ExAMPLER

An ExCALIBUR Project

Exascale computing and agent-based social simulation (ABSS)

Gary Polhill, Alison Heppenstall, Mike Batty, Matt Hare, Doug Salt, Ric Colasanti and Richard Milton

Urban Big Data Centre

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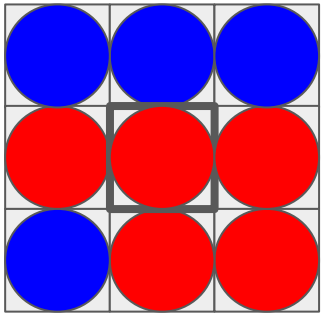
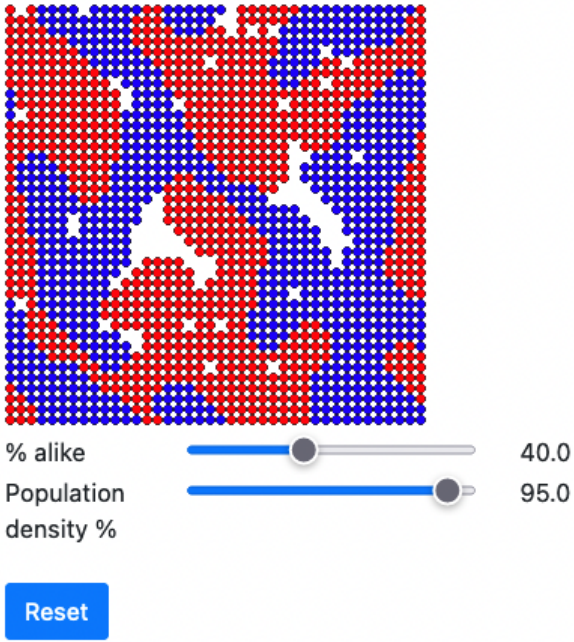
The ExAMPLER project

- 18 month project started 1 June 2023
- Exploring the potential of exascale computing for ABSS
  - … with appropriate institutional and software support …
- Bringing the social sciences into the conversation about exascale computing
- Gap analysis approach
  - How ready is the ABSS community to take advantage of exascale?
  - What needs to be done to get the ABSS community using exascale?

Schelling segregation the “Hello world” of ABSS

1. Count number of each type in immediate neighbourhood
2. If less than % like
   a. Then
      i. Move *
   b. Else
      i. Stay





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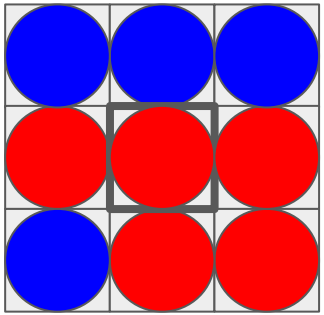

