

Ecole thématique CNRS -GIACS

Agent Based Models for Spatial Systems in Social Sciences & Economic Science with Heterogeneous Interacting Agents (ABM-S4-ESHIA)

Agelonde, La Londe les Maures (var, France), September 17-22, 2007 (6 days).

<http://www.gemas.fr/dhan/laLonde/>

Program: Courses and Lectures

Monday, 17th September

9:00 – 12:30: Opening talks by Scientific Presidents:

- **9:00 – 10.30 Denise Pumain** *Spatial Simulation for the Social Science*

Coffee break

- **11:00 – 12.30 Alan Kirman** *Agent Based Models for Economic Science with Heterogeneous Interacting Agents: and Collective Rationality*

16:00 – 19:00: Workshops

21:00 – 22:00: Conference

- **Sorin Solomon** *Adaptive economic growth emerges from many noisy individual interactions*

Tuesday, 18th September

9:00 – 12:30: Lectures

- **Jean Pierre Muller** *Introduction to the concepts and methodology of conception in multi-agents systems*

16:00 – 19:00: Workshops

21:00 – 22:00: Conference

- **Wander Jager** *A behaviour theoretical perspective on agent based simulation'.*

Wednesday, 19th September

9:00 – 12:30: Lectures

- **9:00 – 10.30 Michael Batty** *Heterogeneous model coupling in Spatial Simulation*

Coffee break

- **11:00 – 12.30 Christophe Deissenberg** *Learning in multi-agents models*

16:00 – 19:00: Workshops

21:00 – 22:00: Conference

- **Jasmina Arifovic**, *Computational mechanism design with heterogeneous, interacting agents*

Thursday, 20th September

9:00 – 12:30: Lectures

- **9:00 – 10.30 Frederic Amblard** *Validation of agent-based simulations*, **Juliette Rouchier** *Models to models* (This lecture is devoted to the general problem of validating agent-based simulations both by internal controls and by comparison of results with empirical data)

Coffee break

- **11:00 – 12.30 Pierre Livet, Denis Phan, Lena Sanders** *Ontological design for Simulation in Social Sciences*

Free afternoon

21:00 – 22:00 Conference

- **Tim Kohler** *Agent-based modelling in Archaeology*

Friday, 21th September

9:00 – 12:30: Lectures

- **9:00 – 10.30 Akira Namatame:** *The theory of interaction and social engineering.* (this lecture introduces to recent developments in the study of social networks with emphasis to their application to agent-based simulations).

Coffee break

- **11:00 – 12.30 Jacques Ferber** *The 4Quadrant integral approach of MAS*

16:00 – 19:00: Workshops

21:00 – 22:00: Conference

- **Enrico Scalas** *Markov chains and continuous-time random walks* (The purpose is to provide information on tools that could be used for the analytical study of agent-based models. The only necessary prerequisite is knowledge of elementary probability theory).

Saturday, 22th September 9:00 – Departure

Program: Workshops (Monday, Tuesday, Wednesday, Friday: 16.00-19.00)

A.1 Arnaud Banos (Image et Ville, FR) and Eric Daudé (MTG, FR): Modelling and simulating spatial processes in NetLogo: from model creation to their exploration

Creating an agent-based model implies going through several fundamental steps, including the formulation of the problem, its formalisation in an agent-based perspective, its implementation in a relevant simulation platform using a programming language, and its exploration through simulation, including sensitivity analysis and validation. This workshop will be dedicated to the whole work chain, with a specific emphasis on the design and implementation of a spatial simulation model (urban growth or epidemic diffusion).

