

Understanding Social Norms

– a multi-level, policy modelling approach

and...

Using ABM for stress-testing policy

– an alternative policy modelling approach

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Two parts to the talk...



1. How ABM might be used to stress-test policies
2. How ABM might start to understand normative (and hence legal) compliance



Part 1:

How ABM might be used to stress-test policies

Most Current “Policy Models”



- ... are often those like “*Computable General Equilibrium Models*” which...
 - Usually represent the reaction of all the people via a *single representative agent* (or a very few agents)
 - which behaves in a classical economic manner – i.e. these *seek to maximise their utility*
 - The outcomes are represented by *a single point – the theoretical equilibrium of the model*
 - Despite all this they *claim to be able to predict the impact of policies* (e.g. taxation)
- These assumptions are **not** supported by the available evidence



An alternative vision...

That we stop pretending that the impact of policies in complex situations can be predicted...

and focus in using modelling for other purposes...

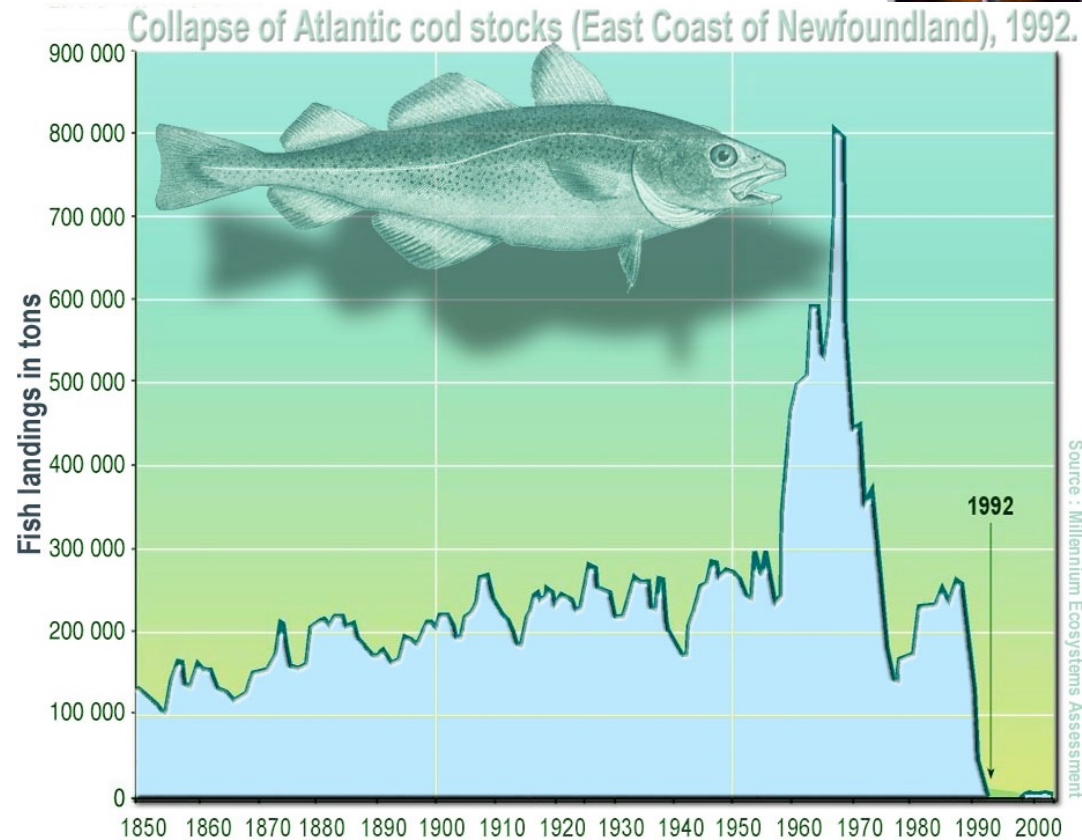
such as '*stress testing*' policies:

1. Use models which are less “theoretical” and more led by the available evidence (thus are complex)
2. To run these under lots of variations so as to understand some of the ways in which a policy might go surprisingly wrong (or indeed surprisingly right)
3. Then use this understanding to design:
 - ways of detecting when these ways are emerging
 - (if feasible) plans to enact when/if they do

North Atlantic Cod Fisheries Collapse



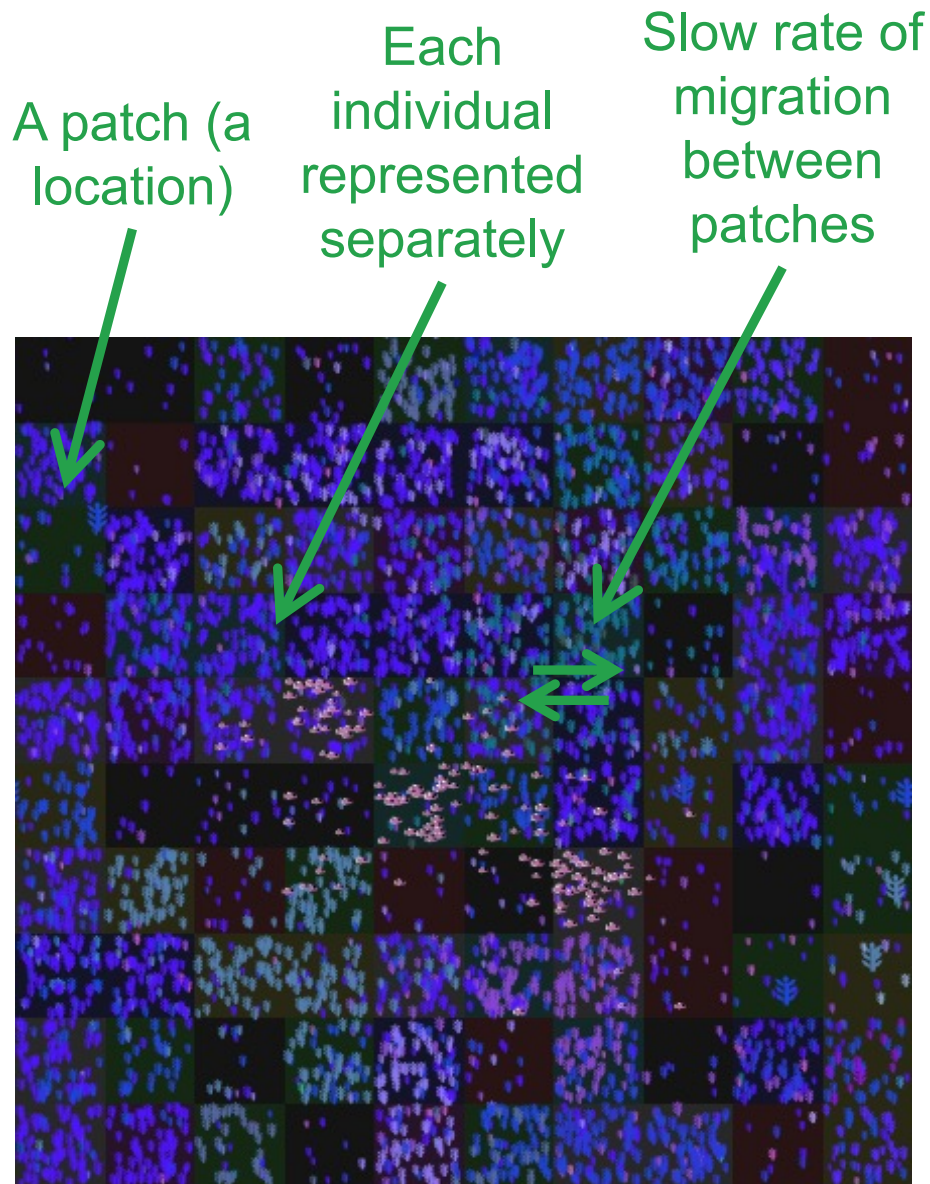
The Harris Commission said that modellers
said that modellers
“...failed to recognize
the statistical
inadequacies in their
bulk biomass model...”
and that they had
concerns that
“...weaknesses in
scientific management
and the peer review
process permitted this to
happen.”



