Newly certified models in the CoMSES model library and newly published models added to the model library.

... a node in the CoMSES Network

CoMSES Digest: Fall 2016

Volume 4, No. 3 June 16, 2015 – September 15, 2016

Table of Contents:

From theEditor:
New Look for the CoMSES Digest - John T. Murphy
CoMSES News
CoMSES Net receives $1M 'Big Data Spoke' award from NSF
Improvements to OpenABM
Quantifying Model Replication
From the Board
Notes from the September Meeting of the CoMSES Executive Board
Reports
Linking Earth System Dynamics and Social System Modeling - Kimberly Rogers
From the Forums
General Forum
Jobs and Appointments
Model Library
Uploads/Downloads/Certifications to OpenABM
Commentary
Do we need licences for our simulation models? by Mariam Kiran

From the Editor: A New Look for the CoMSES Digest

John T. Murphy

Welcome to this quarter's CoMSES Digest. It has long been a goal to expand the Digest to capture more of the community's interests and activities. This issue marks the first such expansion. The report of model library activity is still present in the 'Model Library' section, but this basic report is now accompanied by several new sections.

- 'CoMSES News' will provide brief discussions of the activities of the CoMSES Network and its organizers. This issue includes some very big news about ongoing and future work.

- The 'From the Board' section will provide updates about the most recent discussions of the Executive Board.

- 'Reports' will include longer write-ups of important activities by CoMSES members and across the SES modeling community. This issue includes a description of a series of meetings concerning linking earth system models with social system modeling.

- 'From the Forum' will provide an overview of discussions taking place on the OpenABM forums. The intent is to encourage particpation and use of the forums, and all members are encouraged to log in and start new topics for discussion. Eventually these discussions may lead to more formal articles in the Digest or elsewhere.

- Finally, we offer a new section called 'Commentary', which will include discussions of interest pertaining to research or professional issues. For this inaugural issue we have a discussion on models, modeling frameworks, and licensing issues by Executive Board member Mariam Kiran.

We hope that these are interesting and useful additions. The CoMSES Network has as its primary mission facilitating the work of the socio-ecological modeling community, and we have long hoped that the Digest's role in this could grow as the community matures. If want to give feedback about the new Digest, or if you are interested in contributing something to future issues of the Digest, please contact me at johntmurphy@uchicago.edu. I look forward to hearing from you.

John T. Murphy,
CoMSES Digest Editor

CoMSES News

CoMSES Net Receives $1M 'Big Data Spoke' Award from NSF

CoMSES Net has received a $1M award from the National Science Foundation. The award is part of a 'Big Data Research and Development' initiative launched in 2012. The 'Big Data Spokes' awards will provide funding to 10 institutions across multiple regions in the U.S. to work with the four regional Big Data Hubs on a variety of topics. CoMSES Net's proposal is entitled, "Accelerating and Catalyzing Reproducibility in Scientific Computation and Data Synthesis," and will be used to promote transparency and reproducibility in scientific computation. It will focus on three key areas: cyber-infrastructure, a bibliometric database that can encourage sharing of model code, and a regional Working Group that will bring together stakeholders playing multiple roles in scientific computation and modeling, including software developers, domain experts, and user communities. The proposal was authored by Michael Barton, Marco Janssen, Allen Lee, and Ken Buetow, and included letters of commitment from a number of CoMSES Net members who will contribute as part of the proposed Working Group.

For more details, see: https://www.nsf.gov/news/news_summ.jsp?cntn_id=189864&org=NSF&from=news

Improvements to OpenABM

The CoMSES Net development team will be working over the next year on substantial

improvements to the OpenABM website and computational model library, with particular focus on improved workflows for model submission, peer review of models, and the technologies underlying the computational model library. This will help us to provide stronger preservation guarantees and better integration with other open science initiatives and cloud platforms. If you would like to be involved in these new developments, please feel free to send us a note at comses-dev@googlegroups.com

Quantifying Model Replication

Marco Janssen and his students, with support from the CoMSES Net Development Team, have performed an analysis of the public availability of model code in journal publications by looking at 2400 publications between 1996 and 2014 that describe the results of agent-based models. An initial sample of 200 publications in 5 core modeling journals had suggested that availability of model code was around 30% (http://marco-janssen.blogspot.com/2014/12/archiving-practice-for-model-code-of.html). The analysis of 2400 publications shows that the availability is 11%. This includes model code being available on home pages of authors, journal appendices, and public archives such as Github and OpenABM. Note that this study only considers the code available if a reference is given in the publication to the location of the model code, and if this URL was still available. Some model code might be archived without being referenced in the publication, and therefore 11% might underestimate true model code availability.

