

HOW RUNNING FROM ZOMBIES IS THE SAME AS MARKET BEHAVIORS

By Jacqueline Kazil

PyTennessee, February 9, 2018



PYTHON SOFTWARE FOUNDATION

<https://www.python.org/psf/>

- The PSF protects the Python trademark
- Gives out grants to support Python events and Python development
- Organizes and hosts PyCon US
- Provides fiscal sponsorship support

& Much much more

EDUCATION REQUEST FOR IDEAS

<http://bit.ly/PSF-RFI-EDU>

How to increase Python presence in education?

- Really open ended
- Small or big - \$10 to > \$10 million
- Deadline Feb 18

PYCON 2019: CLEVELAND, OH

<https://us.pycon.org/2019/>

- Tutorials: May 1-2
- Talks & events: May 3-5
- Sprints: May 6-9

..and PyCon 2020: Pittsburgh, PA

PYCON: MAINTAINERS SUMMIT

<http://bit.ly/maintain2019>

<https://www.papercall.io/pycon-maintainers-summit>

- First year thru hatchery program
- Discussion of tooling, community, funding, and sustainability
- CFP open until March 15 for lightning talks

THINGS I JUST MENTIONED

- Python Software Foundation (PSF)
- PSF Education Request for Ideas (Feb 18)
- PyCon 2019: Cleveland, OH (May 1 to 9)
- Maintainers Summit & CFP (March 15)

THE REAL TALK

... modeling the complex world we live in.

part tech talk, but also

part rethinking how you see the world.



2020
Class of 2019?



OVERVIEW OF TODAY'S TALK

- Introduction to complexity systems
- What is complexity science or the study of complex systems
- Considerations for building models
- Some of the practical applications

TOOLING

- Mesa (Python) - Agent-based modeling
- Networkx (Python) - Network/graph analysis
- Netlogo (Logo) - Agent-based modeling