- Models were simplistic
- Focus of models had narrowed
- Excluded input from fishers
- Based on very ‘thin’ data

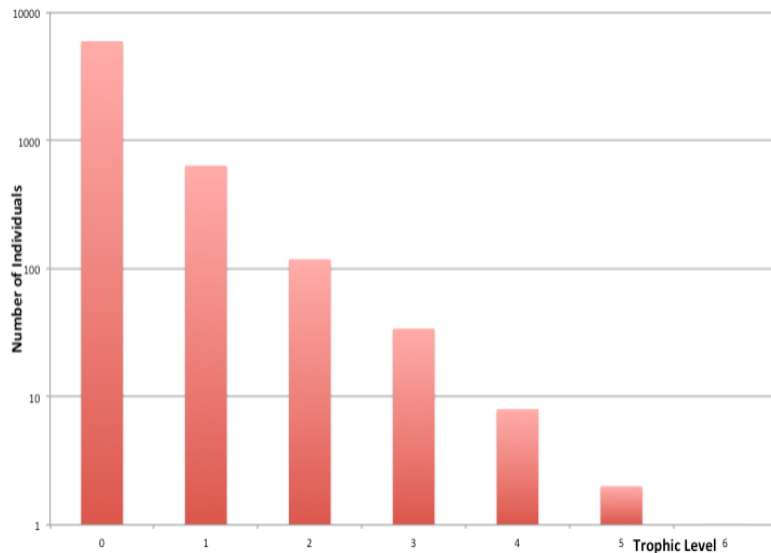
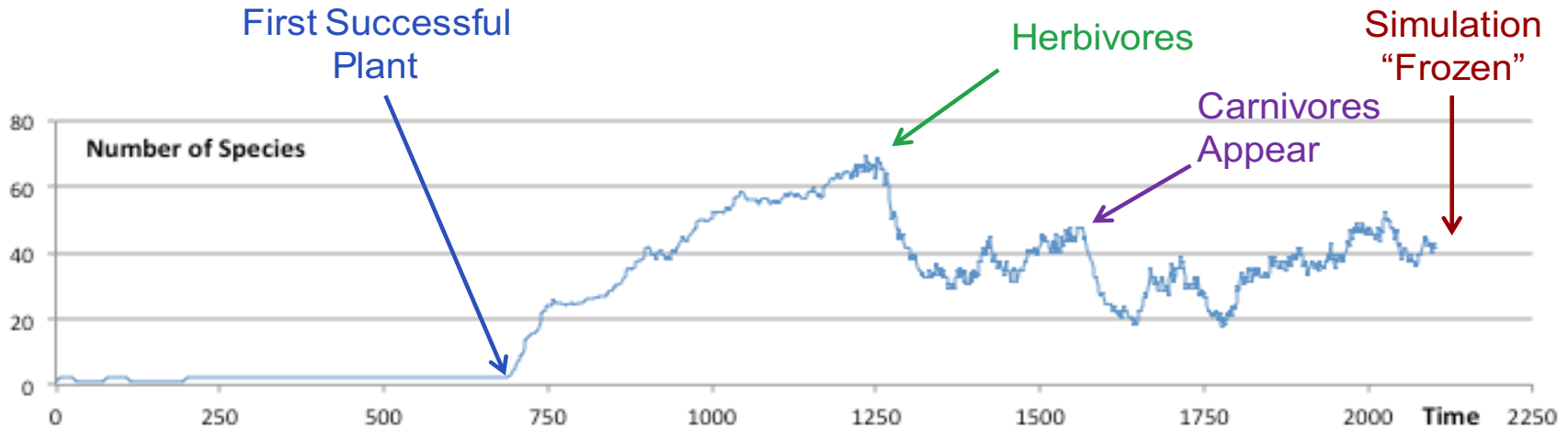