The percent of publications with model code availability is increasing (15% in 2014) mainly due to increased number of journal appendices and entries to the computational model library of OpenABM. A report about this study is being prepared and will be available soon.

From the Board

Notes from the September Meeting of the CoMSES Executive Board

The CoMSES Executive Board met in early September. The attendees included Michael Barton, Marco Janssen, Allen Lee, Calvin Pritchard, and Mady Tyson from ASU; Forrest Stonedahl, Mariam Kiran, Bill Rand, Moira Zellner, and Gary Polhill, members of the CoMSES Executive Board; John Murphy, CoMSES Digest Editor; and Greg Tucker, from the Community Surface Dynamics Modeling System (CSDMS; see 'Reports'). Lilian Alessa attended remotely but with some connection issues.

Among the topics discussed, the link with the CSDMS community, the bibliometric study (see 'CoMSES News'), and the expansion of the CoMSES Digest are discussed elsewhere in this Digest. Also central to the discussion were the new directions that will be available with the new NSF award ('CoMSES News'). The funding level will allow a great deal of progress on a number fronts; look for more information on the shape of this, and how to participate, in the near future.

Interest in creating a library of reusable model elements remains high. This has been a topic of discussion for some time now: the end goal is the ability to make components of models available for reuse, rather than only full models. The technical challenges of this (making the software interoperable) are equalled or even outweighed by the challenges in

developing communities that have common needs for model components and share a modeling vocabulary such that components developed in one modeling context can be brought to another.

Bill Rand shared some information about his ongoing MOOC on Agent-Based Modeling, and the relationship between his students' need to share their code and the model/component library. There is discussion of a CoMSES-sponsored course as a potential future project, and eventually CoMSES conferences, which will probably be virtual/online rather than in-person, to maximize the opportunities of far-flung CoMSES members to participate.

Reports

General Forum Linking Earth System Dynamics and Social System Modeling

Kimberly Rogers

A workshop entitled "Linking Earth System Dynamics and Social System Modeling" was held May 23-25th, 2016 and August 5, 2016, in Boulder, Colorado. It was organized by the CSDMS (Community Surface Dynamics Modeling System) Human Dimensions Focus Research Group, jointly with CoMSES Net (Kathy Galvin, co-chair), and funded by the National Science Foundation, CSDMS, and Analysis, Integration and Modeling the Earth System (AIMES)/Future Earth. It establishes an international Computational Human and Earth Systems Science (CHESS) community to develop a near-term science plan for integrated modeling of human and natural systems.

The Earth system is increasingly dominated by human action, and at the same time Earth system processes continue to significantly impact human life and well-being. This creates an urgent need for integrated human and Earth system models (HESMs) that are capable of capturing the dynamics of both biogeophysical and social systems models of human decisions and actions. Such integrated models will provide new insights into the multi-scale interactions among markets, atmospheric physics, energy consumption, terrestrial hydrology, water use, soil biochemistry, land use, and other societal and biophysical processes.

CSDMS and CoMSES Net are leading this ambitious integrated modeling effort, with the CSDMS Integration Facility hosting the first of several workshops on Computational Human and Earth System Science (CHESS) in Boulder on May 23-25th 2016. The workshop brought together a diverse group of multi-disciplinary researchers to develop a strong research plan and timetable for the integration of human systems models with Earth systems models. The workshop and a follow-up teleconference on August 5, 2016 initiated the process of assessing the intellectual, informatics, and material resources needed to develop models of human systems dynamics and couple them with models of Earth system dynamics.

