MoSeS: Modelling and Simulation of of e-Social Science

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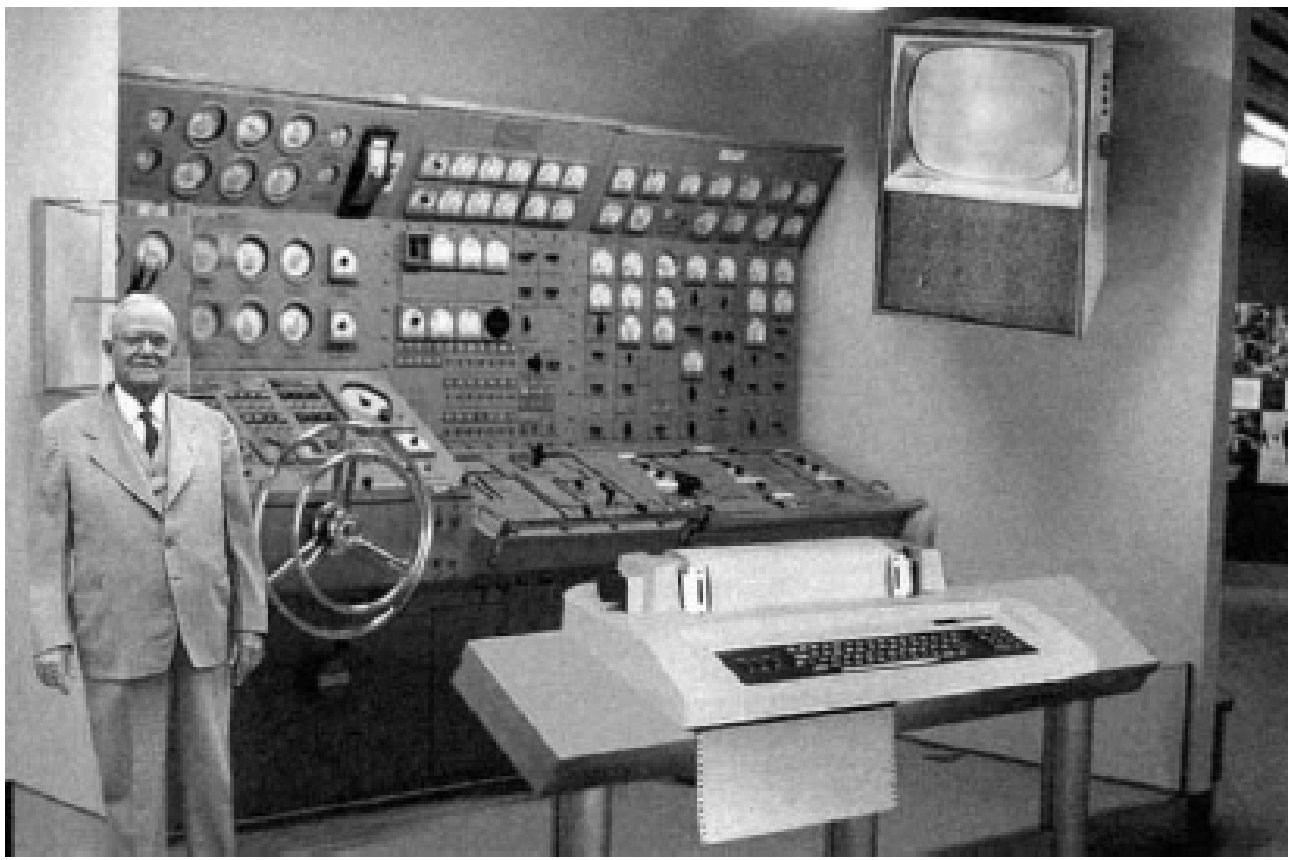
Outline

Background
Introduction of MoSeS
Modelling social systems in MoSeS
MoSeS progress
Conclusion and Future work

