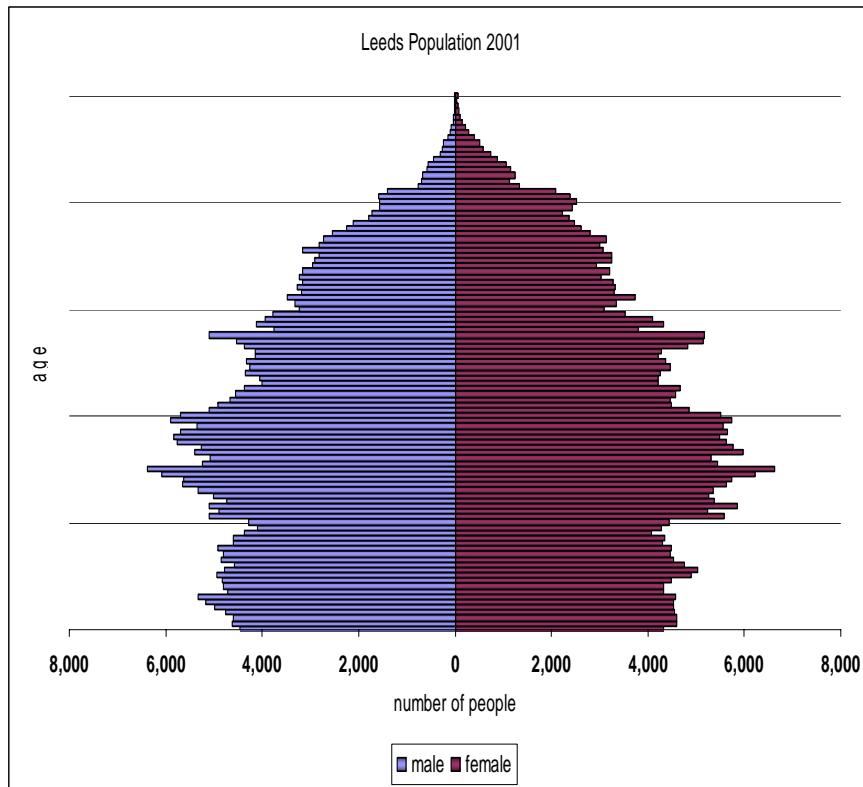
A new hospital?

- Move?
- $>$ Movement probability: stay
- \leq Movement probability: move
- Update
- Intention: move?
- Consideration:
 - Families/friends?
 - Housing? Transport? etc.
- Decision: happy/unhappy
(How? Where? etc.)
- Action: move/stay

Modelling Progress in MoSeS

Results: decision support (high level)