The workshop consisted of 35 leading global representatives from computational social science and Earth system modeling communities, including researchers in collaboration with national and international laboratories that have an interest in the human dimensions of the Earth system. Participants recognized and discussed seven

interdisciplinary research issues related to development of global-scale HESMs: the purpose of linking models; land, water and human dynamics; coupling of existing human and Earth system models; extreme events and migration; decisions, behaviors and institutional change; multi-scalar impact assessment methods, and model evaluation. Following in-depth discussions of each of these key issues, the group identified challenges facing the advancement of HESMs, and set a three-year time frame as a goal for executing a research plan to address these challenges.

To maintain the momentum created by the workshop, the CHESS community is actively producing a white paper and will maintain a wiki on the CSDMS website, and is further increasing visibility through a community-authored editorial paper, an EOS meeting report and a CHESS-themed AGU session. Additional funding and endorsement opportunities have been identified for supporting the growth of CHESS and linking to upcoming Community Earth Systems Model (CESM) meetings. A second meeting on this theme was held in Kyoto Japan at the end of Sepember, 2016, another meeting is planned for Potsdam, Germany in the Spring of 2017, and more opportunities for developing this community will take place at the CSDMS annual meeting in May 2017.

From the Forums

Editor's note: The OpenABM Forums (https://www.openabm.org/forum) provide a way for CoMSES Net members to conduct general discussions about socio-ecological systems modeling, and for professional concerns, including new job announcements. In the past few months, the forums have had activity of both kinds. In the 'From the Forums' section of the Digest we will summarize some of the activity on the forums; forum discussions may for the bases of larger organized pieces, and may be turned into Reports, Commentaries, or other entries in the Digest.

General Forum

Title: Call for intention to submit on topic "Beyond Schelling and Axelrod – The State of the Art of Simulation Models of Ethnocentrism"
http://www.openabm.org/forum/call-intention-submit-topic-beyond-schelling-and-axelrod-state-art-simulation-models

Title: Some Results of the SCID project: Staging Abstraction of Complex Simulations
http://www.openabm.org/forum/some-results-scid-project-staging-abstraction-complex-simulations

Title: Has anyone used the OSF (Open Science Framework)?
http://www.openabm.org/forum/has-anyone-used-osf-open-science-framework

Title: Congress on Agent Computing
http://www.openabm.org/forum/congress-agent-computing

Jobs and Appointments

Note: Some of the postings have application deadlines that have already passed; we

include all of them here for those who are curious about the state of the field, and remind those of you who may be actively searching for a new position that you can subscribe to this forum via the OpenABM web site and receive these posts as soon as they are added. For the information listed here, be sure to check the deadline as given in the original post or from the institutions directly.

Title: Postdoc - social-ecological systems modeling, agent-based modeling, food-energy-water systems
https://www.openabm.org/forum/postdoc-social-ecological-systems-modeling-agent-based-modeling-food-energy-water-systems

Title: Postdoc position - Modeling interactions between humans and wildlife for conservation policy
http://www.openabm.org/forum/postdoc-position-modeling-interactions-between-humans-and-wildlife-conservation-policy

Title: Modeling trends of ecosystem service diversity in socio-ecological systems and their implications for resilience (PhD)
http://www.openabm.org/forum/modeling-trends-ecosystem-service-diversity-socio-ecological-systems-and-their-implications

Title: PostDoc - Improving Resilience for the Rio Grande Coupled Human-Natural System
http://www.openabm.org/forum/postdoc-improving-resilience-rio-grande-coupled-human-natural-system

Title: Executive Director of the Virginia Modeling, Analysis, and Simulation Center/Associate VP for Data Sciences, Old Dominion Univ.
http://www.openabm.org/forum/executive-director-virginia-modeling-analysis-and-simulation-centerassociate-vp-data-2

Title: agent-based modeling and bioenergy.
http://www.openabm.org/forum/agent-based-modeling-and-bioenergy

Title: Culture, Institutions and Sustainability position (open rank)
http://www.openabm.org/forum/culture-institutions-and-sustainability-position-open-rank

Title: Graduate student positions available in study of coupled systems
http://www.openabm.org/forum/graduate-student-positions-available-study-coupled-systems

Title: Faculty positions in Complex Systems
http://www.openabm.org/forum/faculty-positions-complex-systems

