



MoSeS: A hybrid approach for social simulation models

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Outline

Introduction

Modelling social systems in MoSeS

Proposed modelling approach

Model progress

Conclusion and Future work

Introduction

MoSeS

The 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>

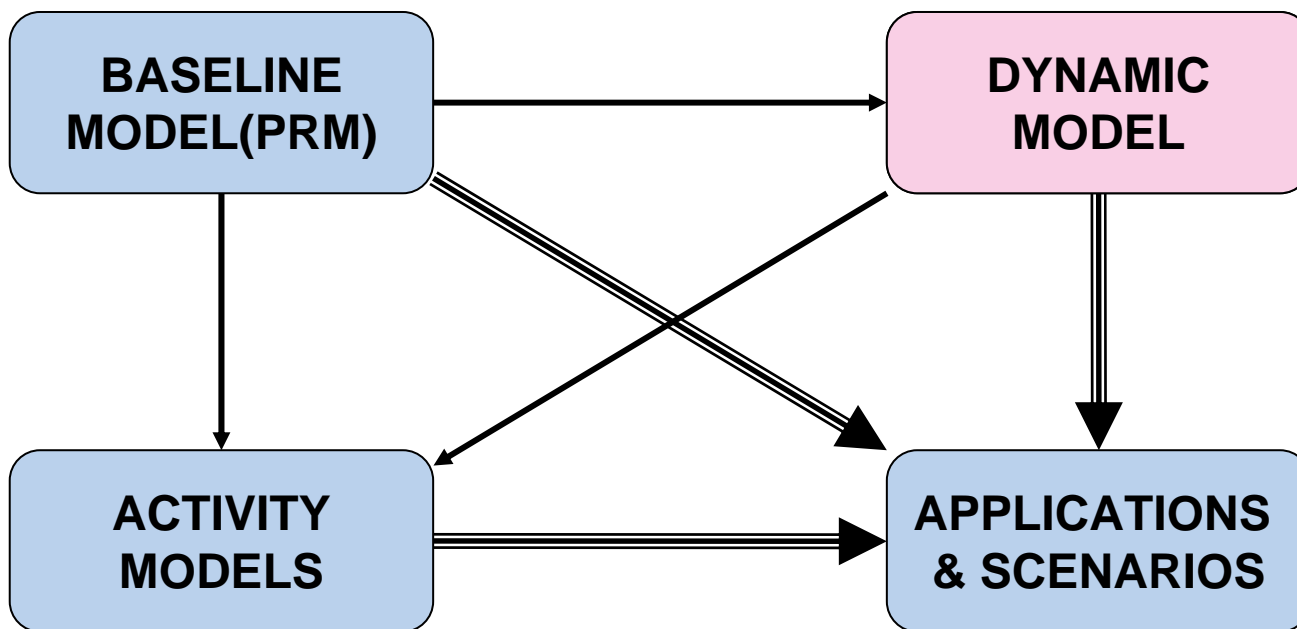
Modelling social systems in MoSeS

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).