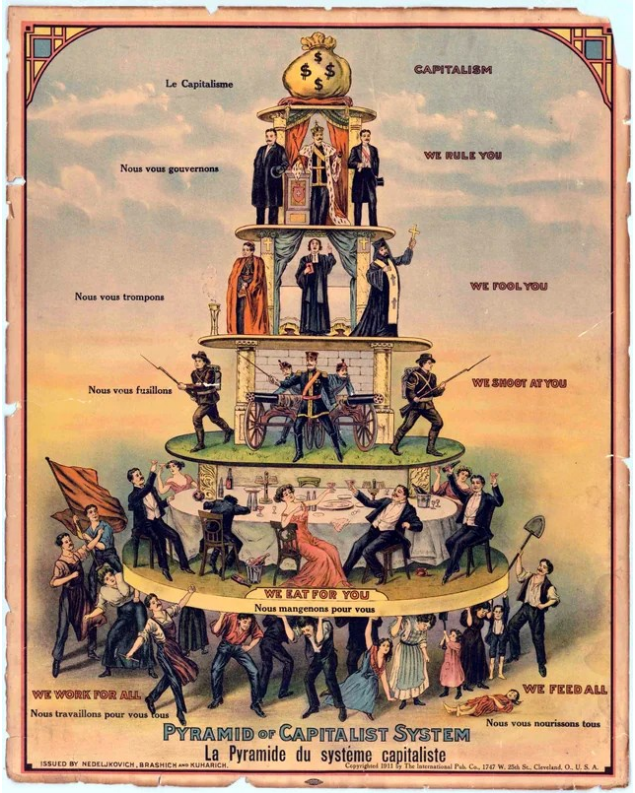

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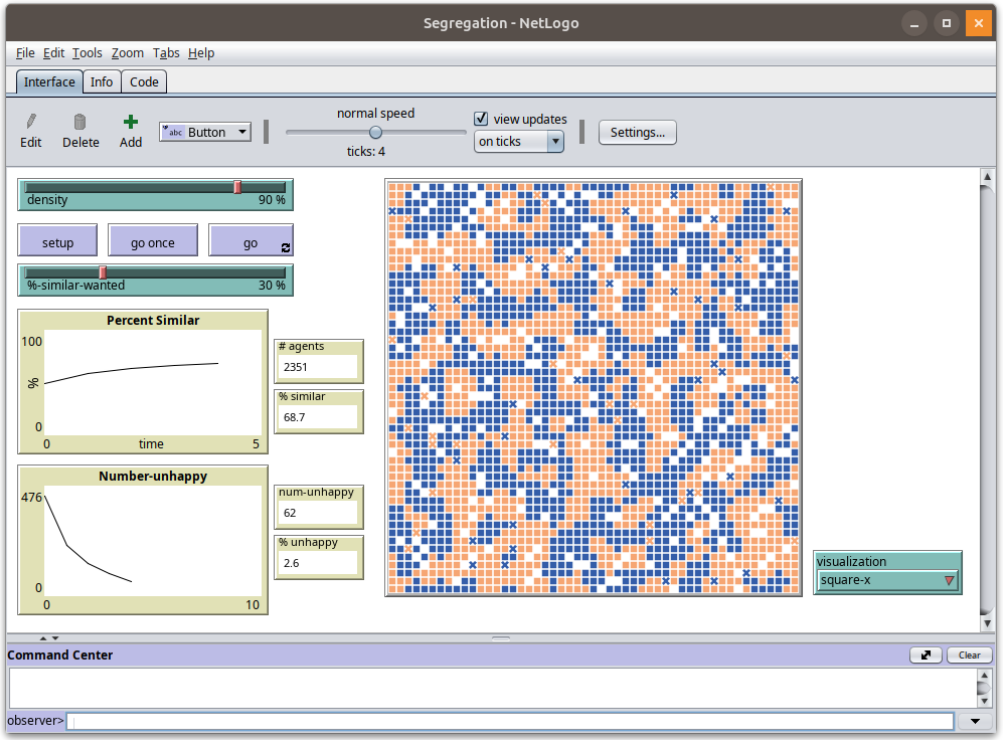