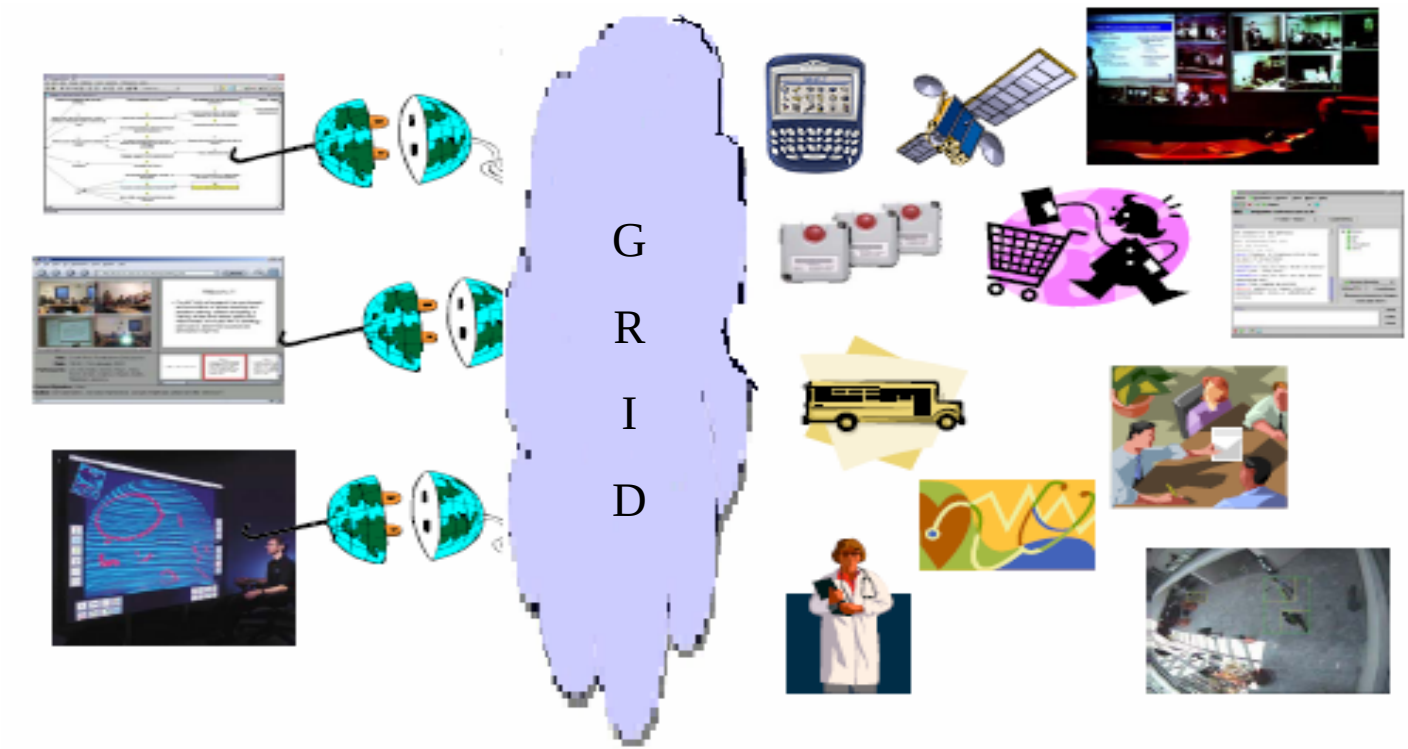
Introduction

RAND's "Home Computer" for 2004 in 1954



Background

The social world is digital



Background

e-Social Science

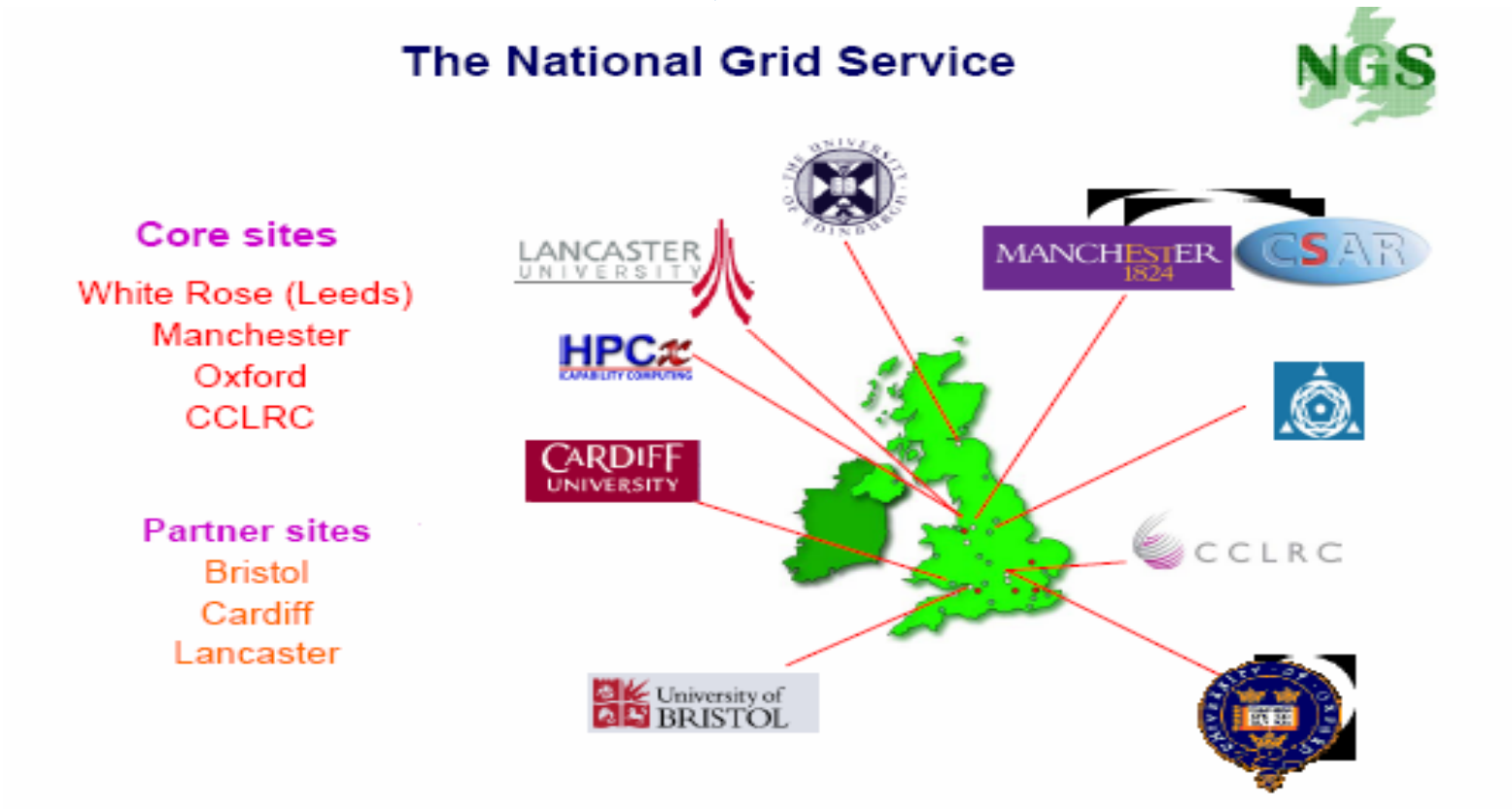
- based on Grid Computing and collaboration