Title: Open pre-doc position at Alpen-Adria Universität Klagenfurt
http://www.openabm.org/forum/open-pre-doc-position-alpen-adria-universitat-klagenfurt

Title: Research Fellow in Agent-Based Modelling of dietary choice at Aberdeen
http://www.openabm.org/forum/research-fellow-agent-based-modelling-dietary-choice-aberdeen

Title: Opportunity in modeling Solar PV adoption
http://www.openabm.org/forum/opportunity-modeling-solar-pv-adoption

Title: 4 PhD Positions at Utah State University
http://www.openabm.org/forum/4-phd-positions-utah-state-university

Title: modeller position on migration and adaptation in deltas
http://www.openabm.org/forum/modeller-position-migration-and-adaptation-deltas

---

Model Library

Eight new models were uploaded to the OpenABM model library during the summer quarter, covering, as usual, a wide range of topics. Manuel Chica has placed a model examining freemium apps and the adoption of premium and paid content in apps such as online game subscriptions. Nanda Wijermns, Caroline Schill, Maja Schluter, Therese Lindhall's 'AgentEx' model is a NetLogo model of common-pool resources; Iris Lorscheid and Matthias Meyer apply ABM to model bounded rationality in an agent learning model. Anna Klabunde, Sabine Zinn, Frans Willekens and Matthias Leuchter use multistate modeling coupled with behavioral rules and intentions, and present an example model of migration from Senegal to Southern Europe. Micholas Mark Gotts and J. Gary Polhill use goal-framing theory to model domestic energy demand in small towns or estates. Bruce Edmonds offers a model in which beliefs are proposed to exist in a network and may change based on coherence with other beliefs in the network and on social interactions among agents. Annalisa Stefanelli also examines opinion dynamics, in this case via pairwise interactions and beliefs on a single topic (contested energy infrastructures) over time.

The eighth newly added model is also a newly certified model: J. Applegate has submitted a model of the behavior of startup firms within a given business sector. The firms' strategies are modeled using an N-K network, and two fitness landscapes- old, with established firms, and new, with the additional startup firms- are explored, with performance based on the firms' strategies, and underperforming firms (relative to that firm's aspirations) periodically removed. The model is in NetLogo and is fully documented with the ODD protocol.

This quarter saw an uptick in model downloads. The most downloaded model is a newcomer to the list: Meysam Alizadeh and Claudio Cioffi-Revilla explore the impact of activation order in a model of opinion dynamics. Numbers two and three on the list a

reprising earlier appearances (Kim's model of worker protest and Edali and Yasarcan's implementation of the 'Beer Game.' Fourth and fifth place are held by newcomers: Alex Zvoleff's model of land use in Nepal (constructed using a new Pthon-based ABM toolkit under development, PyABM), and Diego Valbuena's model of land use/land cover change in the Netherlands.

Newly Published Models in the Model Library

Opinions on Contested Energy Infrastructures

Annalisa Stefanelli

Simulates opinions on a topic (originally contested infrastructures) through the interactions between paired agents and based on the sociopsychological assumptions of social judgment theory (SJT; Sherif & Hovland, 1961). The model shows the opinion dynamics of individuals and the whole agent population regarding a specific issue over time.

A Model of Social and Cognitive Coherence

Bruce Edmonds

This is a model of coherency based belief within a dynamic network of individuals. Here beliefs might be copied (or discarded) by an individual based upon the change in coherence it causes with its other beliefs, but also that an individual will change their social connections based upon the the coherence of their beliefs with those they socially interact with.

Community Energy Demand Social Simulator (CEDSS3.4)

Nicholas Mark Gotts, J. Gary Polhill

CEDSS (Community Energy Demand Social Simulator) is an agent-based social simulation model of domestic energy demand in communities of around 100-250 households, such as a village or urban or suburban estate. It can then be run forward from 2010 under a range of assumptions, to explore possible future trajectories of household energy demand.

Multistate Modeling Extended By Behavioral Rules

Anna Klabunde, Sabine Zinn, Frans Willenkens, Matthias Leuchter

We propose to extend demographic multistate models with a behavioural element linking intentions to behaviour. Concretely, behavioral rules explain intentions and thus transitions. Our framework is inspired by the Theory of Planned Behaviour. Model parameters are determined using empirical data if available. We exemplify our approach with a model of migration from Senegal to Southern Europe. Our approach adds to the toolkit of demographic projection by allowing for shocks and social influence which alter behaviour in nonlinear ways, while sticking to the general framework of multistate modelling.