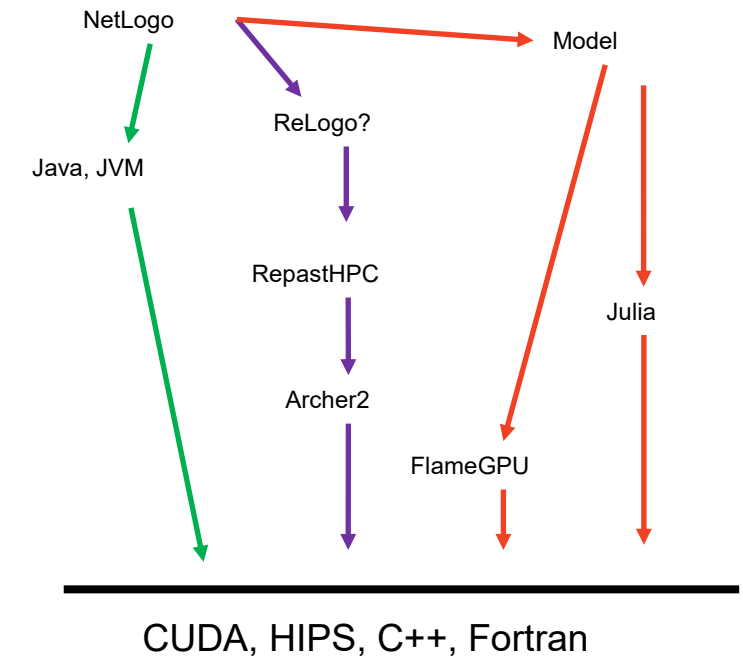

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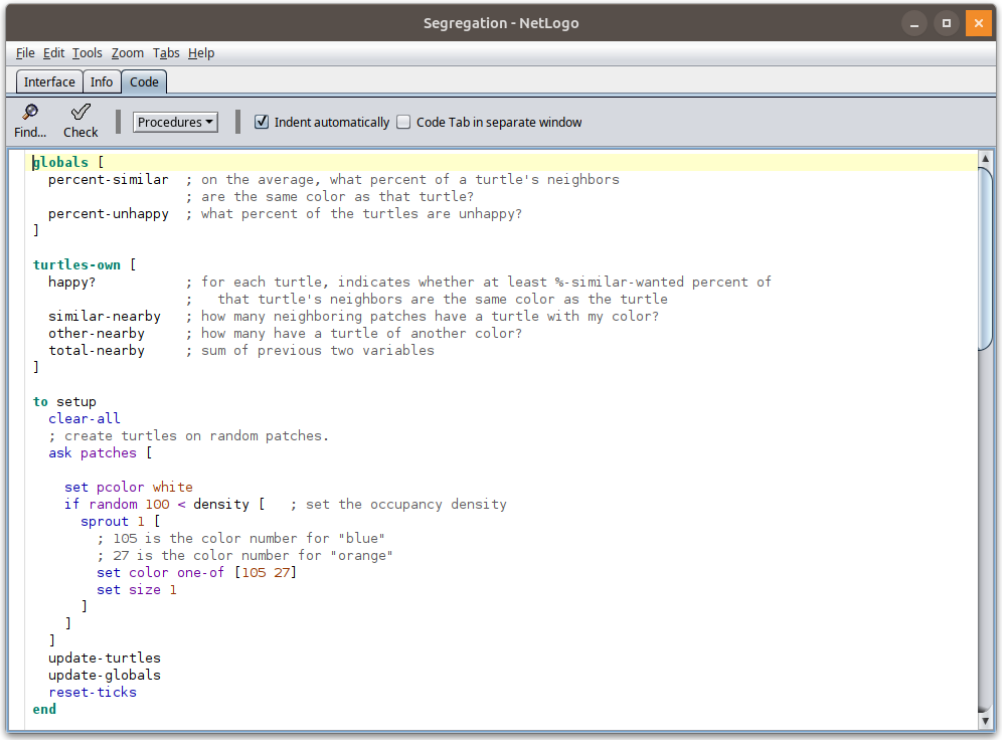
