NSF/ESRC Agenda Setting Workshop on Agent-Based Modeling of Complex Spatial Systems: April 14-16, 2007

Evaluating Agent-Based Spatial Models

Rich Harris
School of Geographical Sciences and Centre for Market and Public Organisation, University of Bristol

My interest in Agent-Based Spatial Models is, in truth, driven less by e-science / e-social science *per se*, and more in an on-going curiosity in the extent to which social 'systems' can or should be modelled, thence predicted and/or 'explained' using quantitative and/or computational methods. This curiosity is better expressed by Peter Haggett who wrote, in 1994, that:

> there may be limits to the predictability of human behaviour which makes prediction in the social sciences fundamentally flawed … But, as one who finds continual refreshment from the work of colleagues in physical geography, I consider that if the boundary exists it should continue to be actively probed (Haggett, 1993: 18)[1]

In short, then, I am interested in what agent-based spatial models can contribute to developing socio-spatial theory: what can they usefully tell us about socio-economic systems that was not known already? Alternatively, if the primary purpose of agent-based spatial models is less to extend theory, than to test it, then my interest is in identifying real-world applications and genuine problem-solving for these, as for other geocomputational toolkits (noting, in particular, Martin's 2005 interest in the potential of e-social science to support the development of geocomputation).[2]

If my 'Bristol upbringing' explains my interest in the possibilities of computational social-science then it also accounts for my caution – exposed, as I am, to the waves of postmodernism, post-structuralism, 'non representational' theory and other epistemological and ontological turns away from the quantitative/computational. Whilst it may be simplistic to suggest that contemporary social science is characterised by the triad of (1) the theory-led and deductive models of e.g. economics, of (2) the data-based, inductive but scientific and mathematically-informed methods of statistics and (3) a rejection of structured forms of enquiry and explanation in, for example, some areas of human geography, still I would argue that many methods of geocomputation and computational e-social science sit away from any clearly identifiable 'camp' and that

[1] Prediction and Predictability in Geographical Systems. Transactions of the Institute of British Geographers, 19, 6-20.
[2] Socioeconomic GeoComputation and E-Social Science. Transactions in GIS, 9, 1-3.

may underpin their credibility or potential for uptake (a point that Couclelis made in relation to geocomputation back in 1998).[3]

To put this all another way, what sort of enquiry (knowledge formation) do agent-based spatial models support, or are governed by? Do they already or can they be shown to have their place within socio-economic research? Do they need to conform to more orthodox traditions or to be defended against philosophical fashions?

A third way of looking at this is to ask whether I could demonstrate, to my students of Derrida, Foucault, Deleuze and Guattari, the value of agent-based spatial models, and convince them of it.? There are two issues, here. One is of a 'flagship' model that showcases potential and raises interest (it probably exists; my ignorance of such matters is not in question here!). The second concerns usability. This becomes increasingly important if we consider the potential to mount such models on, for example, the UK's National Grid Service (NGS): a computational grid of high performance machines primarily developed under the UK's e-science research funding.[4] From experience – and having been on a (so-called) training course – the NGS is in its infancy and extremely difficult to use. The computational power is certainly there but using it is far from straightforward.

To summarise, I am interested in answering the following questions and thence convincing sceptical colleagues:

- What have agent-based spatial models got to do with social science and, in particular, human geography?
- What disciplinary traditions are they founded on, how much so, and are the purposes of the models more for developing or for validating theory (then, how is this done? Can it be done?[5])?
- How should I use them and what are some of the pedagogic considerations of teaching with/about them?
- How can the potential of the UK's National Grid Service be harnessed for agent-based spatial models and other spatial, computational modelling?

Essentially this all amounts to re-stating the aim of the ESRC's National Centre for e-social science: "to investigate how innovative and powerful computer-based infrastructure and tools developed over the past five years under the UK e-Science programme can benefit the social science research community."[6]

[3] In Geocomputation: a primer (eds. Longley, Brooks, McDonnell & Macmillan), Chichester: Wiley, pp. 17-29.
[4] www.rcuk.ac.uk/escience
[5] What does prediction mean, for example, in the context of an open and changing system (which is not actually singular)?
[6] http://www.ncess.ac.uk