'[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:



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).

NCeSS
National Centre for eSocial Science

UNIVERSITY OF LEEDS

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

source: http://www.massivesoftware.com

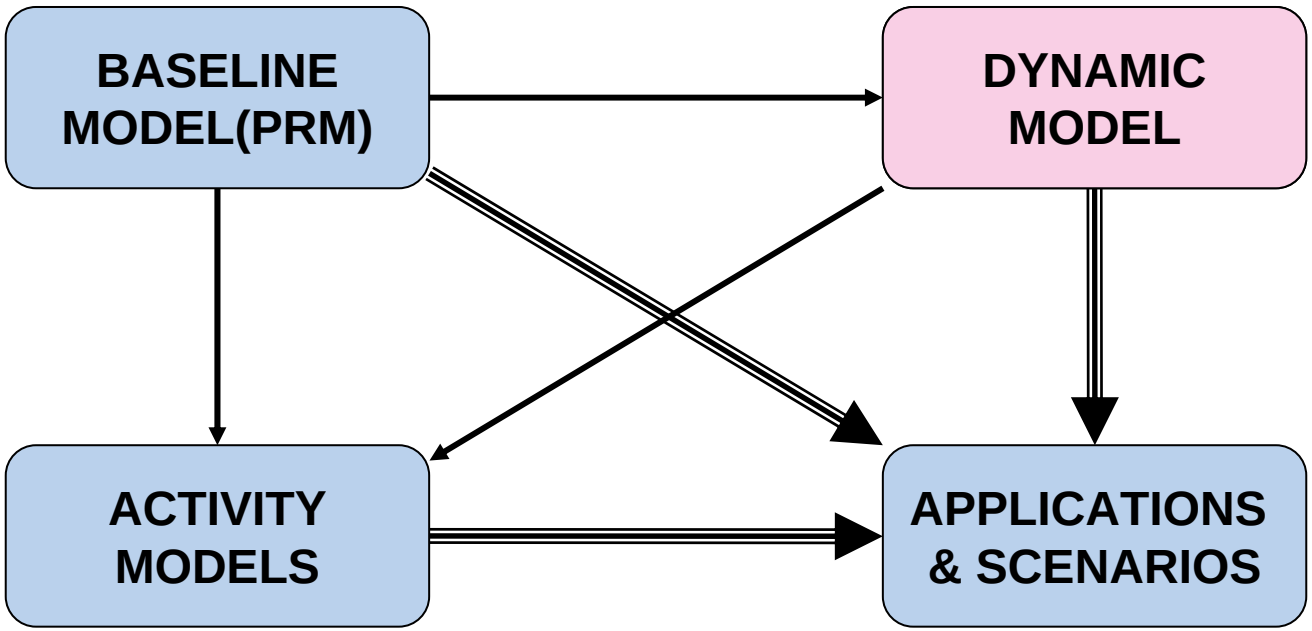
Modelling social systems in MoSeS

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).