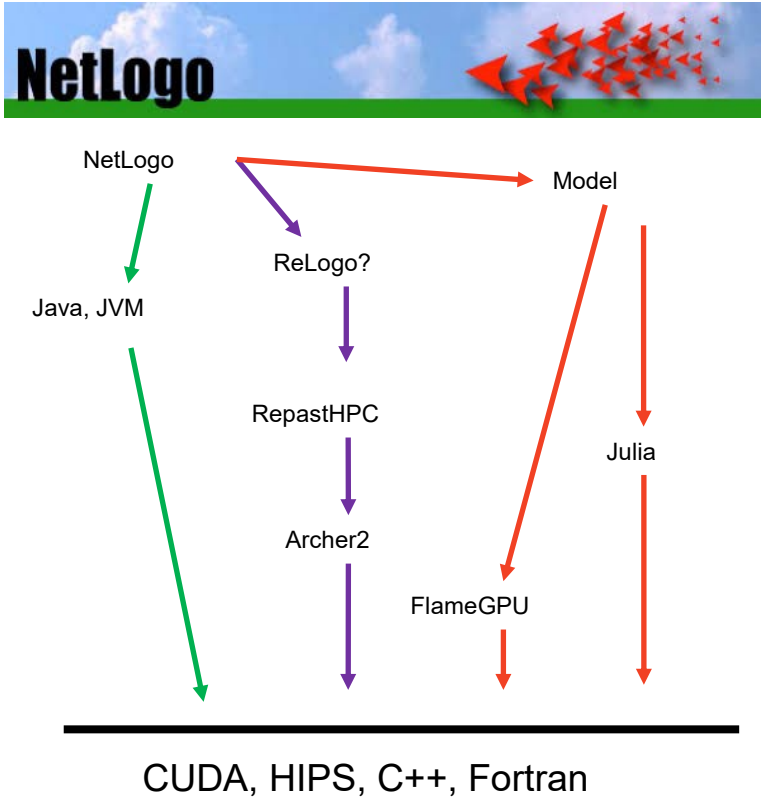
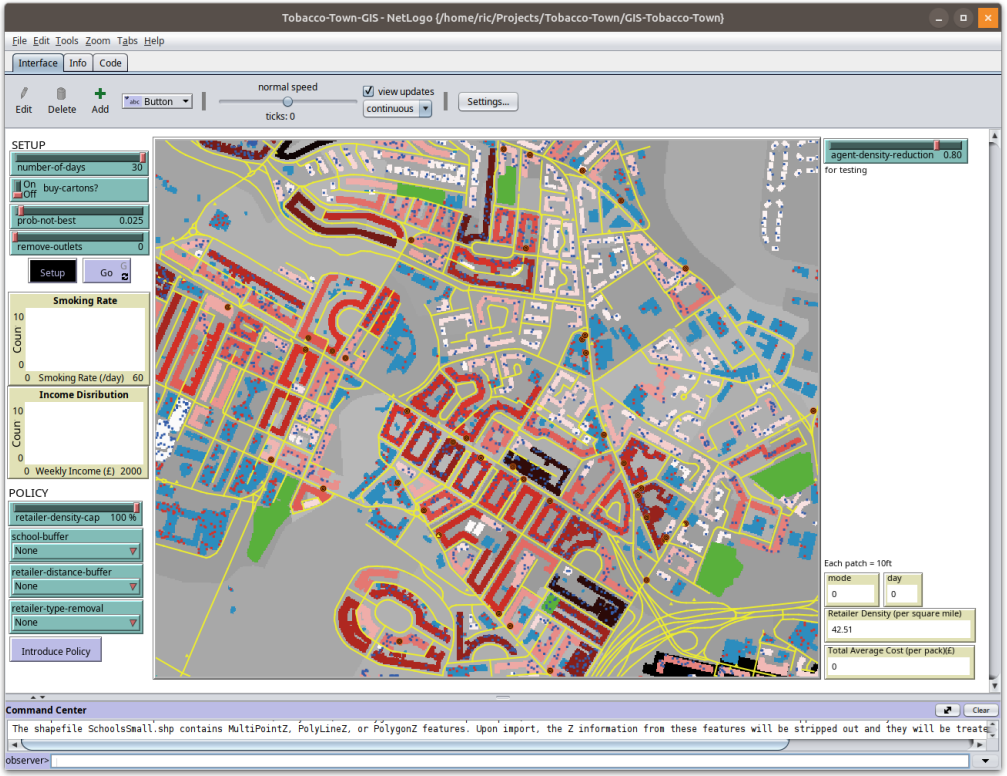
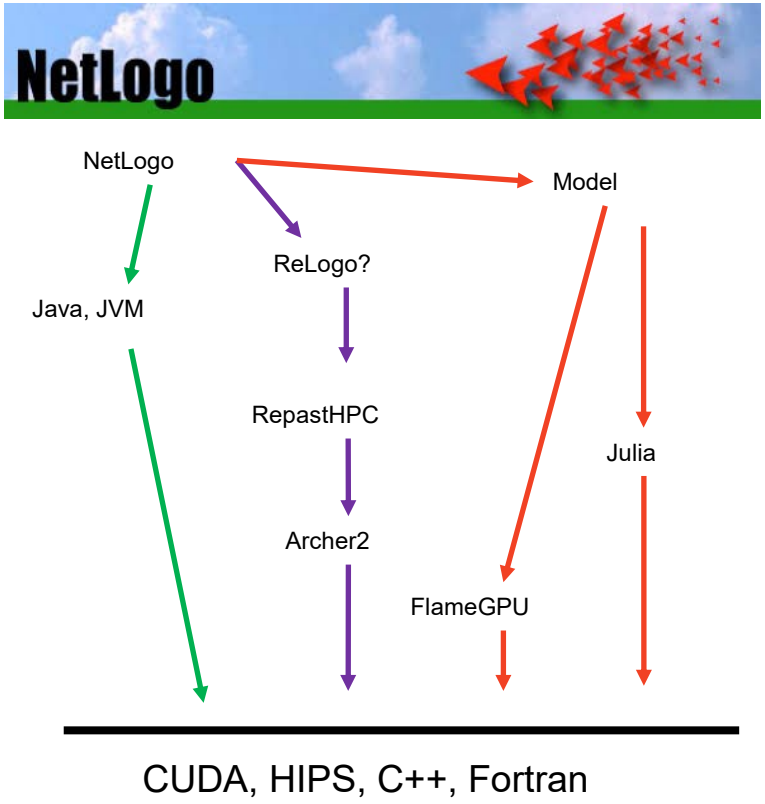