**"YOUR WATCH IS COMPLICATED,
YOUR FAMILY IS COMPLEX"**

Said by David Krakauer, Evolutionary Biologist

COMPLEXITY
AND THE
ART OF
PUBLIC
POLICY

SOLVING
SOCIETY'S
PROBLEMS
FROM THE
BOTTOM
UP

DAVID
COLANDER

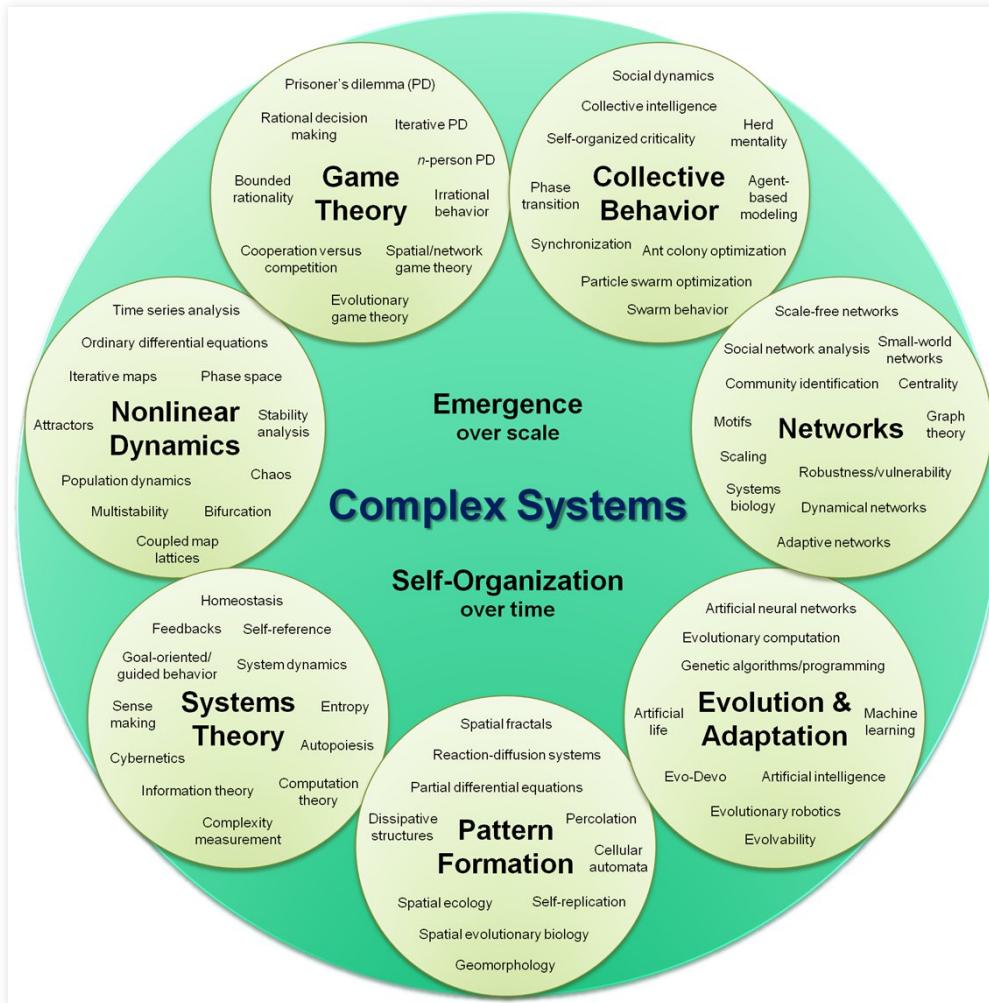
—
ROLAND
KUPERS

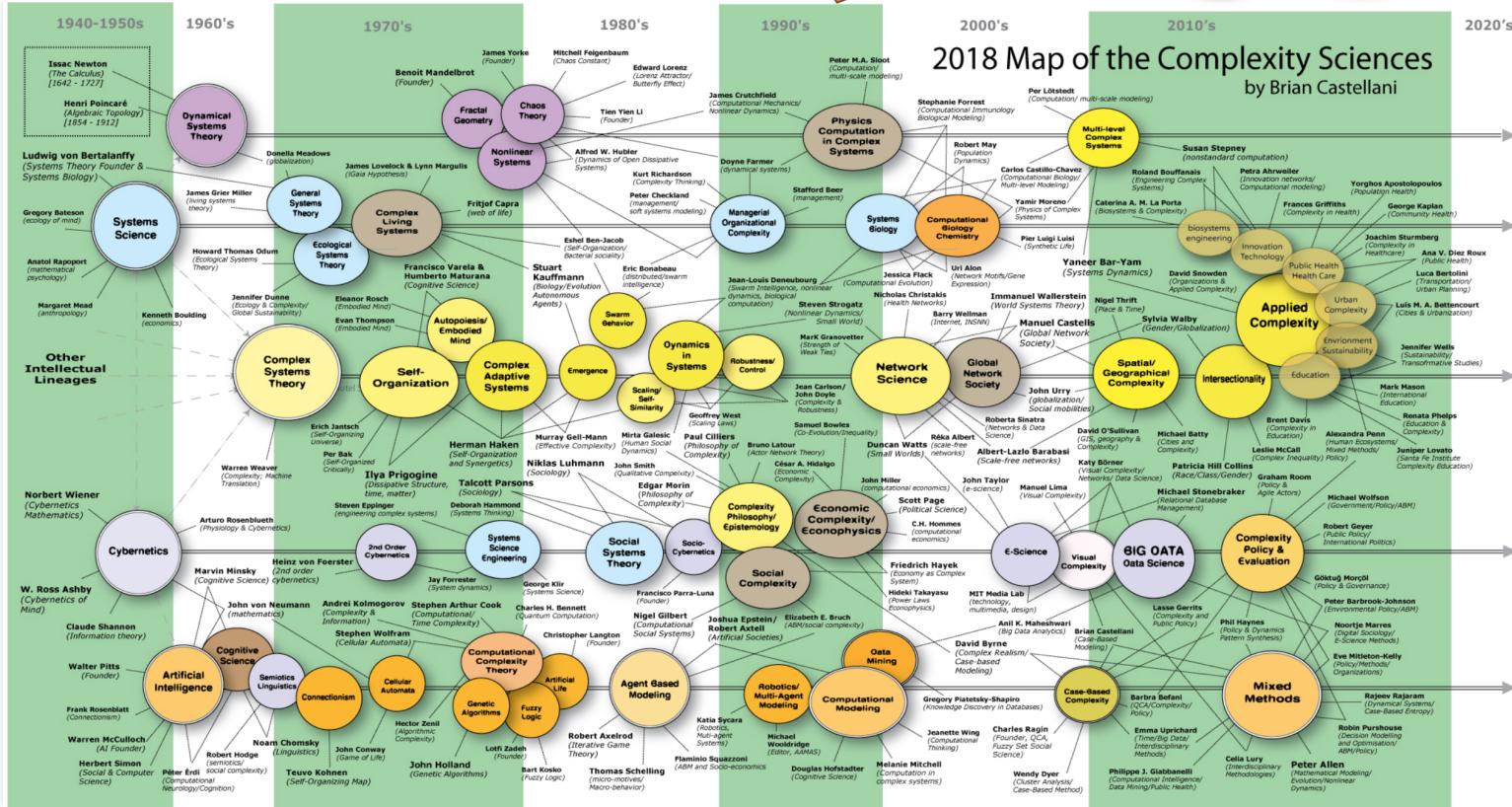
TRAFFIC IN ETHIOPIA



BIRDS FLOCKING

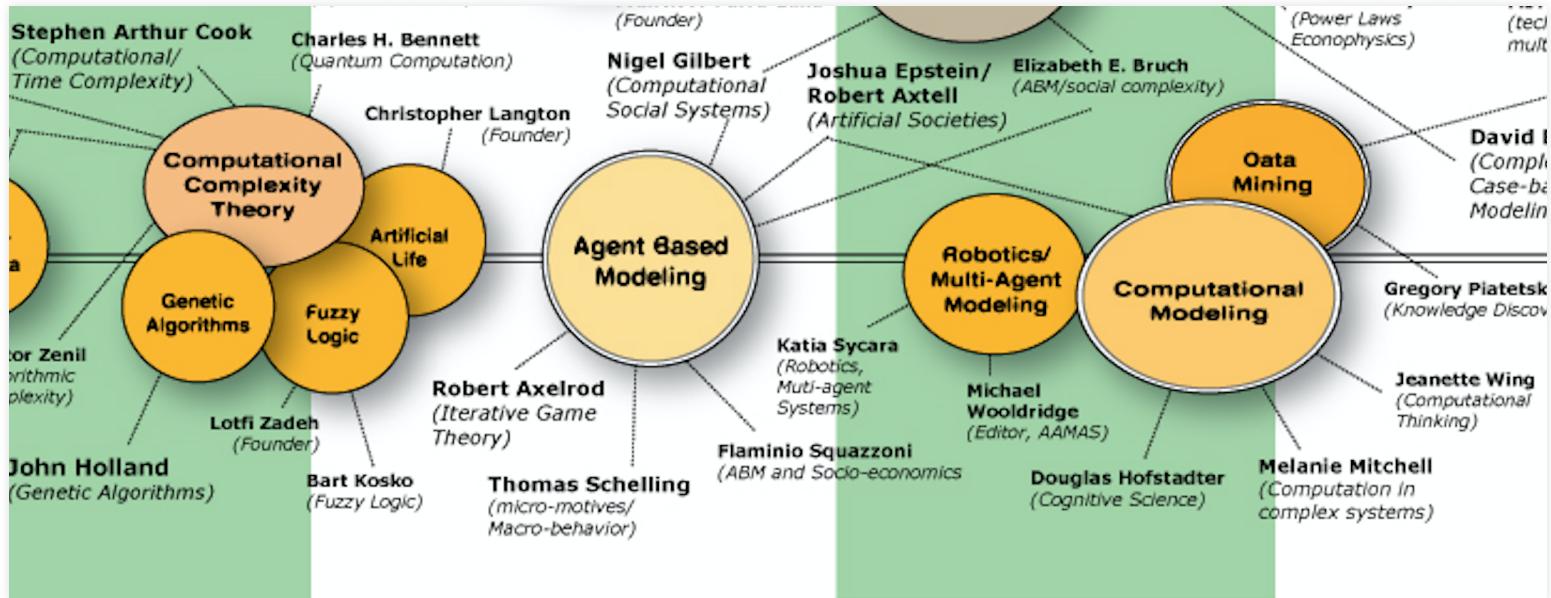






2018 Map of Complexity Sciences by Brian Castellani

AGENT-BASED MODELS



WHAT IS AGENT-BASED MODELING?

ABMs, MAS, Game theory, Cellular automata,
Microsimulation, Individual-based models. Complex
Simulations...

WHAT IS AGENT-BASED MODELING?