- Step 1 : Stating and formalizing a geographic problem in an agent-based perspective
- Step 2 : Some preliminary examples of Small Artificial Worlds Programming : the Game of Life, the Prey-Predator model, the Schellings' segregation model, etc ;
- Step 3 : Introduction to algorithmic programming in NetLogo
- Step 4 : Design and implementation of a geographic model (urban growth or epidemic diffusion)

Steps 3-4 will be open to participants attending other workshops during Step 1-2

Links:

- <http://web.univ-pau.fr/~banos/banos-gallerie.html>
- <http://www.univ-rouen.fr/MTG/EricDaude.htm>
- <http://ccl.northwestern.edu/netlogo/>

Basic support:

- Banos A., Chardonnel S., Lang C., Marilleau N. et Thèvenin T., 2005: Simulating the swarming city: a MAS approach, Proceedings of the 9th International Conference on Computers in Urban Planning and Urban Management, London, June 29-30, 15p.
- Banos A., 2006: Geosimulating the swarming city : a bouquet of alternatives, Geoinformatics, December, Vol 8, pp.58-60
- Bretagnolle A., Daudé E., Pumain D., 2006: From theory to modelling: urban systems as complex systems, *Cybergeog*: European Journal of geography, n°. 335

A.2. Mike Batty (CASA, UK), Andrew Crooks (CASA, UK), Alex Hagen (RIKS, NL) Calibration, validation and comparison of Agent-Based Spatial Simulation Models

This workshop will be focusing on ABMs (Agent-based models), CA (Cellular automata) and LUT (land use transport) models developed at the Centre for Advanced Spatial Analysis, UCL, and map comparison techniques for the validation of spatial cellular models such as Metronamica developed at the Research Institute for Knowledge Systems, The Netherlands.

1. *Calibrating, Validating & Verifying Agent-Based Spatial Simulation Models* (Monday, Tuesday: 16.00-19.00) Workshop Convenor Michael Batty m.batty@ucl.ac.uk

This first part of the workshop will focus on the sequence of stages used in building an agent-based model which is focused on the spatial domain. Differences between these stages:

calibration – fine tuning the model parameters; validation – seeing how well the model reproduces reality; and verification – scrutinizing the model’s logical consistency, will be examined using examples of models based on fine scale spatial movement from pedestrian modelling to residential segregation.

In particular the following topics will be addressed:

- Model specification and data requirements
- Differences between parameter space and plausible model space
- Methods of parameter estimation or calibration
- Methods of spatial validation of spatial activity data
- Methods for exploring model consistency
- Sensitivity analysis

In two afternoon sessions, the methodologies will be introduced and the participants gain hands on experience using the Netlogo/Starlogo software platform. We will expect participants to download this software to their own laptops and it will also be provided on public machines available at the workshop

2. How Well Do You Know Your Model? A Methodology for Map Comparison-Based Model Validation (Wednesday, Friday: 16.00-19.00) Workshop Convenor Alex Hagen-Zanker ahagen@riks.nl

As multi-agent models outgrow the theoretical realm and find practical applications it becomes essential to understand the fit between reality and model. This second part of the workshop introduces a methodology of spatial analysis to understand the nature, extent and spatial distribution of differences between maps.

In particular the following topics will be addressed:

- Distinguishing between minor and major errors
- Balancing structural similarity and location-to-location overlap
- Multi-criteria and multi-scale analysis
- Significance and meaningful interpretation
- Traps and common mistakes

In two afternoon sessions the methodologies will be introduced and the participants gain hands on experience using the free Map Comparison Kit software. Participants are encouraged to bring own data (contact ahagen@riks.nl for details), but case material and exercises are available too.

Links:

- <http://www.casa.ucl.ac.uk/>
- <http://www.riks.nl/>
- <http://gisagents.blogspot.com/>

Basic support:

- Batty, M., 2005: *Cities and Complexity: Understanding Cities with Cellular Automata, Agent-Based Models, and Fractals*, The MIT Press, Cambridge, MA.
- Benenson I., Torrens P., 2002: *Geosimulation: Automata-based modelling of urban phenomena*, Wiley, Chichester, 287 p.
- Hagen-Zanker, A., 2006: Map comparison methods that simultaneously address overlap and structure. *Journal of Geographical Systems*, 8(2), 165-185.