Policy usage of ABSS (Tobacco town)



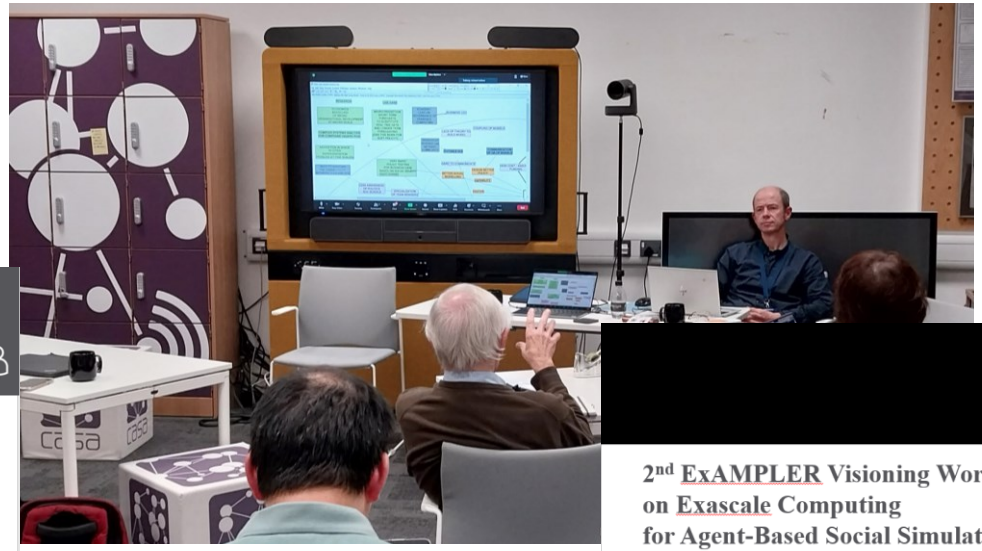


Activities in ExAMPLER

- Systematic Literature Review
  - What is the prevalence of HPC use in ABSS?
  - What demand is there for HPC use in ABSS?
    - Numbers of reported runs, sizes of space, numbers of agents, etc.
- **Visioning workshops (SSC 2023 in Glasgow, London ExAMPLER)**
  - **Visions for exascale computing support for empirical ABSS**
- Roadmap
  - Training ourselves in exascale computing, technology, software and algorithms
  - Workshops next year (iEMSs, SSC 2024 in Cracow, and in Glasgow) – what's needed to bring the visions about?
- Knowledge exchange
  - Promoting exascale ABSS at conferences and workshops in the ABSS and HPC communities

ExAMPLER Work Package 2: Visions of Exascale Computing for Agent-Based Social Simulation

An ExCALIBUR Project



1st ExAMPLER Visioning Workshop on Exascale Computing for Agent-Based Social Simulation:

Uses, benefits and challenges for the social simulation community

Social Science Simulation Conference 2023,
4th September 2023

Matt Hare, Doug Salt, Gary Polhill (JHI)
Ric Colasanti (Glasgow Uni)
Richard Milton (UCL)
matt.hare@hutton.ac.uk