Computer simulation

Consisting of agents

... interacting with one another

... in order to study an overall system

COMPONENTS OF A MODEL

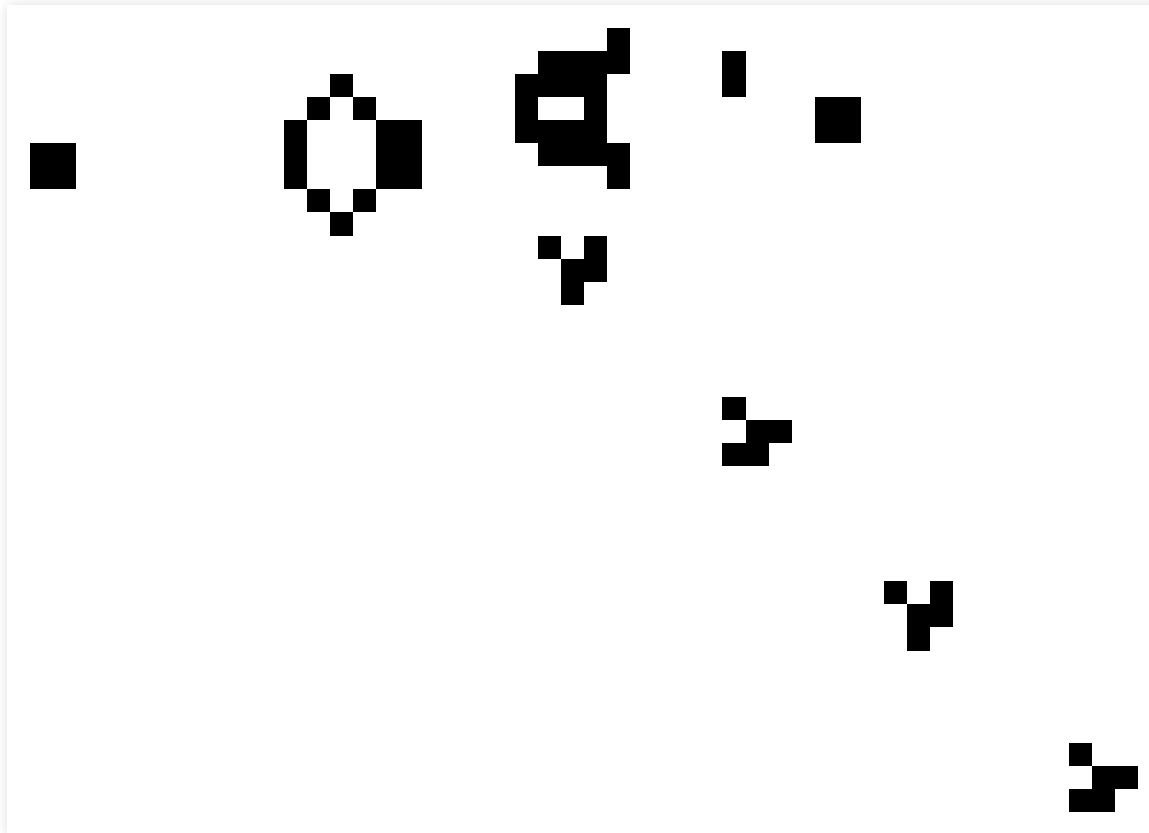
Space

Agents

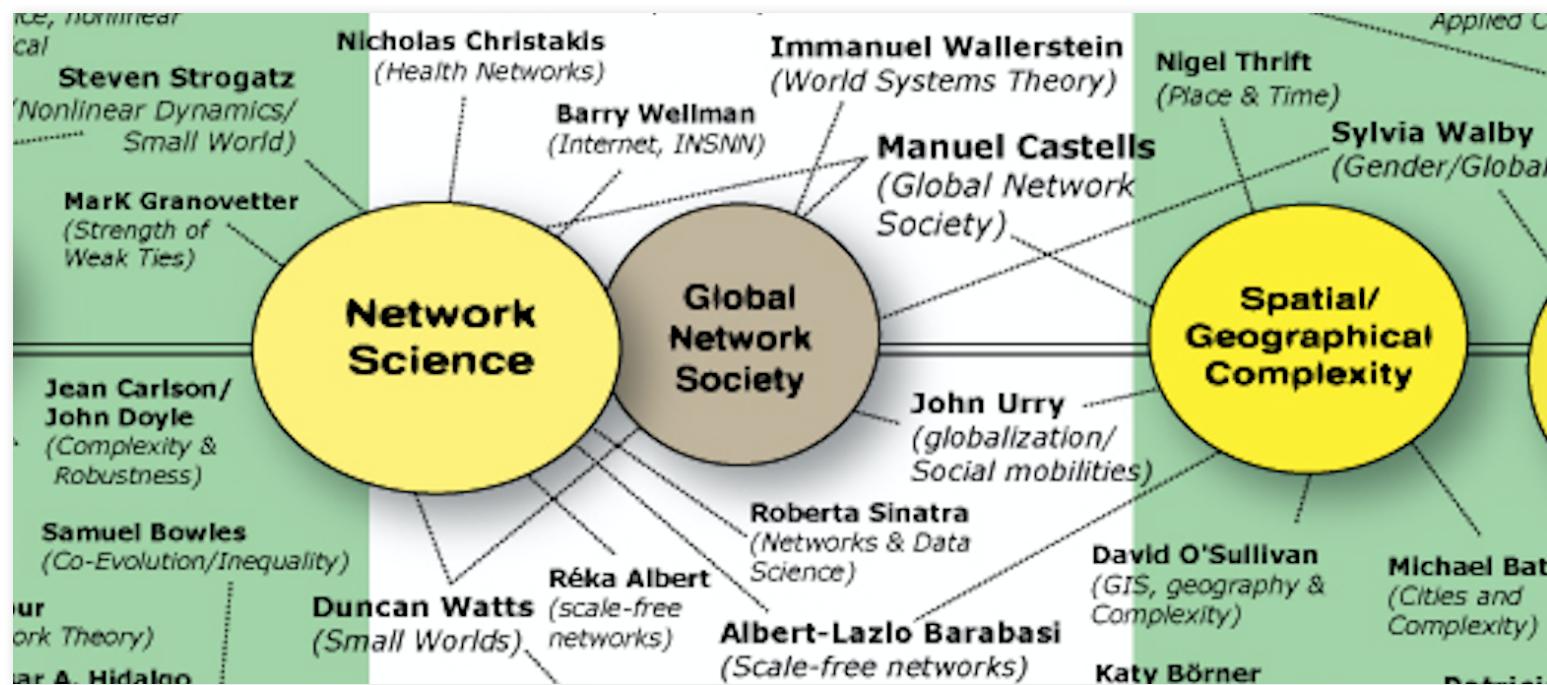
Time

Visualization (not required)