The Model



- A 2D space for interaction
- Organisms represented individually each with its own characteristics
- Including different species of plants, herbivores, carnivores and higher-order predators

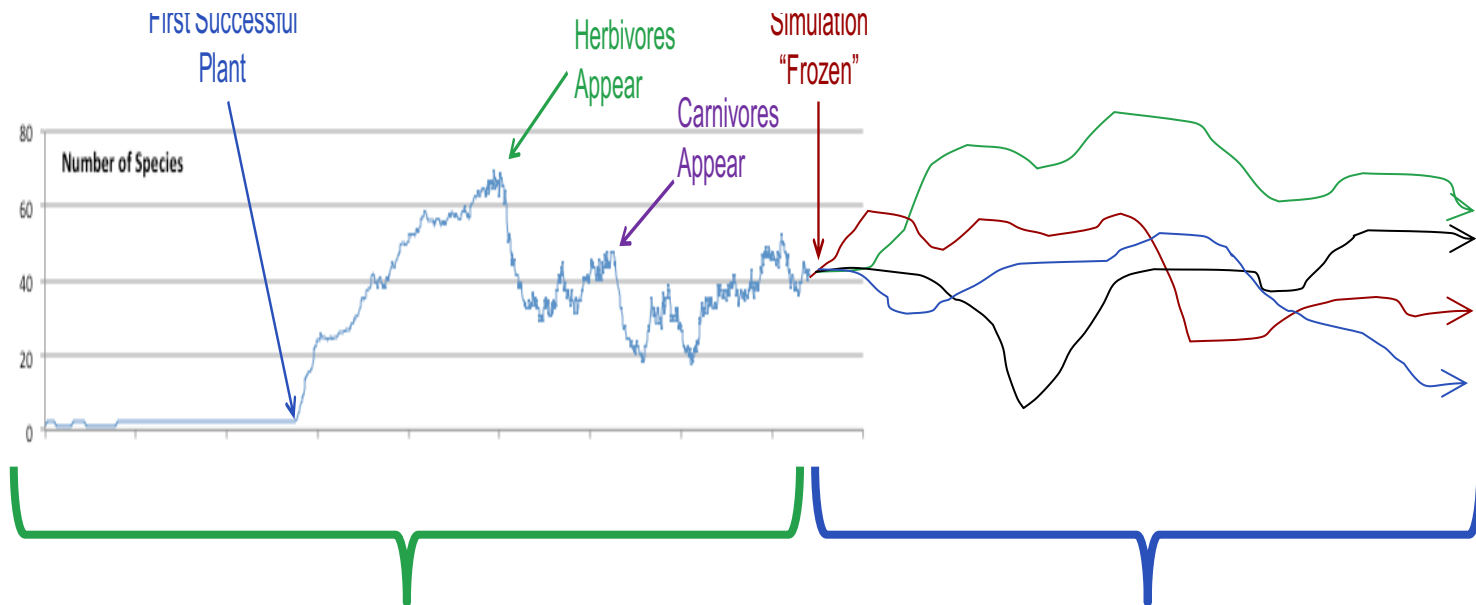
First, evolve a rich mixed ecology



Evolve plants then inject and evolve fish (first herbivores – later predators appear).