LAMDA - Learning Agents for Mechanism Analysis

Iris Lorscheid, Matthias Meyer

The simulation model LAMDA demonstrates how agent-based simulation (ABS) may provide a computational testbed for mechanism design using concepts of bounded rationality (BR). Based on an analysis of the requirements of the decision context, we describe a systematic way of incorporating different BR concepts into an agent learning model. The presented BR concepts as simulated by agent models cannot model human behavior in its full complexity. The simplification of complex human behavior is a useful analytical construct for the controlled analysis of a few aspects and an understanding of the potential consequences of those aspects of human behavior for mechanism design.

AgentEx

Nanda Wijermans, Caroline Schill, Maja Schlüter, Therese Lindahl

AgentEx aims to advance understanding of group processes for sustainable management of a common pool resource (CPR) in dynamic social-ecological environments. It targets to qualitatively reproduce and explain patterns observed in behavioural CPR laboratory experiments. AgentEx (v1.0) represents an explanation that is characterized by three individual-level factors: individual ecological knowledge, confidence in knowledge and social skills that interact to determine individual and group knowledge as the outcomes of communication/knowledge sharing and knowledge updating

An Agent-Based DSS for Word-of-Mouth Programs in Freemium Apps

Manuel Chica

This software implements an agent-based framework that aggregates social network-level individual interactions to guide the construction of a successful decision support system (DSS) for WOM. The framework also has a data-driven iterative modeling approach to increase validity through automated calibration by metaheuristics. The framework is applied to run targeting and rewarding programs for a freemium social app where premium users discuss the product with their social network and promote the viral adoption

Strategy with Externalities

J M Applegate

The purpose of this model is to explore the effects of technological and social shifts on the behavior of incumbent and startup firms. A firm’s performance is determined by its location on an NK fitness landscape, and each firm’s strategy, or technology portfolio, is modeled as a string of bits which locate the firm on the landscape. Firms move along the landscape by modifying their strategies. The model explores how the performance landscape needs to shift in order for startups to become established and incumbents motivated to search for higher preforming strategies.

Most Downloaded Models in the Model Library
(June 15, 2015 – September 15, 2016)

1. (61 Downloads) Activation Regimes in Opinion Dynamics ***by Meysam Alizadeh, Claudio Cioffi-Revilla***

2. (60 Downloads) A Computational Model of Workers Protest ***by Jae-Woo Kim***

3. (50 Downloads) A Mathematical Model of the Beer Game ***by Mert Edali and Hakan Yasarcan***

4. (46 Downloads) Land Use in the Chitwan Valley **, Alex Zvoleff**

5. (44 Downloads) An Empirical ABM for Regional Land Use/Cover Change: A Dutch Case Study **by Diego Valbuena**

Commentary:
Do we need licenses for our simulation models?

Mariam Kiran

Editor's Note: The 'Commentary' section allows members to present an argument, viewpoint, or point of interest from his or her own perspective. The intent is to spark discussion among the CoMSES members about topics that are of professional or intellectual interest across domains. If you are interested in submitting a commentary article, contact me at johntmurphy@uchicago.edu**.**

You can continue the discussion of this topic in the OpenABM Forums; go to https://www.openabm.org/forum/do-we-need-licenses-our-simulation-models-mariam-kiran

In the many years since its original description, the well-known Sugarscape model has seen multiple reproductions and versions released by multiple developers. As Sugarscape evolved, it ended up being used in a range of diverse fields, including the social sciences, economics, and biology, studying behaviours such as hierarchy, society and organisation. Sometimes the authors of these new versions gave credit to the original Sugarscape developers; sometimes, however, these newer versions did not, and, furthermore, did not document what was changed nor what the reproduction is designed to do.

