Model to Model analysis

Validation ???

Accuracy to represent « outside world »

(fitting to data)

Or

Help to understand general dynamics

(model of micro-macro link)

Aims of M2M workshop

- The first model-to model workshop's aim was to increase the transfert of knowledge (model and results) in agent research -
- Following model-to-model workshops were set up with a view to gathering work on comparative analysis of social simulations.
- 3 workshops where participants provided methods and examples to stop "working on your own model"
- http://jasss.soc.surrey.ac.uk/6/4/11.html

Sensitivity analysis

Simulation results can be sensitive to **parameter settings** of the corresponding model and especially to the **algorithm used to model the agents' behaviour**.

This is part of the internal process for knowing the model. It is a necessary step, considering the number of parameters usually at stake.

Note: reading papers for conferences, one can note that this is not always achieved.

Sensitivity analysis

Izquierdo et. al. 2007: mathematical analysis to study sensitivity in their social dilemma model. Replication of Flache model. Different learning rates (fast > reach asymptotic results) and the introduction of stochasticity (destroys predictible equilibria)

Takadama et al. 2007: study the rationality of agents: internal logic + global behaviour. Comparison with human subject experiments.

Kluver and Stoica, 2003: Cellular Automata, Neural Networks and Genetic Algorithm implemented in the same framework (following tradition, they are used in different . Here they succed in converging to the same global model.

Janssen and Ahn, 2003, 2006: Analysis of the influence of the learning algorithm / attempt to fit to data from experimental economics, so that to “evaluate the validity” of different algorithms. WA, fictitious play, learning direction. Results not so positive.

Cross-paradigm comparison

- MABS can be used to better understand **existing models** by implementing agents following such models but relaxing previous constraints (ie homogeneity) [Vila, 2007 – in Bertrand competition reproduces analytical results]
- Social simulation models are **compared** with models developed in alternate paradigms, e.g. equilibrium models, or social theoretical models. (economics and game theory)
- **KISS vs KIDS: choice** between building a very simple agent model that can be compared to a formal analysis but contributes little understanding to empirically observed social phenomena, and a more applicable agent-based model that includes a lot of heterogeneity and learning but is far from tractable analytically.

Cross-paradigm comparison

- For example [Edwards et al. 2003] align top-down with bottom-up models: : develop innovation diffusion (Young 1999). The equation-based model provides an explanation (local maxima and hence attractor basins of the agent model. if more than one attractor, the equation-based model (being deterministic) gets trapped in the minority basin, whilst the individual-based model would eventually escape from this to the principal attractor due to is stochastic nature
- Vriend, 2000 (out of M2M): “local learning vs global learning” - Cournot -Nash equilibrium vs Walras. (global = social comparison learning)

Replication / aligning

- Replication: Rewriting models that others have described in papers so as to understand them more deeply and reproduce the stated results (Axelrod 1997). check if the same theoretical model gives the same results
- « aligning »: check if models that are supposed to give same results do so (Axtell et al. 1996)
- accept the fact that we are closer to experimental science than formal one

- Edmonds and Hales 2003: "tags" model (Riolo et al. 2002) re-implemented on different platforms and aligned (or docked) their models before comparing their results with the previously published results. "double" implementation >> single re-implementation. However, the process of duel implementation helped to uncover inaccuracies in the original interpretation placed on the model by Riolo et al. Indeed they claim to have invalidated the central claim the model was published to support.

Replication

Rouchier 2003: re-implementation of Duffy and Ochs (1999) which is an agent-based version of a model proposed by Kiyotaki and Wright (1989). Suggestions concerning reporting simulation work, including:

- Algorithm: when the main hypothesis is about learning, it would be useful to have adequate data about the knowledge of the agents and its evolution in time, so as to be able to judge the degree of misrepresentation and its importance;
- Results: it would be useful to give more detailed lists of individual behaviours (not just averaged data) so as to be able to compare processes;
- Results: it is essential to give a genuine description of the dynamics of the model, with different indicators (and not just the one that is most central to the issue) so as to help the aligning of future models and aid the comprehension of the logical processes in the system.

Problem of

- understanding
- trust

Multi-scale analysis, abstraction, models of models

Quality of results? what is the result? added value? generality?

- Models are compared at various spatial, organisational or temporal scales, sometimes using a simple model as an abstraction of a more complex one.
- **Abstraction** is important to the social sciences, particularly where different case studies can be abstracted to grow models and meta models that can be exploited to develop more general theories (Przeworksi and Teune 1970; Cioffi-Revilla 2002).
- General issue in MAS (Gilbert): several models can give same “results” (depending on indicators, of course) > how do you differentiate among them?

Taxonomy and classification

Taxonomy and classification are often known as “systematics” in other fields, such as biology. Here models are grouped into common classes. This is a potentially fruitful line of enquiry, as yet little explored in social simulation, particularly if certain classes of models can be shown to have specific expected results.

However, the systematics of complex models such as most social simulations (which are dynamic, depend on initial conditions, and usually have a large number of parameters) is difficult to achieve through intuitive reasoning alone

Taxonomy and classification

Cioffi-Revilla and Gotts (2003): TRAP^2 class to analyse two models: GeoSim, a model of military conflict and FEARLUS, a model of land use and ownership change.

Grimm 2006: ODD http://www.ufz.de/oesatools/odd/

Overview	Purpose
	State variables and scales
	Process overview and scheduling
Design concepts	Design concepts
Details	Initialization
	Input
	Submodels

Reuse – Standards ?

Composing models where different scales // different approaches are inter-related in a larger model - the results of one model being used in the other

Outside standard simulation libraries, such as Swarm, RePast or MASON, very little of this is done.

Kahn 2007: Uses libraries of ‘micro-behaviours’ in NetLogo and shows how a simulation can be built up, and different micro-behaviours compared for their effect on the dynamics of the model.

Problem of the reusability // supposed to be easy with object-oriented programming but lack of documentation. >> Marco Janssen et al. 2007 Open Agent Modelling Consortium. http://www.openabm.org/site/

Where is M2M going?

~~"Good modelling practices"~~

~~"Good social science"~~

Accumulation of knowledge

Proper description of models

Replicated results for robustness

....

Validation? (help to understand abstract dynamics)

http://m2m2007.macaulay.ac.uk/m2m_programme.html

http://jasss.soc.surrey.ac.uk/6/4/11.html