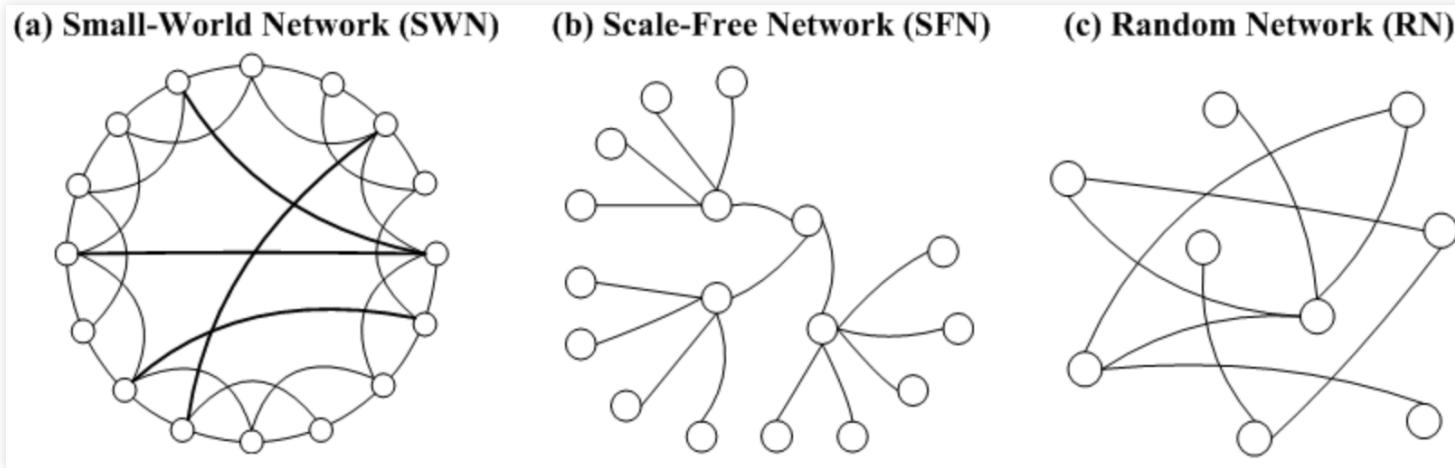
CONWAY'S GAME OF LIFE



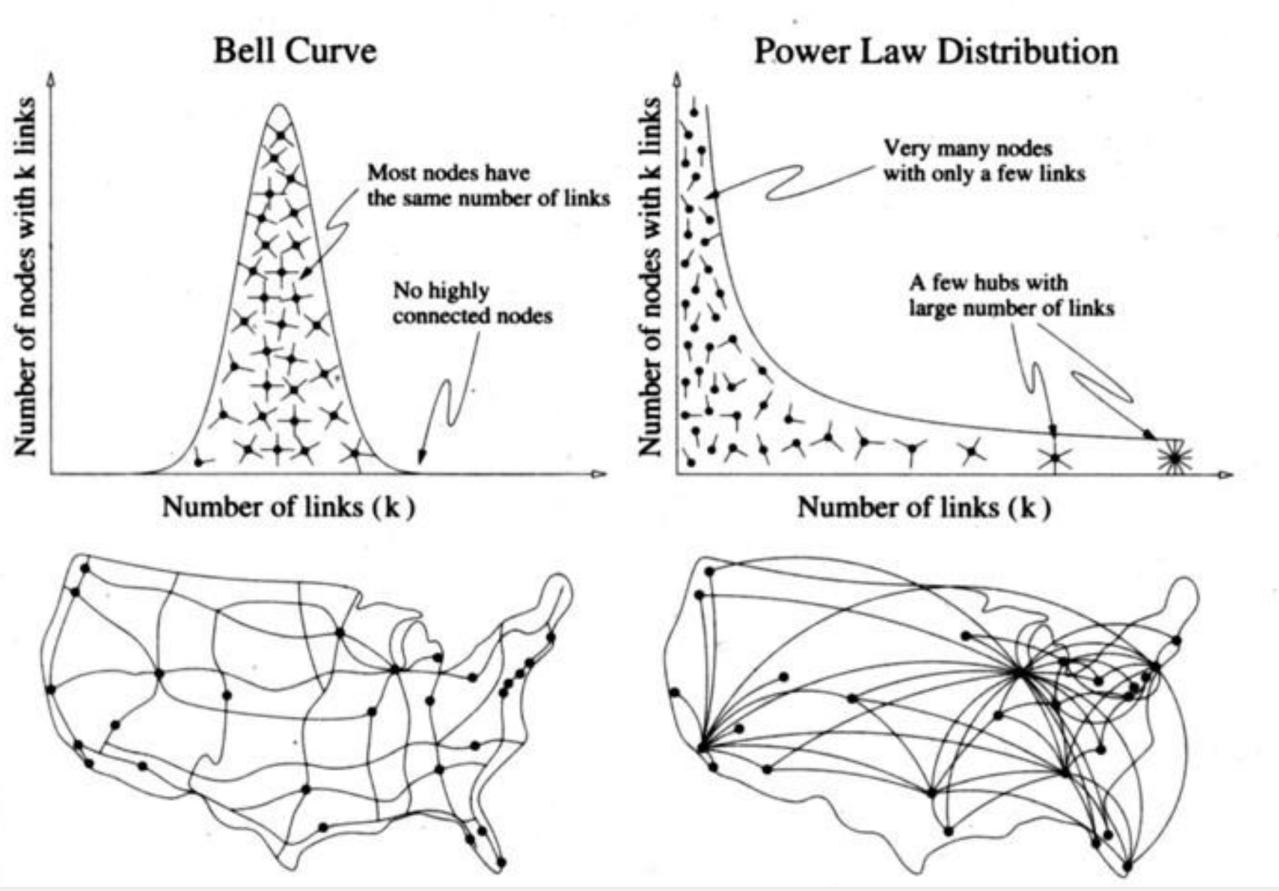
NETWORKS



GENERAL NETWORK TYPES



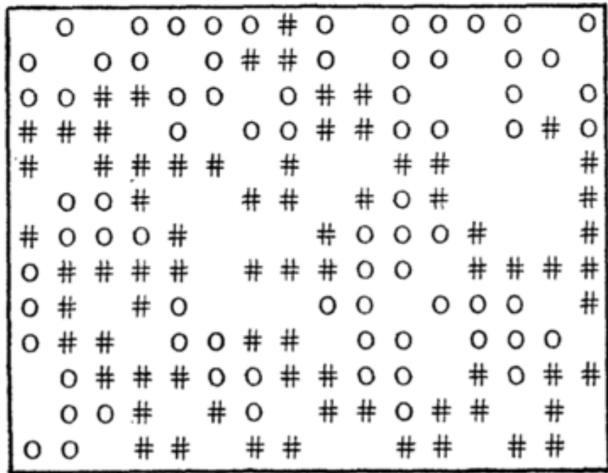
Source: Huang, Chung-Yuan, Sun, Chuen-Tsai and Lin,
Hsun-Cheng (2005).