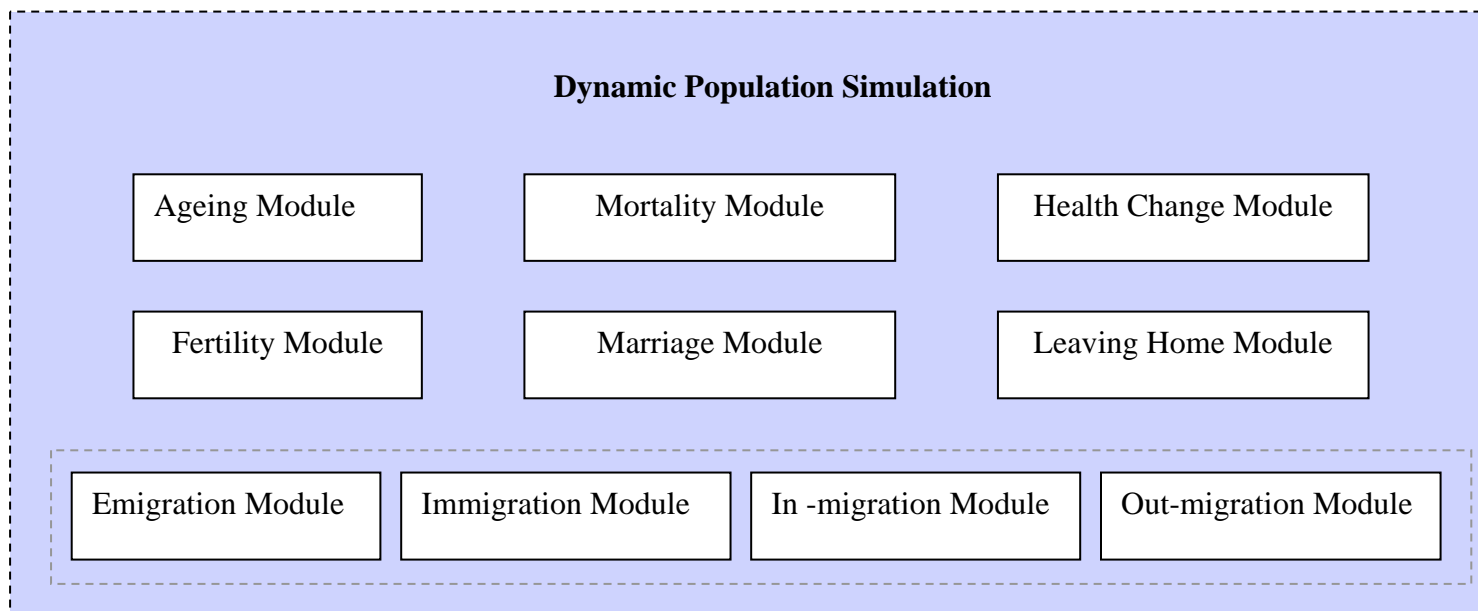
Modelling progress in MoSeS

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...