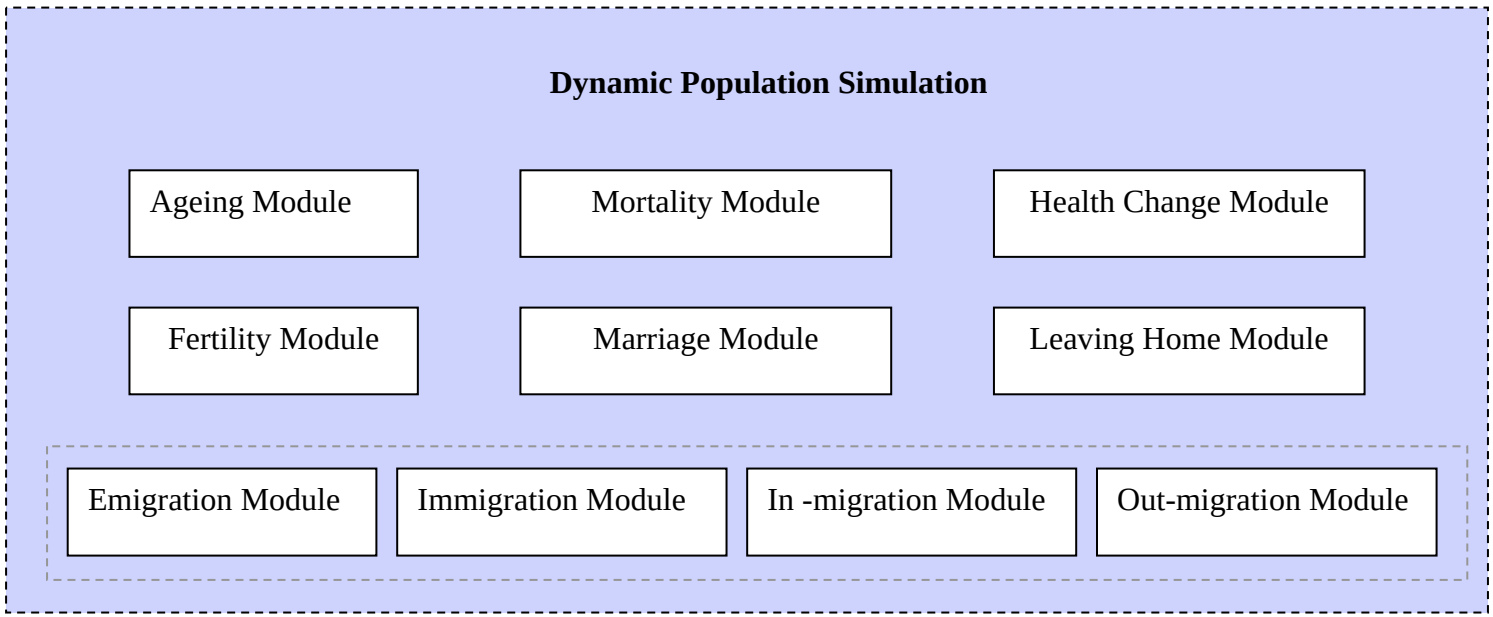
Modelling progress in MoSeS

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
  <=Survival probability: live
- Update

- Intention?
- Consideration?
- Decision?
- Action?

Modelling Progress in MoSeS

MSM vs ABM

2. Policy interaction

What if…

A new hospital?

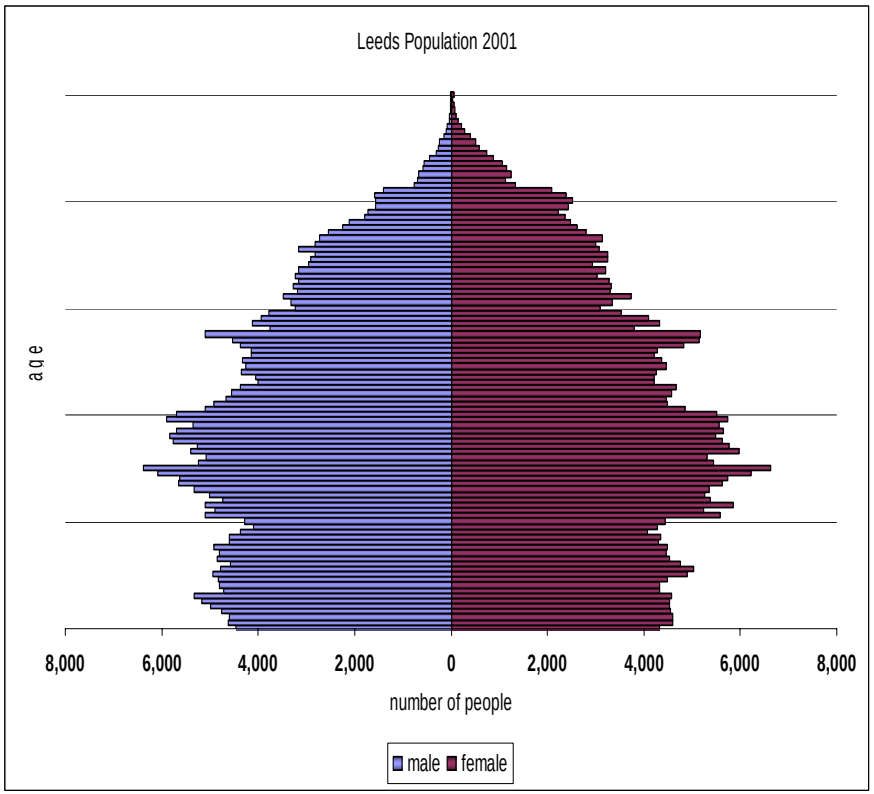
- Move?
- >Movement probability: stay
  <=Movement probability: move
- Update