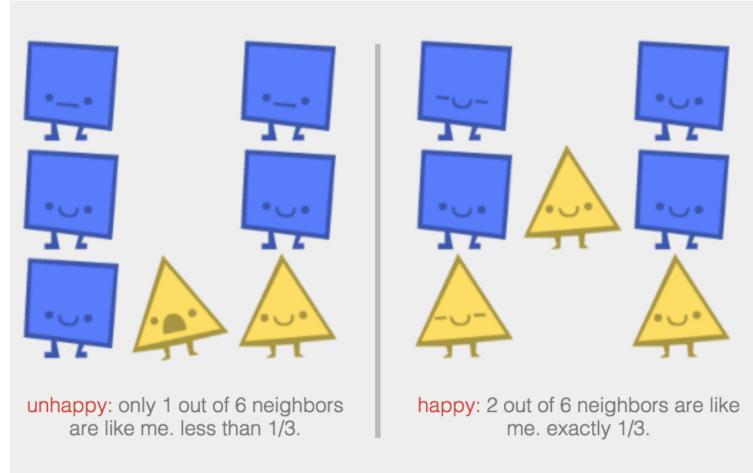
MODELING

"THE RIGHT THING"

SEGREGATION MODEL

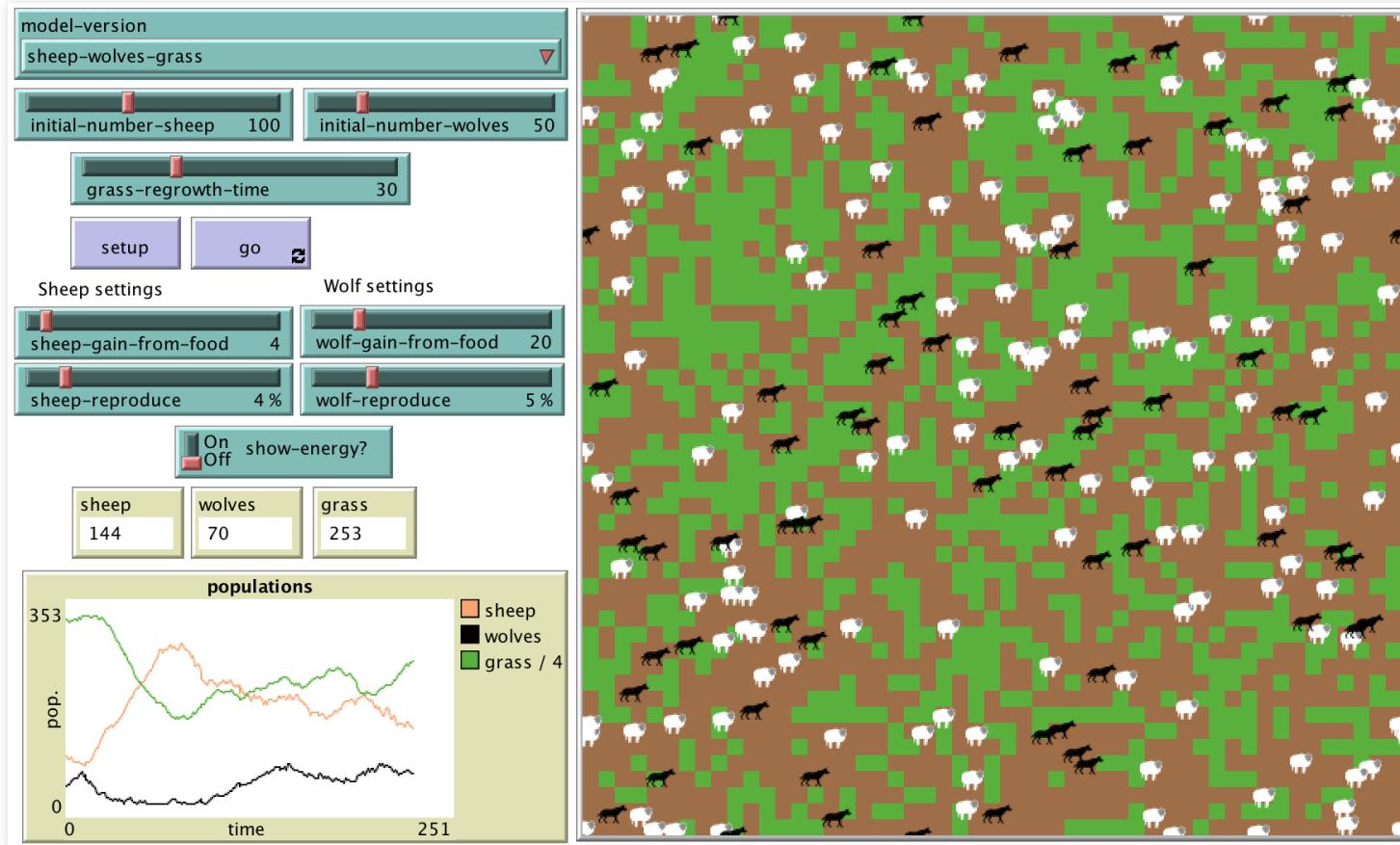


Source:
Schelling, 1971. "Dynamic Models
of Segregation." *Journal of
Mathematical Sociology*.

