

## **Workshop overview: Development of a code kernel for agent-based land market models**

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The challenges of code sharing for agent-based models are a well-worn point of discussion in the community. Calls for sharing of model code date back 15 or more years. The creation of a platform for posting code for agent-based models (openABM.org) and the concurrent emergence of a broadly accepted protocol for documentation of agent-based models (ODD) have increased the proportion of modelers who post their model code. However, despite these efforts, the majority of agent-based modeling projects author new code when starting a new project. This practice persists even among leaders in the agent-based modeling community, who have spent considerable intellectual effort analyzing potential barriers to code sharing and contributing to potential solutions. Concurrently, individual researchers frequently assert that they are building a multi-purpose model that would be suitable as a common code base—yet, none of these efforts have been widely adopted.

This persistent problem was brought into focus at the 2016 International Modelling and Software meeting in a session on modeling agent decisions. Myself, Tatiana Filatova (my former PhD student) and Nick Magliocca (a former collaborator on a large grant of mine) acknowledged that, although we had been in mutual communication regarding our respective agent-based land market models since their inception, none of us could clearly articulate the subtle ways in which our model assumptions and mechanisms differed. Further, our models are all written in different programming languages, creating additional barriers to integration. Each of our models has produced distinct theoretical advances, but without being able to plug each other's assumptions into our own models, it's difficult to evaluate the robustness of these advances. Further, we are left with sets of theoretical building blocks that can only be integrated into our own work at considerable cost. In short, we cannot exchange Lego blocks.

Discussions around barriers to a shared code base have often highlighted the experience of communities who have solved the “common code base” problem (Jin et al, 2017). Such communities often model a single, well-defined problem. They also have seed funding and/or institutions to support a code base. Our community has not yet attempted to form a common code base—but there is consensus that now is the time to try.

To address these challenges, we are holding a workshop that will bring together a group of agent-based modelers working in a fairly narrow research domain (agent-based models of land markets) to develop a common rule framework, and from that, the kernel of a common code base. The workshop will be held concurrently with the WICI conference on modeling complex systems (June 21-22, 2018) in Waterloo, Canada (<https://uwaterloo.ca/complexity-innovation/events/wici-conference-modelling-complex-urban-environments>).

- Workshop participants are encouraged to submit for presentation in the organized session on **Agent-Based Modelling of Urban Markets** (see the Call for Papers). We hope to organize a special issue based on the conference.
- An extended set of working sessions over the course of the conference (at least 1 full day) will hash out the design of a common code base, using a combination of Parker's MR POTATOHEAD framework (with appropriate updates) and Volker Grimm's ODD protocol. Both tools have been used successfully in the past for describing related models in a common meta-model and for model design.
- Following this effort, a one-term graduate research assistant will be hired to program a new model kernel.

The following schedule is proposed:

<b>Milestone 2:</b>	Development of code kernel for agent-based land market models	<b>Dates</b>
Activity 1:	Develop modified "MR POTATOHEAD" ontology/meta-model for land-market models. Distribute to workshop participants	February, 2018
Activity 2:	Participants return their conceptual instantiation of their ABM-LMM; suggest modifications of MP 2.0.	April 2018
Activity 3:	Parker and RA compile individual instantiations into meta-model; make any needed changes to MP 2.0	May 2018
Activity 4:	Hands-on workshop at UW to reach consensus on minimum common model functionality	June 20-23 <sup>rd</sup> , 2018
Activity 5:	Parker and GRA collaborate to build code kernel	June-July 2018
Activity 5:	Code distributed to model participants for testing and feedback	August-October 2018
Activity 6:	Code posted on OpenABM.org	November, 2018