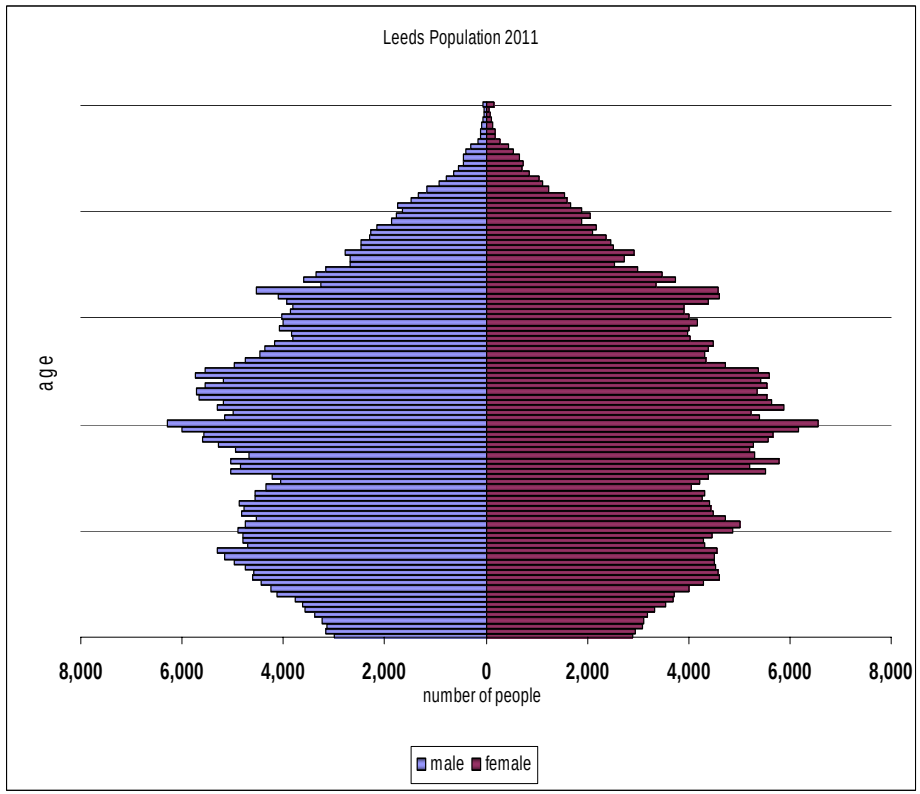
- Intention: move?
- Consideration:
  Families/friends?
  Housing? Transport? etc.
- Decision: happy/unhappy
  (How? Where? etc.)
- Action: move/stay

Modelling Progress in MoSeS

Results: decision support (high level)