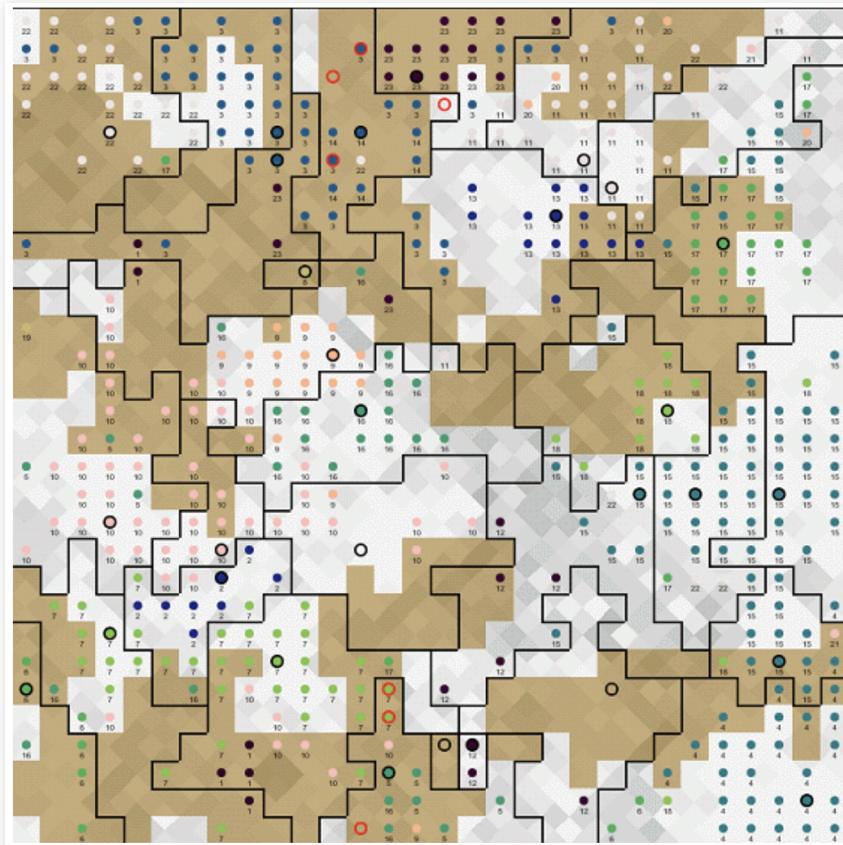


Source:
Case, "Parable of the Polygons"
<http://ncase.me/polygons/>

PREDATOR-PREY DYNAMICS



POLITICAL DYNAMICS

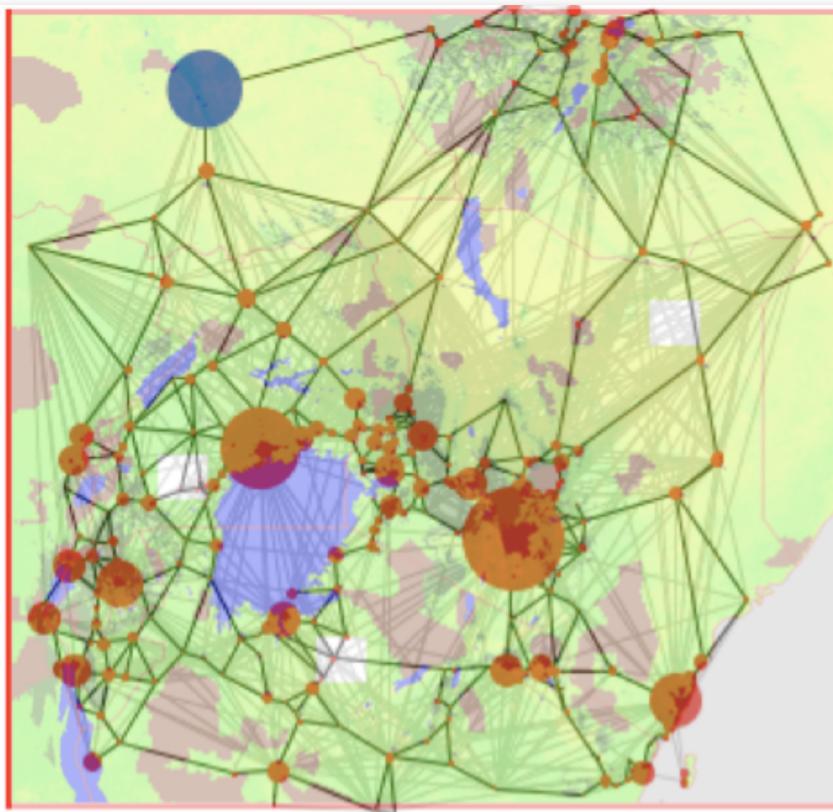


Source:

Cederman et al. "GeoSim Framework."

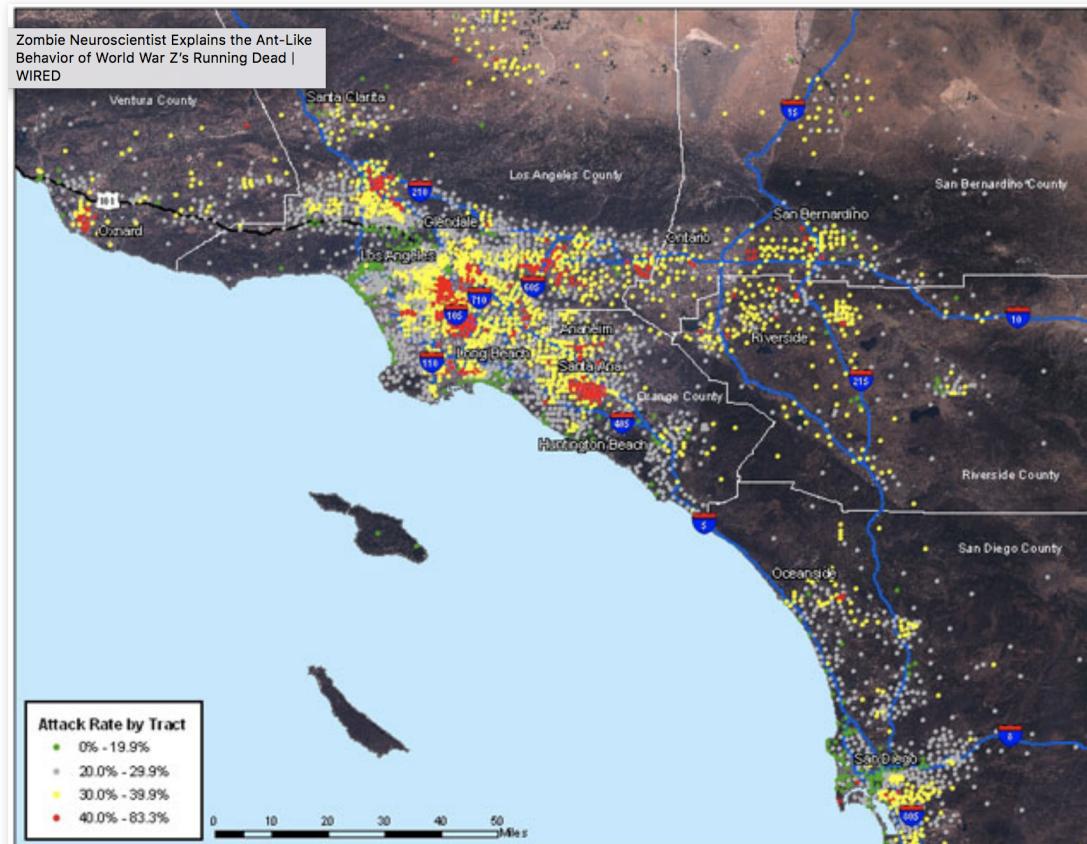
<http://www.icr.ethz.ch/research/geosim>

Migration Modeling



Source:
Gulden et al. 2011, "Modeling Cities
and Displacement through an
Agent-Based Spatial Interaction
Model," Computational Social
Science Society of America
Conference

EPIDEMIOLOGICAL SIMULATION



Source:
Los Alamos National Laboratory, OPPIE
epidemiological model.
<http://www.lanl.gov/projects/mathematical-computational-epidemiology/agent-based-modeling.php>