- Hagen-Zanker, A., Straatman, B., & Uljee, I., 2005: Further developments of a fuzzy set map comparison approach. *International Journal of Geographical Information Science*, 19(7), 769-785.
- Maguire, D. J., Batty, M., and Goodchild, M. F. (Editors), 2005: *GIS, Spatial Analysis, and Modeling*, ESRI Press, Redlands, CA.

A.3 Denis Phan, Jean Pierre Muller, Frederic Amblard, Wander Jager, Juliette Rouchier, Simone Alfarano, Eric Darmon : Multi-agent models based on analytical models or diagrammatic representations

This workshop will be devoted to the development of multi-agent models based on complex variations of basic analytically solvable problems. It will include:

Monday, September 17

- 16h - 17h30 **Denis Phan** - discrete choice with externality, network effects (Phan, Amblard 2007, Ch10)
- 18h - 19h30 **Jean Pierre Muller** - UML workshop (Phan, Amblard 2007, Ch12)

Tuesday, September 18

- 16h - 17h30 **Frederic Amblard & Wander Jager** - Simplifying psychology in ABM
- 18h - 19h30 **Frederic Amblard** - introduction to models of opinion dynamics

Wednesday, September 19

- 16h - 17h30 **Juliette Rouchier**
- 18h - 19h30 **Simone Alfarano** Parameter Estimation in Agent-Based Models

Friday, September 21

- 16h - 17h30 **Eric Darmon** - Adaptive Sellers on search markets
- 18h - 19h30 **Denis Phan** - "Emergence" (Phan, Amblard 2007, Ch14)

A.4. Enrico Scalas and Michael Koenig, Markov Chains in Economics (From Monday to Friday 16:00 - 17:30).

This workshop will be devoted to the application of Markov Chains in Economic modelling, stressing the analogy with various models used in Physics.

A.5.ESHIA. Michael Koenig and Enrico Scalas, Networks in Economics (From Monday to Friday 17:30 - 19:00).

This workshop will be devoted to the application of Networks in Economic modelling, stressing the analogy with various models used in Physics.

- Basic support :
Amblard F. Phan D. (eds.), *Modélisation et simulation multi-agents pour les Sciences de l'Homme et de la Société : une introduction*, Hermès, Paris, 2006, English version at [The Bardwell Press](#)

Phan D., Amblard F. Eds. (2007) *Agent-based Modelling and Simulation in the Social and Human Sciences*, Oxford, The Bardwell Press, ISBN-13: 978-1-905622-01-6

- The web site of the CNRS researcher school of Porquerolles (September 2005, 19-24) « Modélisations et simulations multi-agents de systèmes complexes pour les Sciences Humaines et Sociales : principes et méthodes de conception et d'usage » (in french) : <http://perso.univ-rennes1.fr/denis.phan/PorquerollesXAgents/>

ERG-S4 web site for the comparison of models: <http://www.spatial-modelling.info>

- Tesfatsion L., Judd K.L. Handbook of Computational Economics, Vol. 2: Agent-Based Computational Economics, Amsterdam, New York, Elsevier North-Holland, 2006
- Ferber J. (1999) Multi-agent Systems, Addison Wesley Reading, MA.
- N.Gilbert, K.Troitzsch, Simulation for the social scientist, Open University Press, 1999.

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- Leigh Tesfatsion's web site: <http://www.econ.iastate.edu/tesfatsi/ace.htm>
- Complementary support:
The web Site of the CNRS researcher school of Agay (2004): « Dynamique des systèmes complexes et applications aux SHS : modèles, concepts méthodes » (in french) : <http://www-eco.enst-bretagne.fr/~phan/AgayComplexiteSHS/programme.html>

[Journal of Economic Interaction and Coordination](#)

[Journal of Artificial Society and Social Simulations](#)

Phan D., Amblard F. Eds. (2007)
*Agent-based Modelling and Simulation
in the Social and Human Sciences*,
Oxford, The Bardwell Press

ISBN-13: 978-1-905622-01-6

http://www.bardwell-press.co.uk/publications/agent-based_modelling.htm