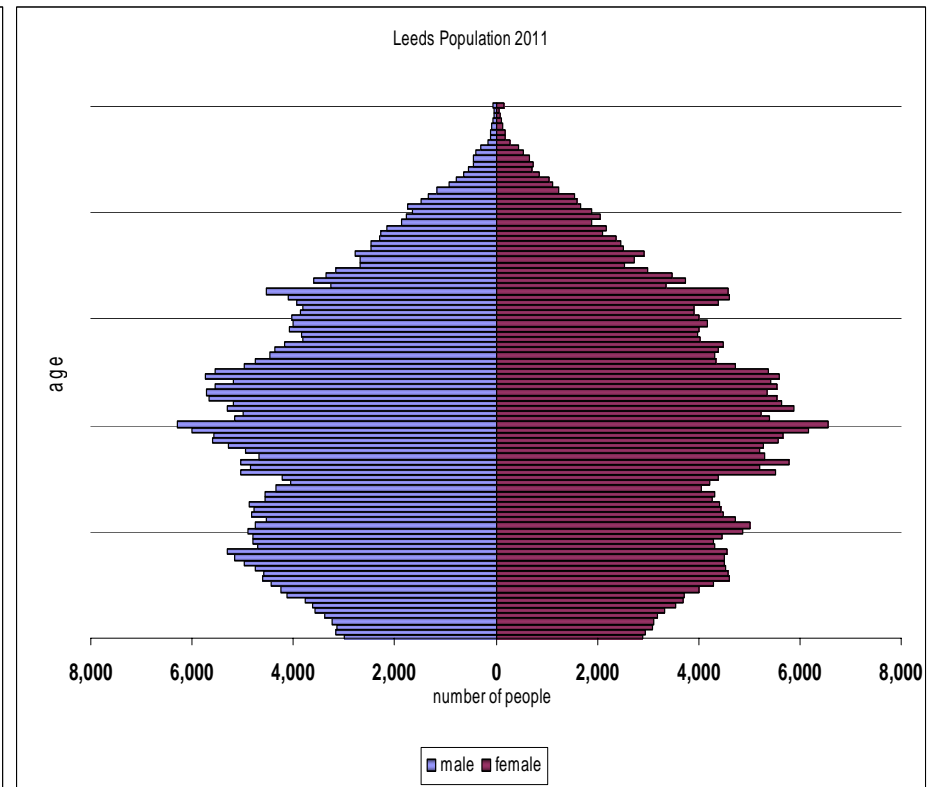
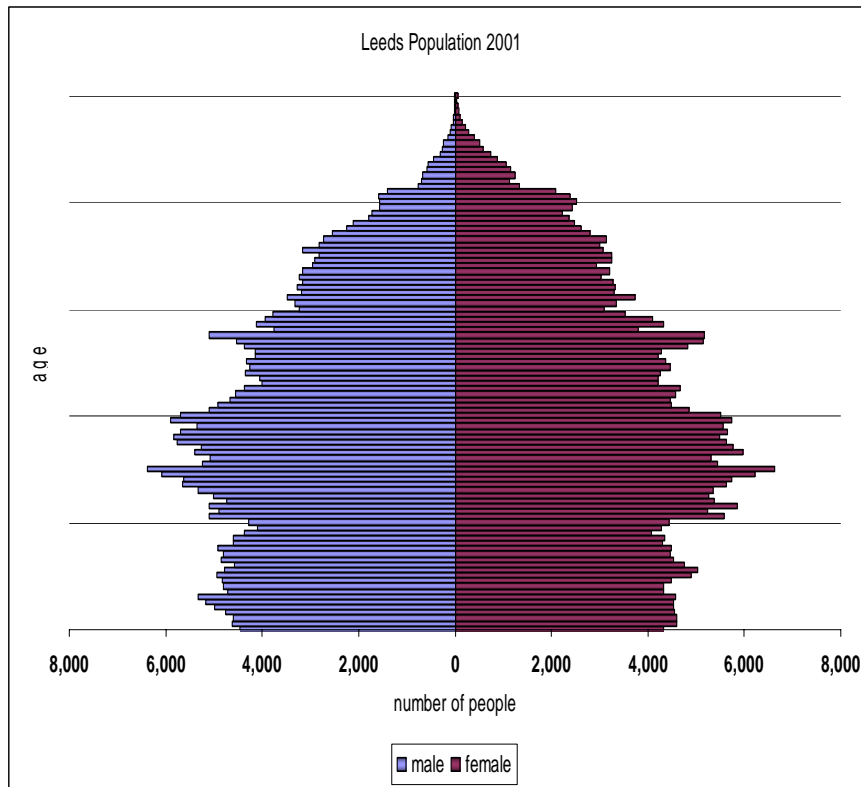
A new hospital?

