



Eduserv Foundation Grants Programme Project Final Report

Project Title	Modelling4All
Project Start Date	1 August 2007
Project Manager	Ken Kahn
Reporting Period	1 August 2007 to 1 August 2010

Summary of project achievements

We developed and deployed the client and server code for *BehaviourComposer 2.0*. <http://modelling4all.nsms.ox.ac.uk/Model>. Its functionality includes

- The ability to browse for modelling components called micro-behaviours anywhere on the web
- The ability to customise micro-behaviours by changing the values in text areas and by adding and removing micro-behaviours
- The ability to compose micro-behaviours to define how prototypical agents should behave and how populations of them should be created
- The ability to generate and run a Java applet based upon the model composed by the user
- The ability to embed generated models as links, frames, or applets in other web-based services
- The ability to collaborate in real time in model construction
- The ability to view and navigate the history of the construction (including undo and redo)
- The ability to tag micro-behaviours using third-party tagging services
- The ability to generate a stream of events from the execution of a model that can be used to visualise the execution in other software (see Second Life below)

We built several libraries of micro-behaviours to enable both generic model building as well as specialised models in epidemiology, animal behaviour, ecology, sociology, and anthropology, and economics. Over 250 micro-behaviours were developed and tested. This also entailed the construction of library of over 150 NetLogo procedures that support and simplify the program code of the micro-behaviours.

We developed both on-line embedded documentation and more technical documentation on the project wiki. <http://modelling4all.wikidot.com/> This includes documentation for how third parties can author micro-behaviours.

We developed and tested three guides for model building. One guides students in building an epidemic that spreads over a social network. The student explores how the choice of different kinds of social network topologies influences the dynamics of an epidemic. They then explore the effectiveness of interventions that target the most highly connected individuals. Another guides students in the construction of the famous Sugarscape model of an artificial society [*Growing Artificial Societies* by Joshua M. Epstein and Robert Axtell, Brookings Institute Press, The MIT Press, 1996]. The third guide shows how to build an ecosystem consisting of predators, prey, and vegetation.

We produced video tutorials including a BehaviourComposer introduction, a guide to specialised techniques, and debugging tips. <http://www.youtube.com/user/modelling4all>

We built a layer on top of the BehaviourComposer called the *Epidemic Game Maker* that enables exhibit visitors and casual web site visitors to build models and games in a few minutes to learn about epidemics, public health interventions, and computer modelling. We exhibited this at the Royal Society Summer Science Exhibition at the Royal Festival Hall for ten days.

We wrote scripts for objects in *Second Life* to start and stop the remote execution of a previously built model. Other scripts were developed that read the stream of events produced by the execution of the model on the server and reproduce the movements, turns, and changes in appearance inside of Second Life.

We trialled the system with scores of Oxford university students in biology and the business school. We hosted over a dozen work experience students (14 to 17 year olds) for a day of testing and two students for an entire week.

We collaborated with researchers at the Stockholm Environment Institute and the Universidade Federal do Rio de Janeiro in developing a library and guide for modelling sustainability of savannahs and forests.

We ran a general workshop on agent-based modelling at Oxford University using our system. We ran a day-long agent-based training session for post-graduate students from several different social science departments at the University of Oxford. We ran Modelling4All workshops at the 6th European Social Simulation Association Conference and the Constructionism 2010 Conference.

We presented Modelling4All talks at many universities and research labs including Northwestern University in Chicago, OLPC (<http://laptop.org/>), Santa Fe Institute, the FriamGroup in Santa Fe, New Mexico, MIT, University of Cambridge, Oxford e-Science Research Centre, the Oxford University interdisciplinary meeting on agent-based modelling, the University of Edinburgh, University College London, University of Bath

We published and presented papers including SimuTools'09 "The Modelling4All Project — a web-based modelling tool embedded in Web 2.0" (http://modelling4all.wikidot.com/local--files/simutools-paper/SIMUTools09_v3.pdf), an abstract and poster at CAL'09, presentations and demos at Shock and Agent-based Modelling and Sustainability, and a paper, poster, and workshop at Constructionism 2010 (<http://modelling4all.wikidot.com/local--files/publications/M4A%20Constructionism%202010v3.pdf>), and XXth IAHR Quinquennial World Congress.

Future plans

In September we plan to write and submit a grant proposal to carry this work further.

We have been in discussion with the Science Oxford Museum about running agent-based modelling sessions with school children

We plan to continue working with Zoology, Said, Economics, and Anthropology departments at the University of Oxford. We plan to continue to support lab sessions with students using the Modelling4All services. We plan to finish the network formation library and construction guide together with the Economics department. We are writing a paper together with the anthropology professor we are collaborating with on our joint work on the modelling of the dynamics of religions.

We plan to continue our collaborations with the Stockholm Environment Institute and the Universidade Federal do Rio de Janeiro. Part of this will entail supporting the translation of the BehaviourComposer to Portuguese.

We have arranged to support a four-hour Modelling4All session in Paris at Institut d'Etudes Politiques with Masters of Public Administration students in October.

Technically we plan to port the server code to the Google App Engine and move the server to the Google cloud. We plan to generalise the Epidemic Game Maker so similar applications can be constructed for other topics such as climate change.

The ability to run Second Life scripts to see the live executions of Modelling4All models was broken in the latest release of Second Life. We plan to fix this and generate some videos of it in action. We will document for others how to run these simulations in Second Life.