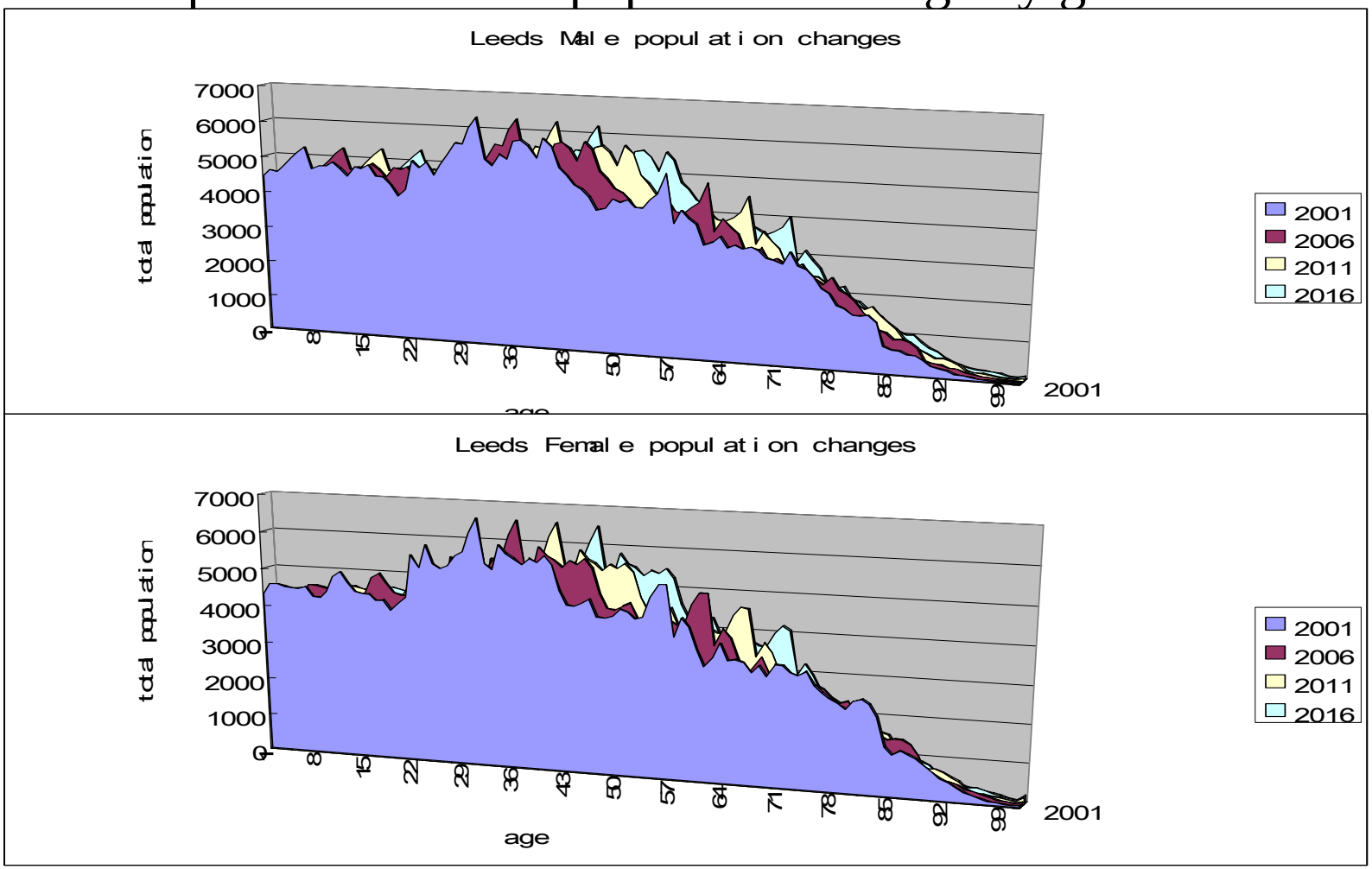
1. Leeds population change





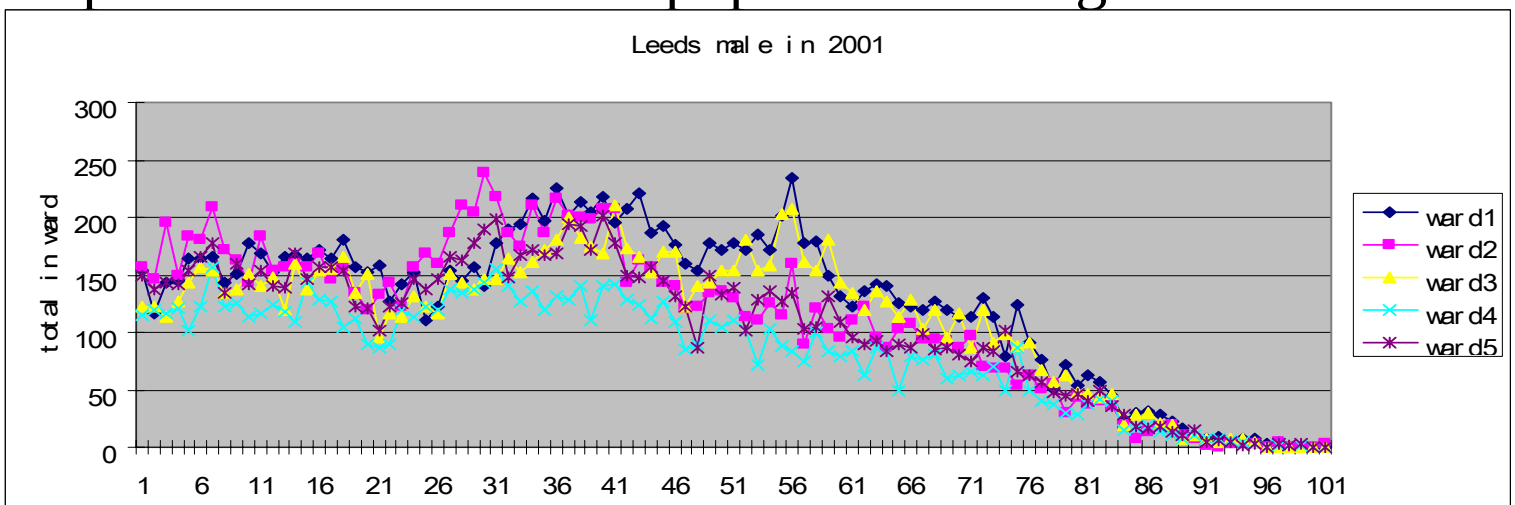
Modelling Progress in MoSeS

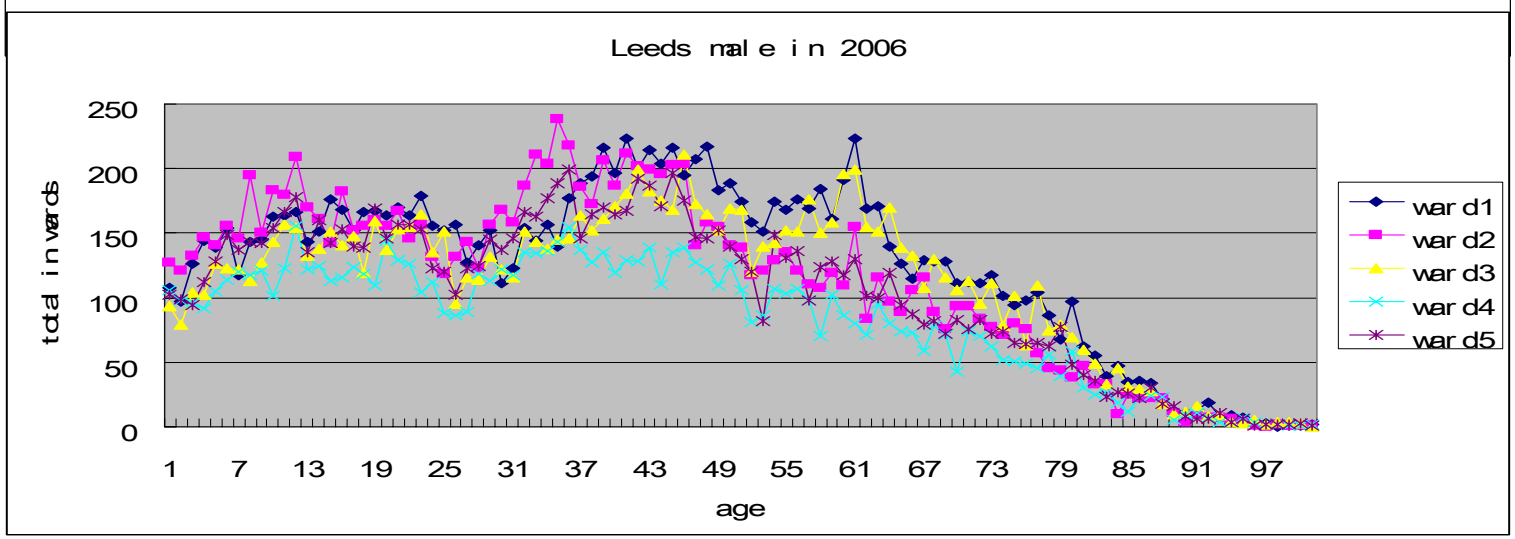