In a case like the Sugarscape model, this can lead to the contributions of the original authors being blotted out or omitted entirely, costing them the academic and intellectual credit they deserve. But similar trajectories apply to other models, such as models of the stock market that are now being used to predict market changes- enough to start earning a monetary value. These scenarios raise a question for the M&S community: is there a need to recognize original authors and contributors for models and research as they become increasingly valuable?

The answer lies in whether there is a need for having model release standards.

Modelers often maintain their own model libraries, where code is uploaded with version numbers, how-to-run help files, simulation details and accompanying dependencies – all to allow easy result reproducibility. However, there is a lack of '*model release'* standards in the modeling and simulation community (M&S), discussing details on how models are documented, used and modified as research progresses. Most models are released to the public-domain as 'free-to-use', extend and publish results. However, recent reproductions and publication problems have raised issues of reliability and confidential research tools being used in policy making.

The software writing community, particularly the open-source community, has largely investigated problems of what is open-source and how developers re-use software, in commercial purposes. Stallman argued a case for code freedom and GNU General Public Licenses (GPL), attaching readme text files with every code release. GPL, itself, has multiple versions, allowing user's different access and re-use or sell details. Adobe, YouTube and more have been releasing their own licenses with their code carefully crafted using legal terms. Other licenses such as creative commons, MIT or BSD grant users more kinds of access, leading to so many licenses with more complications in trying to find the right license for me for developers to use. Here, there is a need to create a distinction between commercial and academic research software licenses. While the commercial world seems to have a great number of legal guidelines, academic research mostly favours open access and model reproducibility because of the nature of publications, transparency and credibility. Reuse of models is often preferred but there do not exist any methods to allow original authors to say how they would want it to be reused.

Simulation code and its rights

The plethora of legal terms for software releases becomes increasingly complicated for developers. Releasing code as open-source by default may not be a good idea if someone else downloads it and starts making money from it. Various terms can thus be added to create tailored licenses for specific developer releases (See Polhill 2007 for more details):

- Copyleft allows original authors to relinquish all rights to the software, allowing it to re-used, modified, enhanced and redistributed by future developers.
- Create an unrestricted right to execute the software allows certain number of allowable users to run the code.
- Grant access to inspect the code allows users to read or critique the code.
- Right to re-implement the code.
- Right to modify the code, which is different from above and implies using most of the original code and adding or deleting parts of it for desired model output.
- Right to redistribute the code in the modified version. Here the GPL v3 license, particular states, that any modification re distributed, would attach the original authors name as well as a means to protect the original copyrights.

Agent-based modeling frameworks and their licences

Agent-based modeling toolkits allows modelers to easily write and simulate their models. These toolkits have their own licences to allow users to use them. However, they

do not document what happens to the model written using them. One could argue, that toolkits released under the GPL license, which basically means all files modified or reused should also be under the GPL license, would automatically deem models to be GPL as well. But the argument would not follow for toolkits with licenses other than GPL. This raises a number of arguments here:

- Should models then have their own global licenses independent of the toolkits used?
- Should model licenses complement toolkit licenses; because there is a dependency, needing each other to simulate and execute?
- Do models written using toolkits, naturally inherit the toolkit license?
- If models are released to the public domain for free-to-use, but the toolkit is not, how does this relationship play when it comes to seeking permission to simulate models?
- Is there a need for toolkit developers to engage with the developer community, tracking the models being written, in cases the models become complex and valuable?

All of the above questions, stipulate the need for a wider community discussion involving toolkit and model developers to come together and agree on releasing standards. Efforts by CoMSES, Repast, JADE and research projects have attempted to create model catalogues which can shine a light on the general direction being developed. But currently there is a need to have a uniform body to discuss these problems. Perhaps the leading conferences in Complex Systems can be excellent venues to aid this agenda. Commonly used ABM frameworks and their licenses include Repast: BSD, JADE: LGPL v2, SWARM: GPL, SOAR: BSD, FLAME: Originally GPL v3 (now being commercialized new license unknown), Starlogo: Free, Netlogo: GPL and Mason: Academic Free license (More info: https://en.wikipedia.org/wiki/Comparison_of_agent-based_modeling_software)

Where do we go from here?