- 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

Example: Population changes

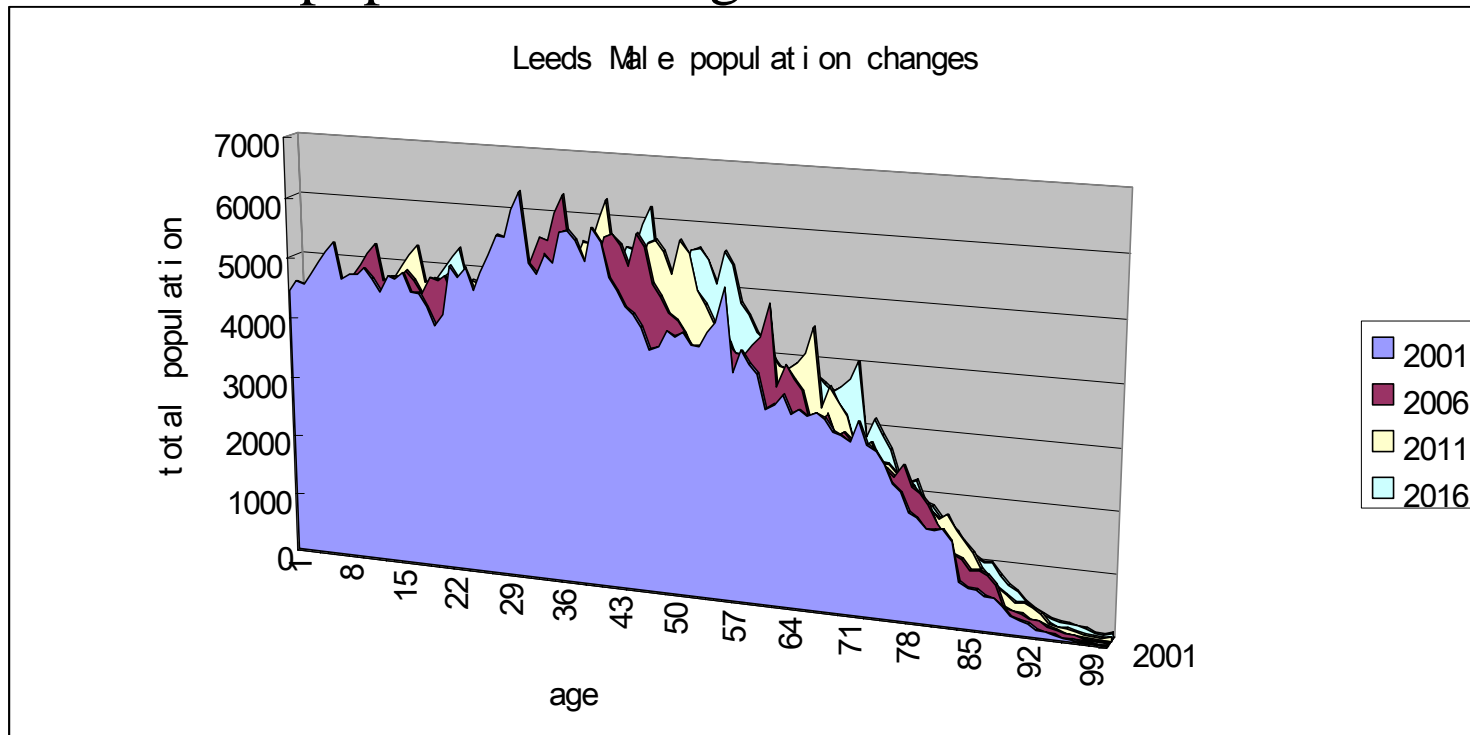
1. Leeds population change



Modelling Progress in MoSeS

Example: Population changes

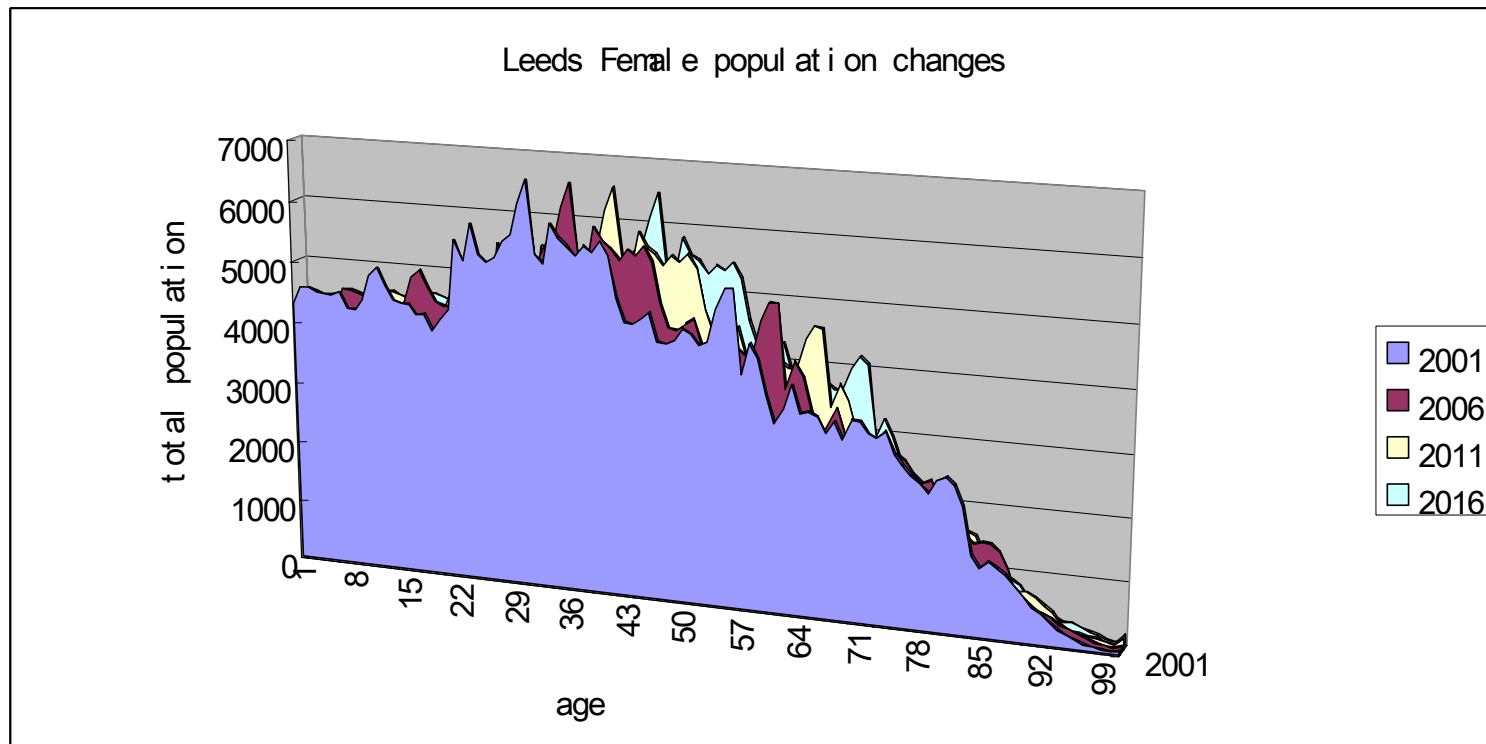