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Two "visions" workshops implemented with academics, policy-makers and other stakeholders

2nd ExAMPLER Visioning Workshop on Exascale Computing for Agent-Based Social Simulation:

Capabilities, transformational use cases, capacity requirements and potential threats

London Workshop 8-9th November 2023

Matt Hare, Doug Salt, Gary Polhill,
Richard Milton, Michael Batty,
Alison Heppenstall, Ric Colasanti
matt.hare@hutton.ac.uk

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Some Visions of Exascale Agent-Based Social Simulation: Capabilities, Use Cases, Capacity Requirements, Threats

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Threats:
Inequitable access to exascale resources

Increased energy consumption

Threats:
1:1 social simulation

Dependence on Artificial Intelligence

Faster, bigger, more detailed simulations

Use Cases:
Individual-based social science

Formalization of qualitative social theories

Use Cases:
Rapid real time participatory policy modelling

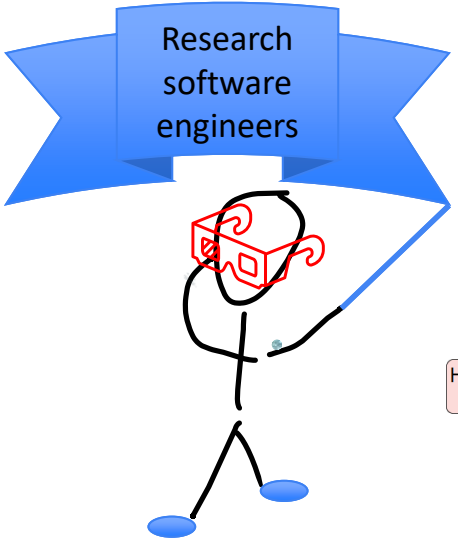
General model emulation

Capacities needed:
Lots of Artificial Intelligence

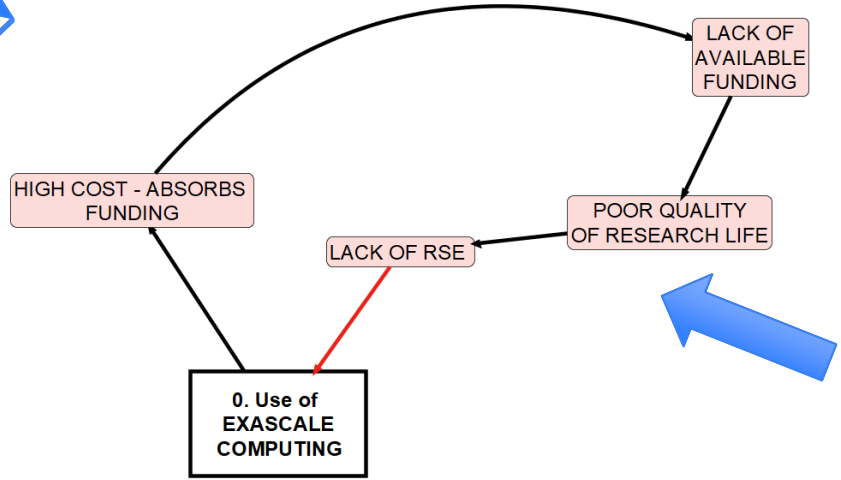
Lots of data

* For more results, see Hare, M., Salt, D., Colasanti,R., Milton, R., Batty, M., Heppenstall, A., & Polhill, G. (in submission) *Taking Agent-Based Social Simulation to the Next Level Using Exascale Computing: potential use cases, capabilities and threats*. Submitted to: Autonomous Agents and Multi-Agent Systems 2024, New Zealand.

Professional capacity requirements



In order to exploit the benefits of exascale computing: "Developing scientific software is a highly challenging task … programmers must address the tricky, highly specialised, low level details of parallelism"
XDSL project → https://excalibur.ac.uk/projects/xdsl/



The feared self-limiting cycle that could threaten exascale computing (if funds are absorbed in hardware at the expense of funding enough research software engineers to support the transition).
As identified from a component of the causal loop model elicited from the participants of the 2nd Workshop in London.

The XDSL project → https://excalibur.ac.uk/projects/xdsl/