2. Comparison of Leeds population change by gender



Modelling Progress in MoSeS

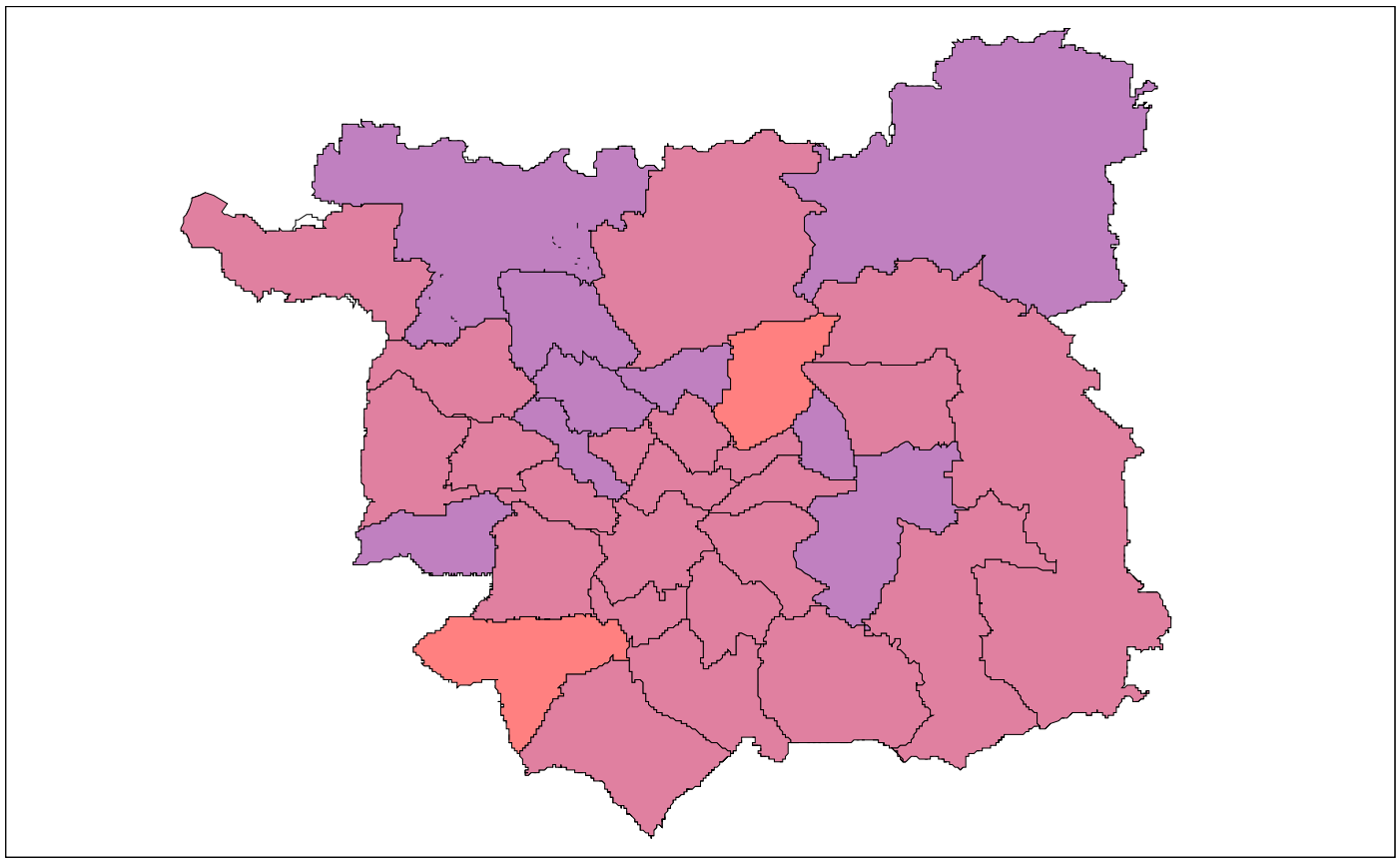
3. Comparison of Leeds male population changes in 5 wards