DEMOS

- Predator-Prey Dynamics in Netlogo
- Schelling in NetLogo
- [Schelling by Ncase](#)

MODELING ON THE FRONT-END

- Parable of the Polygons (Javascript) - ncase.me/polygons
- Agent Base (Javascript) - bit.ly/abm-ants
- Agent Script (CoffeeScript) - agentscript.org

MODELING ON THE BACK-END

- NetLogo (Logo), 1999 - bit.ly/abm-netlogo
- MASON (Java), 2003 - bit.ly/abm-mason
- RePast (Java), 2006 - bit.ly/abm-repast
- Mesa (Python), 2015 - bit.ly/abm-mesa

CHESTERTON'S FENCE



Source: [Wikipedia](#)

PYTHON RESEARCH

Name	2.7	3+	Active Dates	PyPI	Description
Simx	Y	N	11/12-12/14	Y	Framework for discrete simulations, optimized for parallel computing; no built in visualization
PyCX	Y	Y	06/11-03/16	N	Repository of ABM examples & GUI script for desktop visualization; Focused on ease of writing; Mostly pure python; not a framework
<u>PvABM</u>	Y	N	09/12-03/14	Y	Partial ABM framework, not working
Indra	N	Y	12/14-Today	N	ABM framework to write models similar to Netlogo; lacks docs & tests; visualization ability in the future?
Mesa	N	Y	09/14-Today	Y	ABM framework to build models with repeatable components; uses browser for visualization

DEMO OF MODELS

- Docs: bit.ly/abm-mesa
- Code: github.com/projectmesa/mesa

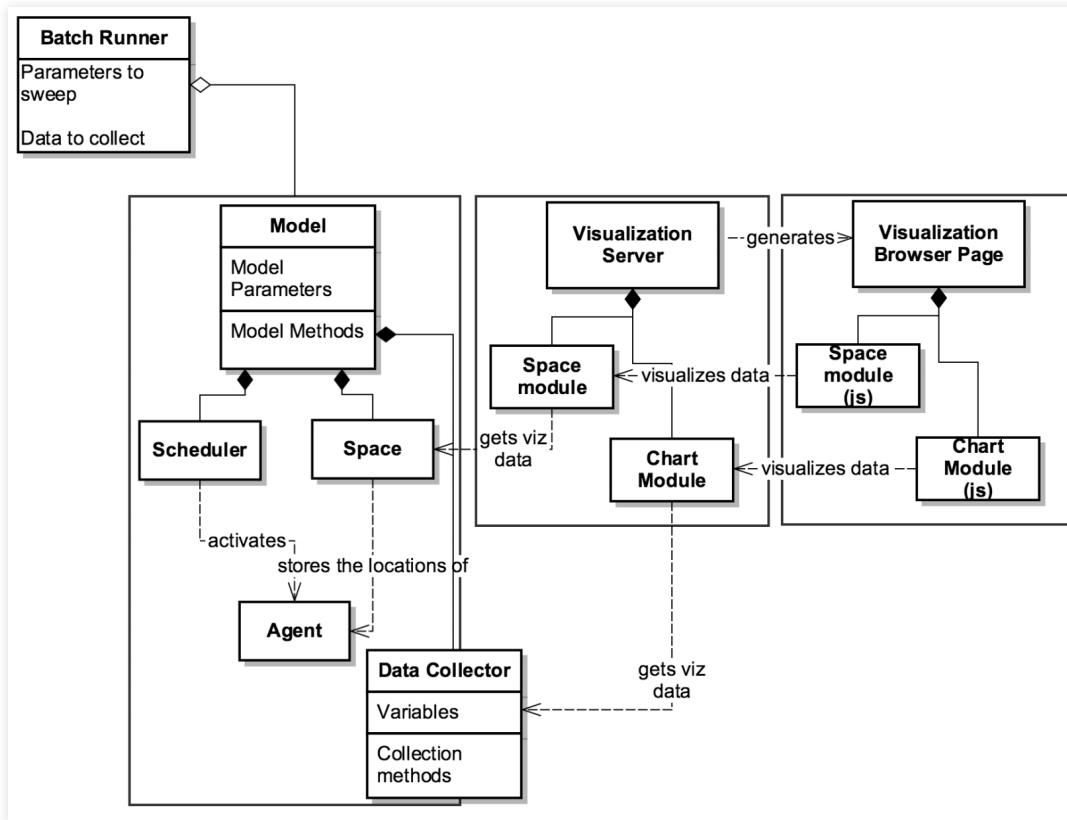
HOW TO RUN DEMOS

You install the requirements for that model

```
$ pip install -r requirements.txt
```