Simulation code is intellectual property, similar to any source code. The complication of using toolkits to run these simulations lead to contradictions for licenses. But what constitutes to code requiring licenses? Simulations written in MATLAB, have an inherent dependency of MATLAB that carries a commercial software. Even if the simulation code is released free, it cannot be reused until one has MATLAB installed on their lab computers. This leads to an interesting chicken and egg conundrum of whether MATLAB simulations can be released by researchers, or does MATLAB own them? Keeping in line with academic purposes, there is also a discussion on algorithms. Simulation code can also be rewritten as set of algorithmic steps which inherently removes any toolkit dependency for it. This also allows models to be written for multiple toolkits regardless of computational dependencies.

The algorithm likeness seems to reduce some of the complexity in license discussions here. In order for any code to carry a license, it should be independent. So would it be easier to call our models algorithms rather than code? Recent successes of new tools

such as Ipython, Jupiter and Docker could also help in releasing platform dependencies for code simulations.

Whether you release all software as free by default on Github or only release results, in the academic world, reuse, reproducibility and transparency are of utmost importance. A few points to recommend here:

1. Every model can attach an *authors* text file, documenting names of original developers. This gives credibility to PhD students and Post-docs, who are commonly doing most of the development.
2. Every model should have a how-to-run file, to show how code is available and its dependencies such as toolkits needed to run it.
3. Documenting simulation code itself, describing what all functions do to allow easy understanding of model behaviour. This is similar to having architectural or algorithm description of the model to allow reuse and adaptation.
4. Documenting a list of assumptions in the model, to identify shortcomings of the models.
5. Results of the simulation are released as free to use to the wider community. This allows wider criticism of ideas encouraging academic collaboration and research improvement across the discipline.

Some licenses offer freedoms for developers and modelers. The license GPL prevents some code freedom, by limiting all files produced to also be GPL, but does give original authors credit. BSD implies freedom, but modifier becomes the benefactor. The source code community, itself, is actually extremely honest when it comes to acknowledging and sharing code, but it is still difficult to catch modifications if software is used offline. There is a strong case for models to have a license attached, as a tailored one or allow toolkits to relinquish dependencies from them. However, whether we need licenses or just plain guidelines to help increase model reusability and transparency can help improve domain knowledge, is possibly an easier solution.

Extra Reading

- Copyleft license: Use, modify and distribute, but share the source code.
- Berkeley Software Distribution license (BSD): Can combine the software with proprietary software and release it under a proprietary license, but retain the BSD license text and notices. This license may also include author's name or advertising details.
- Gnu Public License (GPL): Can use, modify and distribute the software for free or for a fee, but distribute the source code with it. If software is combined with other software, everything should be released as GPL, unless it is a LGPL
- Lesser Gnu Public License (LGPL): Same as GPL, but allowed to release it under your terms under certain conditions.
- MIT license: Can use, modify and distribute software allowing same rights to the users.
- Apache License: Can use, modify and distribute copies of the software, add own copyright statement to the changes with additional terms for use of the modified

version.

- Mozilla Public License (MPL): Can use, modify, distribute and sell the software, with the source code. Can also sub-license the modified work, but do not restrict access to the source code.
- Various license permissions include:

- Download and run: permitted by GPL, LGPL v 2.1, Apache 2.0, Mozilla, GPL v3, GPL v2 and Creative Commons.
- Redistribution: permitted by LGPL v 2.1, Apache 2.0, GPL v3, GPL v2 and Creative Commons (with parameters nc = non- commercial, nd = no derivatives of the work, sa = share with same license, which can be combined to create own)
- Modify: permitted by LGPL v 2.1, Apache 2.0, GPL v3 and GPL v2.
- Can be used with commercial software LGPL v2.1, Apache 2.0, GPL v3 and GPL v2.
- Must include original authors, Apache 2.0, GPL v3 and GPL v2.

References

G. Polhill, B. Edmonds (2007), Open Access for Social Simulation, Journal of Artificial Societies and Social Simulation, vol. 10, no. 3 10/

R. Stallman (2002). Why "free software" is better than "open source". In Gay J (Ed.), Free Software, Free Society: Selected Essays of Richard M. Stallman. Boston, USA: GNU Press, pp. 55-60

We would like to thank the National Science Foundation for their support via grants (NSF BCS-0623162 and GEO-0909394).
