Modelling for FIRMA

An Example

Relation to previous IAM

- Request by Tom Downing to develop a simple model of Thames region for SIRCH
- Meeting with Nils Ferrand and Olivier Barreteau indicated canonicity of problem and relevance of model to IMAGES project
- Preparing for meeting with Maastricht team led to an understanding of the role for agent based modelling in previous work

Maastricht issues

- van Asselt-Rotmans (*Global Env. Change*, 1996, pp. 121-57) modeled world populations with "coherent world views" taken from Thompson *et al.*, *Cultural Theory*

- Three world views to generate extreme scenarios: hierarchist, egalitarian, individualist.

Validation and world views

Relation of world views to observation indicated by quote from Thompson *et al.*:

A further virtue of the …framework is that the categories are formed from dimensions rather than being derived ad hoc from observation. (p. 14)

The categories in social life generated by the … dimensions possess the dual advantage of holding on to the best in previous [theoretical] research …while opening up relatively unexplored, but important, avenues of cultural expression (p. 13)

Modelling and validation

- A bottom up approach – even without observation – can inform specifications of world views

- Example model turns out to give some pointers in this direction

Problem addressed for SIRCH

- Simple water demand module to link with simple environmental specification

- Issue is *whether and in what conditions* policy pronouncements *can* significantly affect water consumption

- Approach: consider various personality types in different proportions in the population
  - Word of mouth communication considered first

Canonically similar IMAGES problem

- Diffusion of organic farming techniques among intensively run farms

- Interaction among farmers important

- Government pronouncements and advice a key means of effecting changes
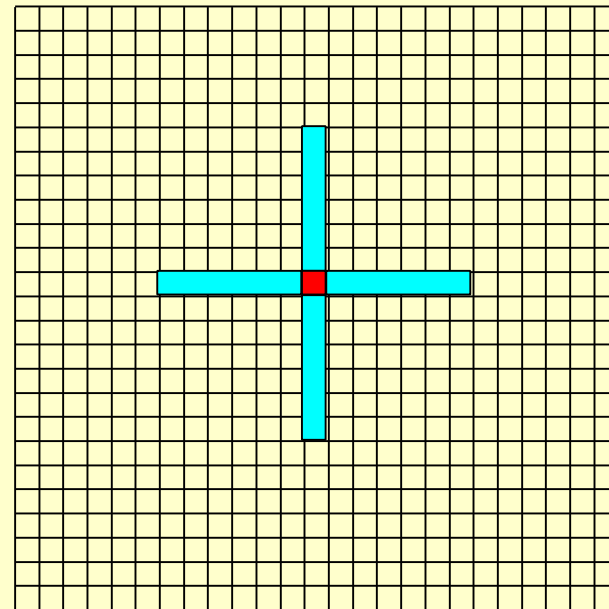
First-cut model: agent motivation

- Agents of three broad types though none are identical with any of the others
- One type listens primarily to government
  - Hierarchist world view?
- One type decides on basis of interaction with neighbours
  - Egalitarian world view?
- One type pleases primarily own self
  - Individualist world view?

The physical analogy

- Agents placed at random on toroidal grid
- Can "see" other agents in limited number of nearby cells

Modelling judgement, experience and "world view"

- The endorsements mechanism is the basis
- Each agent has 2 endorsement schemes
    - for evaluating rules of behaviour
    - for evaluating other agents
- Rules of behaviour are judged by provenance:
    - invented by oneself
    - observed behaviour of other agents
    - behaviour suggested by "authority"

Differences of "world views"

- Endorsements are tokens
  - Endorsements on rules of behaviour were:
    - globallySourced (a hierarchist would like this)
    - neighbourhoodSourced (egalitarians would like this)
    - selfSourced (individualists would like this)
- The relative value of each endorsement was chosen at random for each agent.
  - Some would be strongly of one type, others of mixed type or competing types.
- Agents chose actions to take in prevailing circumstances depending on how valuably they were endorsed accorting to their own schemes

Evaluating endorsement values

- Two means in the literature:
    - Paul Cohen's original method:
    - Moss's method
- If the results are sensitive to the evaluation method, endorsements are a bad technique.