2. Leeds male population change



Modelling Progress in MoSeS

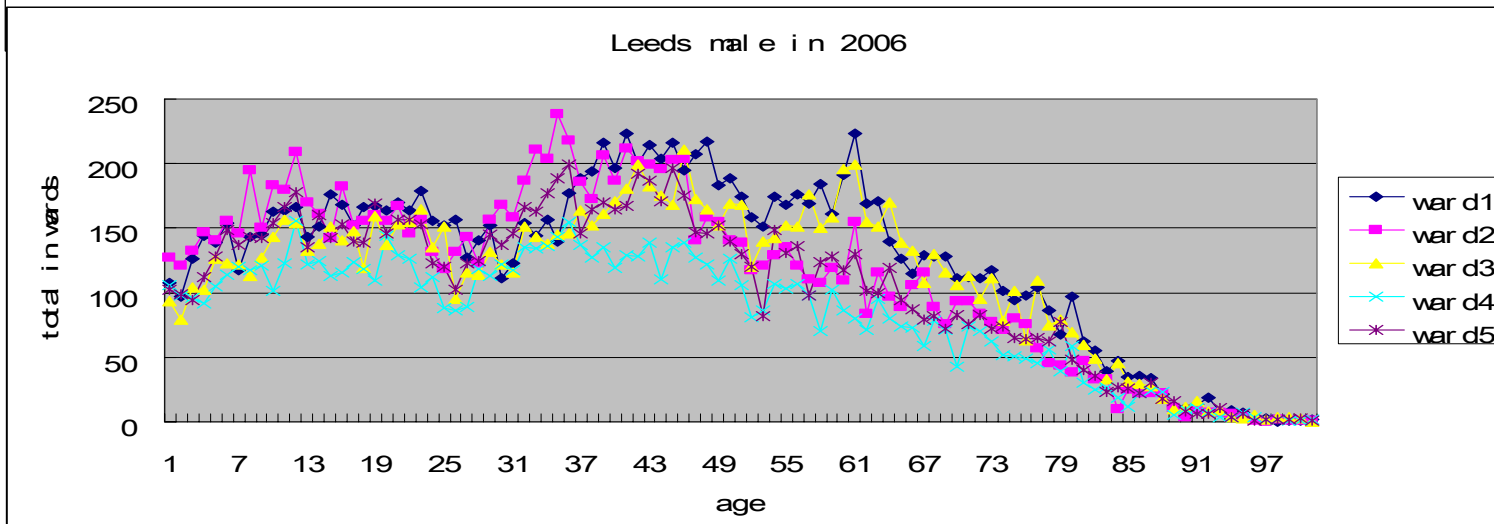
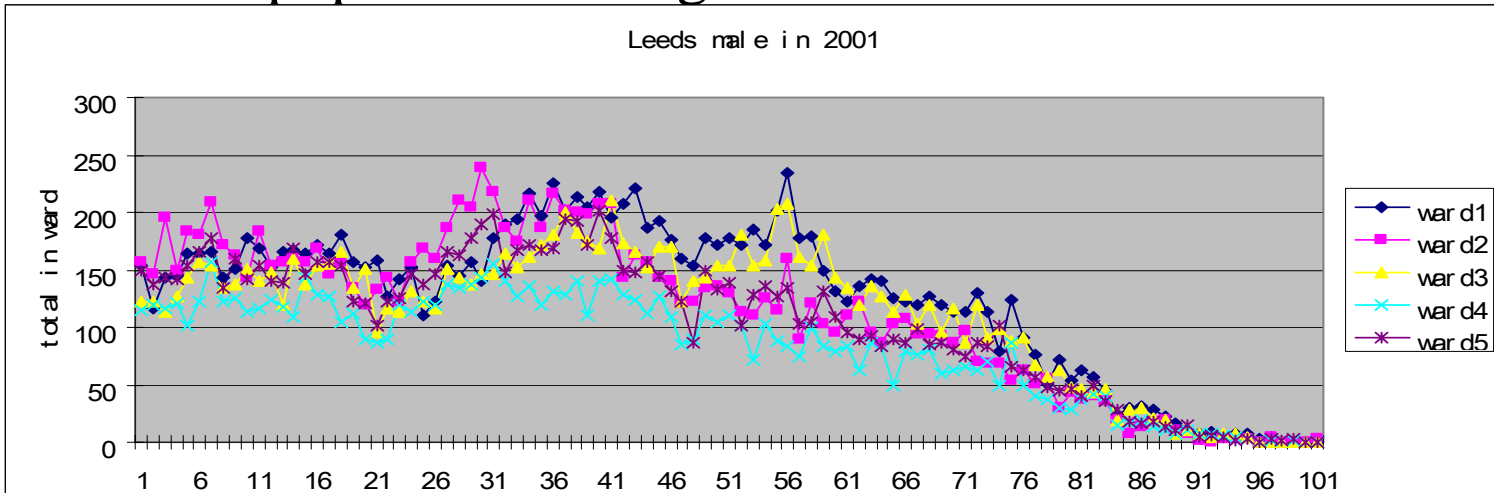
Example: Population changes

3. Leeds female population change



Modelling Progress in MoSeS

4. Leeds male population change in 5 wards



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.

Next steps:

- Activity Models
- Applications and Scenarios

Time lines:

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



Thank you!

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