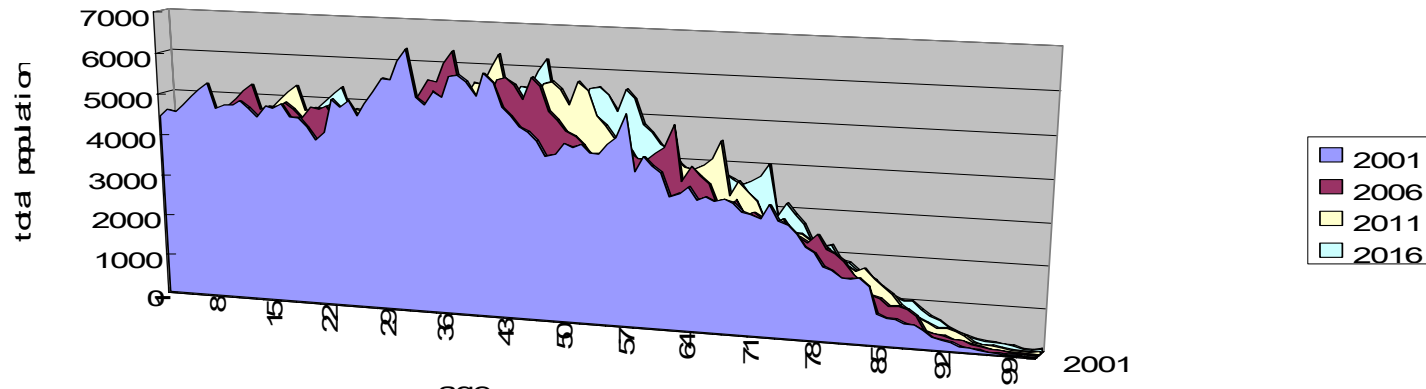
1. Leeds population change



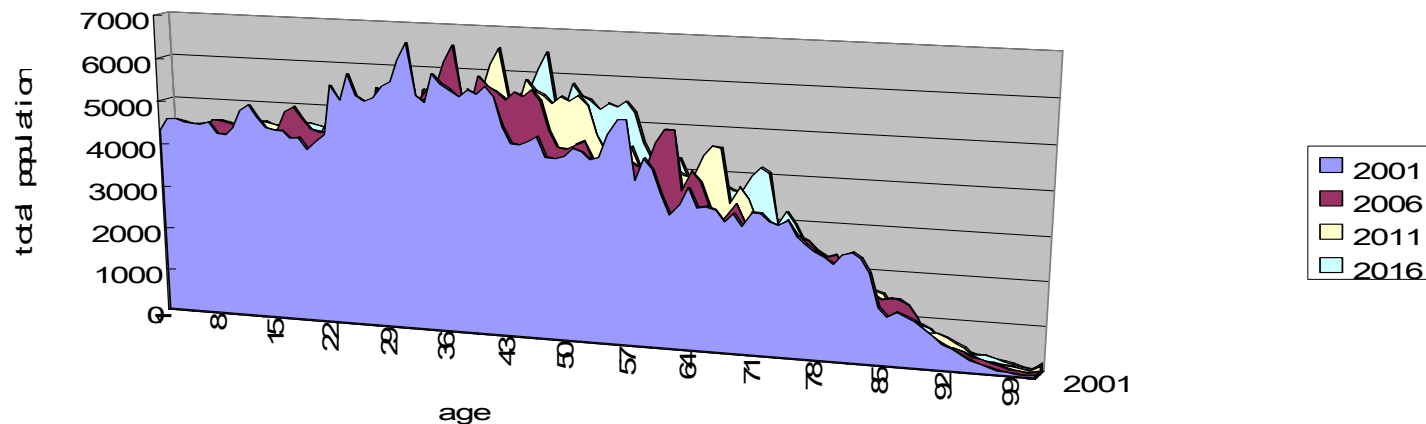
Modelling Progress in MoSeS

2. Comparison of Leeds population change by gender

Leeds Male population changes

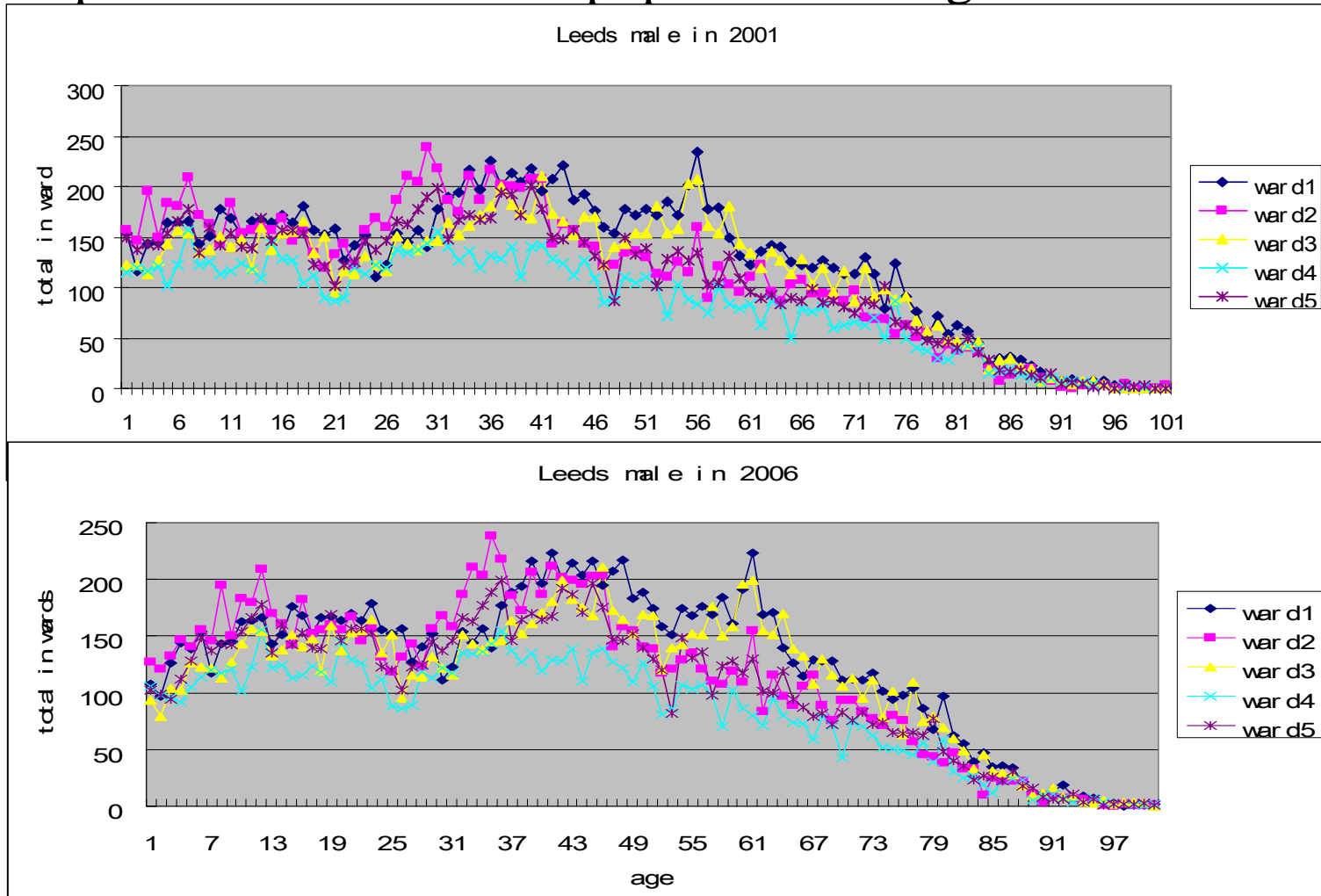


Leeds Female population changes



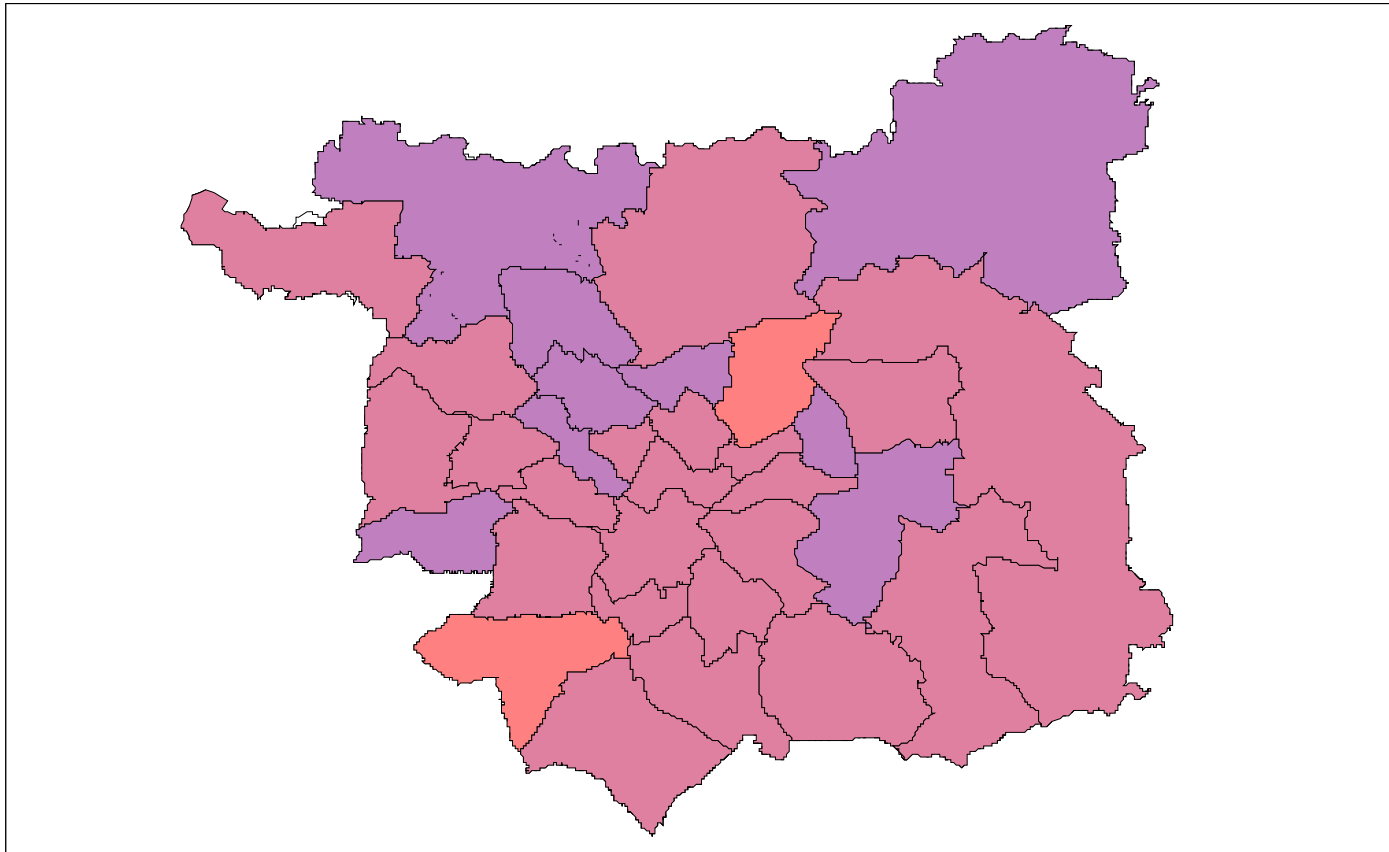
Modelling Progress in MoSeS

3. Comparison of Leeds male population changes in 5 wards



Modelling Progress in MoSeS

4. Comparison of diabetes distribution in Leeds in 2005 and 2030



Modelling Progress in MoSeS

Results: decision support (low level)

HYDRA Health Care Planning Support System | University of Leeds, 2004

Help

Service is NOT available for Scotland
Locate a county using the tree below or by clicking on the map:

- Counties
 - Avon
 - Bedfordshire
 - Berkshire
 - Buckinghamshire**
 - Cambridgeshire
 - Cheshire
 - Cleveland
 - Clwyd
 - Cornwall and Isles Of Scill
 - Cumbria
 - Derbyshire