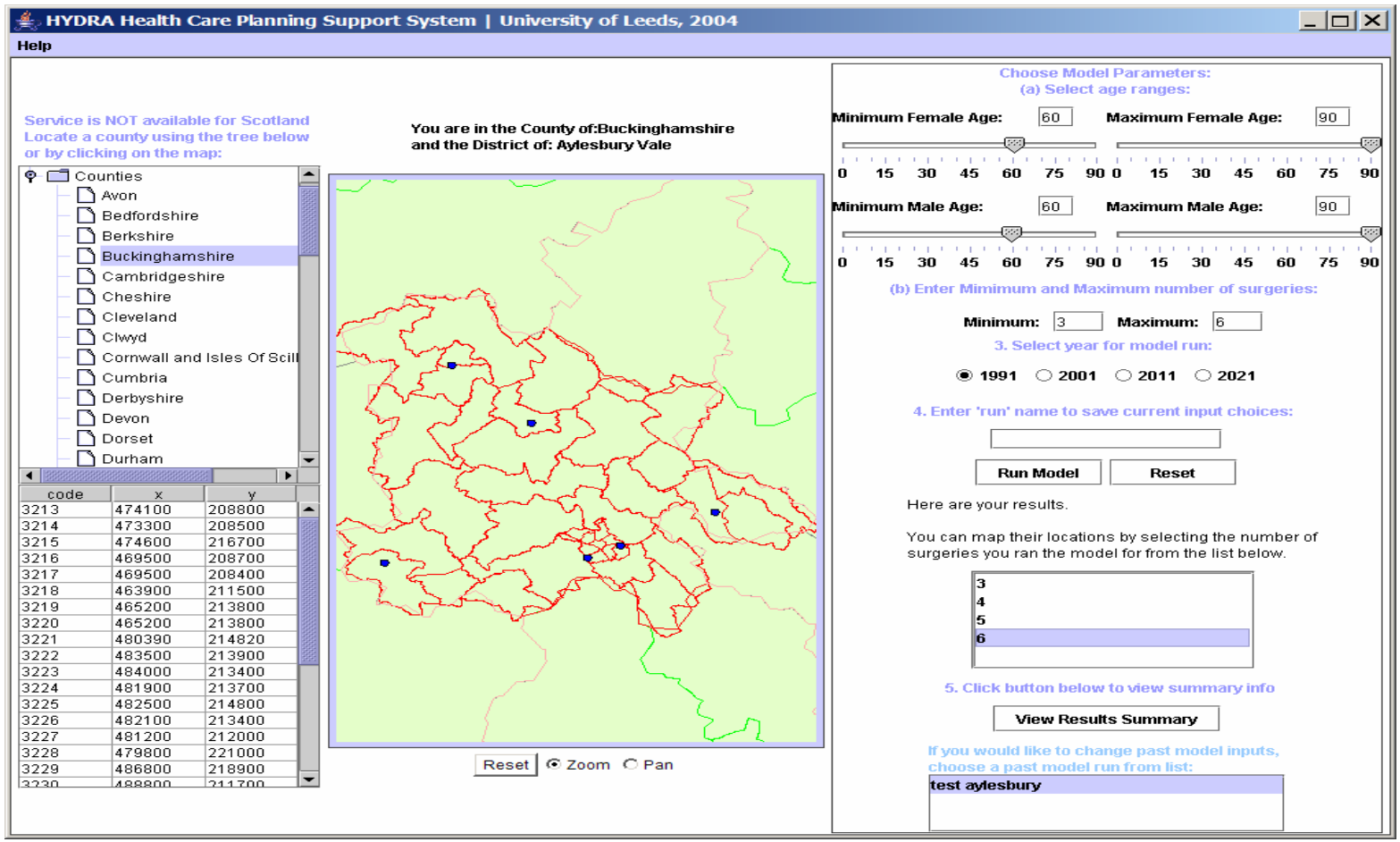
Modelling Progress in MoSeS

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



Modelling Progress in MoSeS

Results: decision support (low level)



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!

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