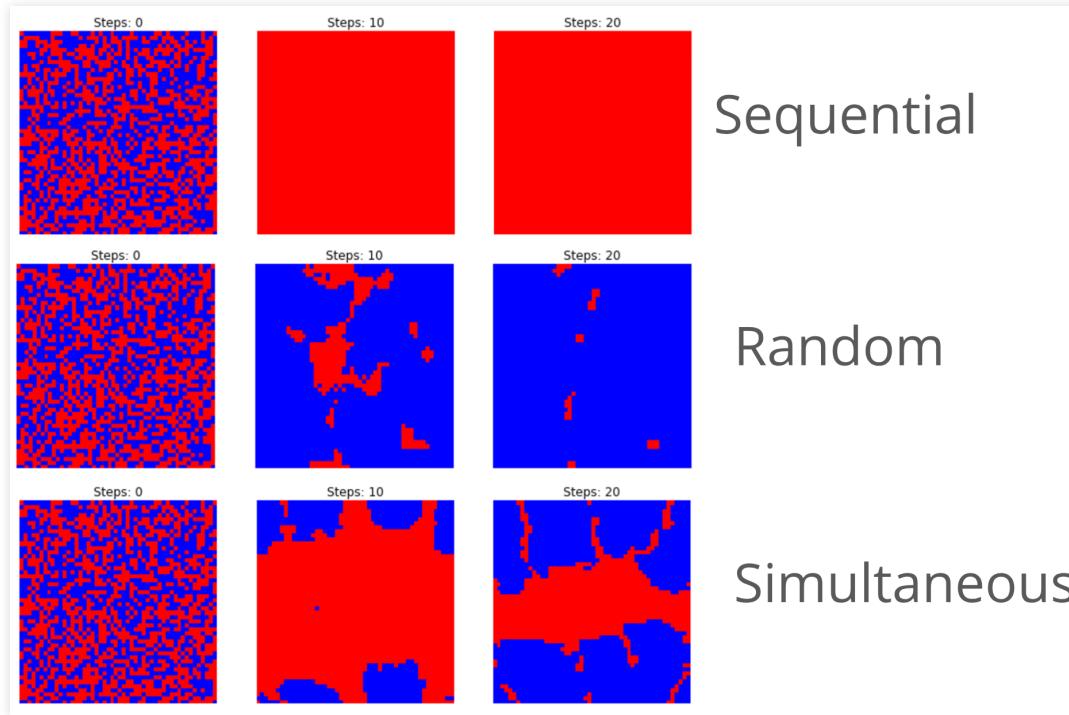
```
mesa runserver
```

Browser opens to <http://127.0.0.1:8521/>

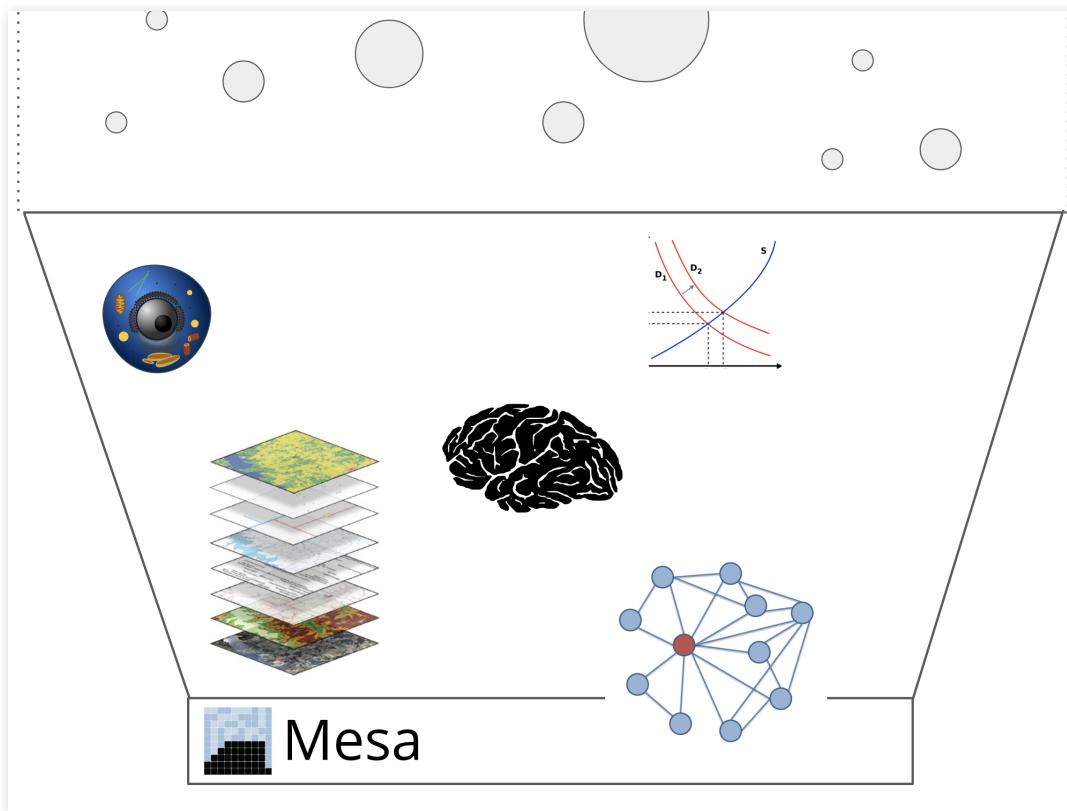


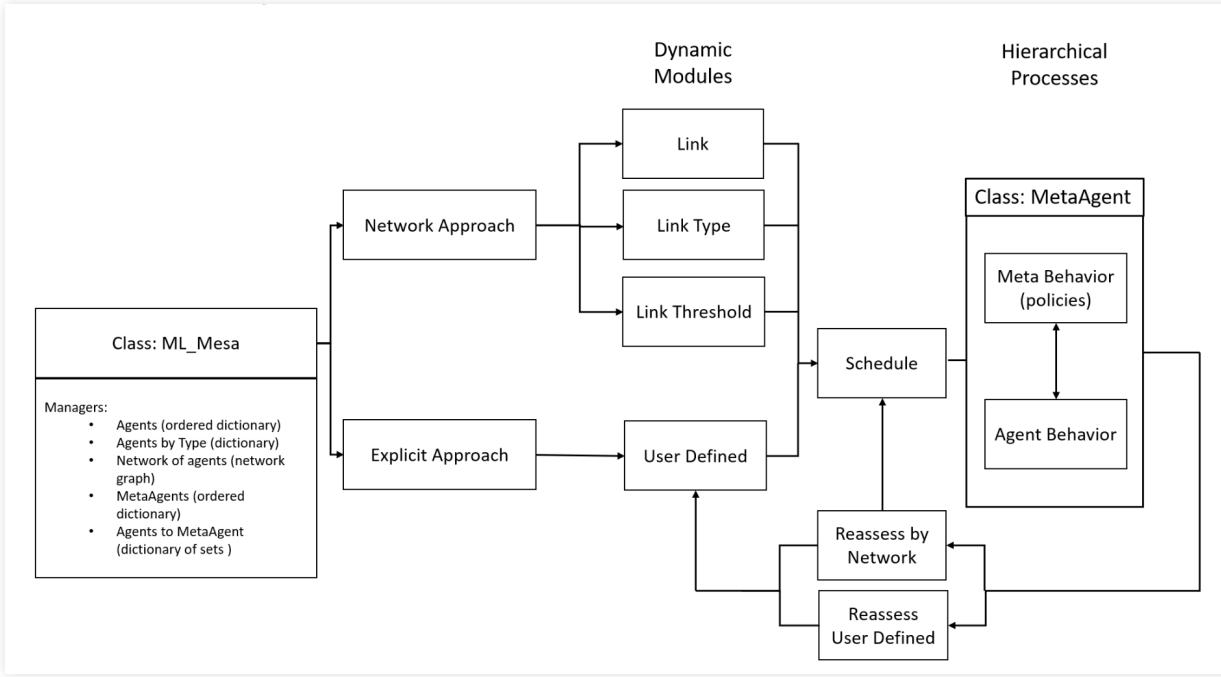
Source: Masad and Kazil (2015).

MESA'S SCHEDULING FEATURE



MESA PACKAGES





Source: [Multi-Level Mesa](#)

OUR GOALS WITH MESA

- Framework for reuse
- Decoupled / decentralized
- Domain experts "own" components
- Reproducibility
- Building models on accepted truths

**SO, HOW IS
RUNNING FROM
ZOMBIES THE SAME
AS MARKET
BEHAVIORS?**

Mathematical Modelling of Zombies



Robert Smith?

University of Ottawa Press

THE END.

Questions?

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github.com/projectmesa/mesa