 - Devon
 - Dorset
 - Durham

code	x	y
3213	474100	208800
3214	473300	208500
3215	474600	216700
3216	469500	208700
3217	469500	208400
3218	463900	211500
3219	465200	213800
3220	465200	213800
3221	480390	214820
3222	483500	213900
3223	484000	213400
3224	481900	213700
3225	482500	214800
3226	482100	213400
3227	481200	212000
3228	479800	221000
3229	486800	218900
3230	488800	211700

You are in the County of: Buckinghamshire and the District of: Aylesbury Vale

Reset Zoom Pan

Choose Model Parameters:
(a) Select age ranges:

Minimum Female Age: Maximum Female Age:

Minimum Male Age: Maximum Male Age:

(b) Enter Minimum and Maximum number of surgeries:
Minimum: Maximum:

3. Select year for model run:
 1991 2001 2011 2021

4. Enter 'run' name to save current input choices:

Here are your results.

You can map their locations by selecting the number of surgeries you ran the model for from the list below.

- 3
- 4
- 5
- 6**

5. Click button below to view summary info

If you would like to change past model inputs, choose a past model run from list:

Conclusions and Future Work

Relatively early stage for MoSeS, but we expect fruitful outcomes through the hybrid approach combining the strength of both MSM and ABM.

Time lines:

- MoSeS aims to make the model available as open source through Grid within 3 years;
- Toy Model version 3.0 released;
- Grid demonstrator – SC06 (November).

Next steps:

- Activity Models
- Applications and Scenarios

Conclusions and Future Work

- e-Infrastructure for e-Social Science is in its infancy
- We are hoping to:
 - Develop and adopt standards
 - Let engineers organise the hardware
 - Develop Open Source software solutions
 - Show case the enormous data and computational problems of e-Social Science
 - Collaborate
 - Spread the word



Thank you!

e-mail: B.Wu@leeds.ac.uk

For more information of MoSeS, visit:
<http://www.ncess.ac.uk/nodes/moses/>