Result is a mature ecology with many species in a complex food web (left shows balance of trophic layers with log population scale)

Then explore starting from there



Evolve a complex ecology and save this state

Do multiple runs of the simulation starting from there for each condition to test

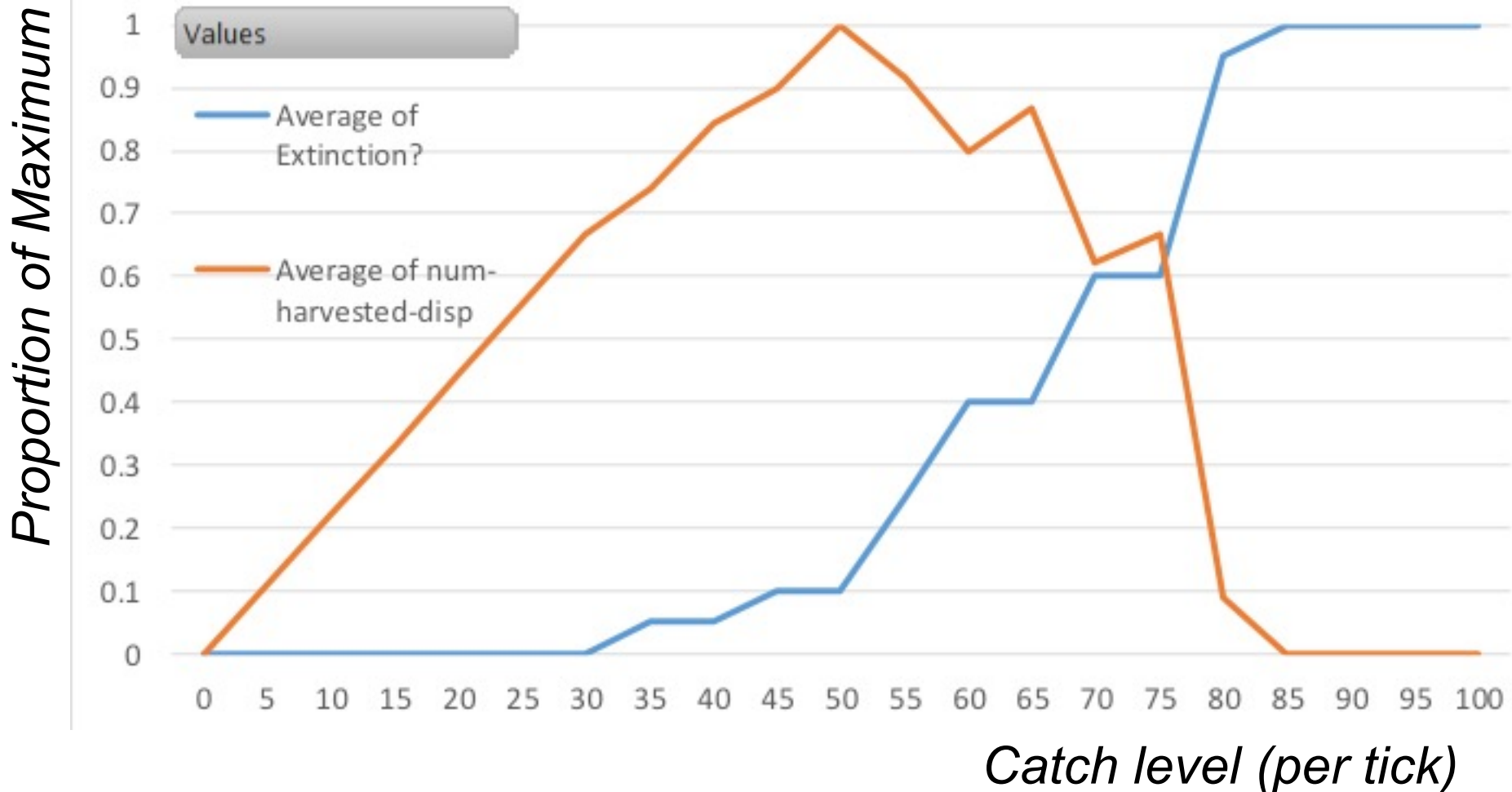
Each ecology evolved is not *the* ecology but *a possible* ecology, but it has the kind of complex interactions not present in simpler models

This version designed to test possible outcomes of fishing policies

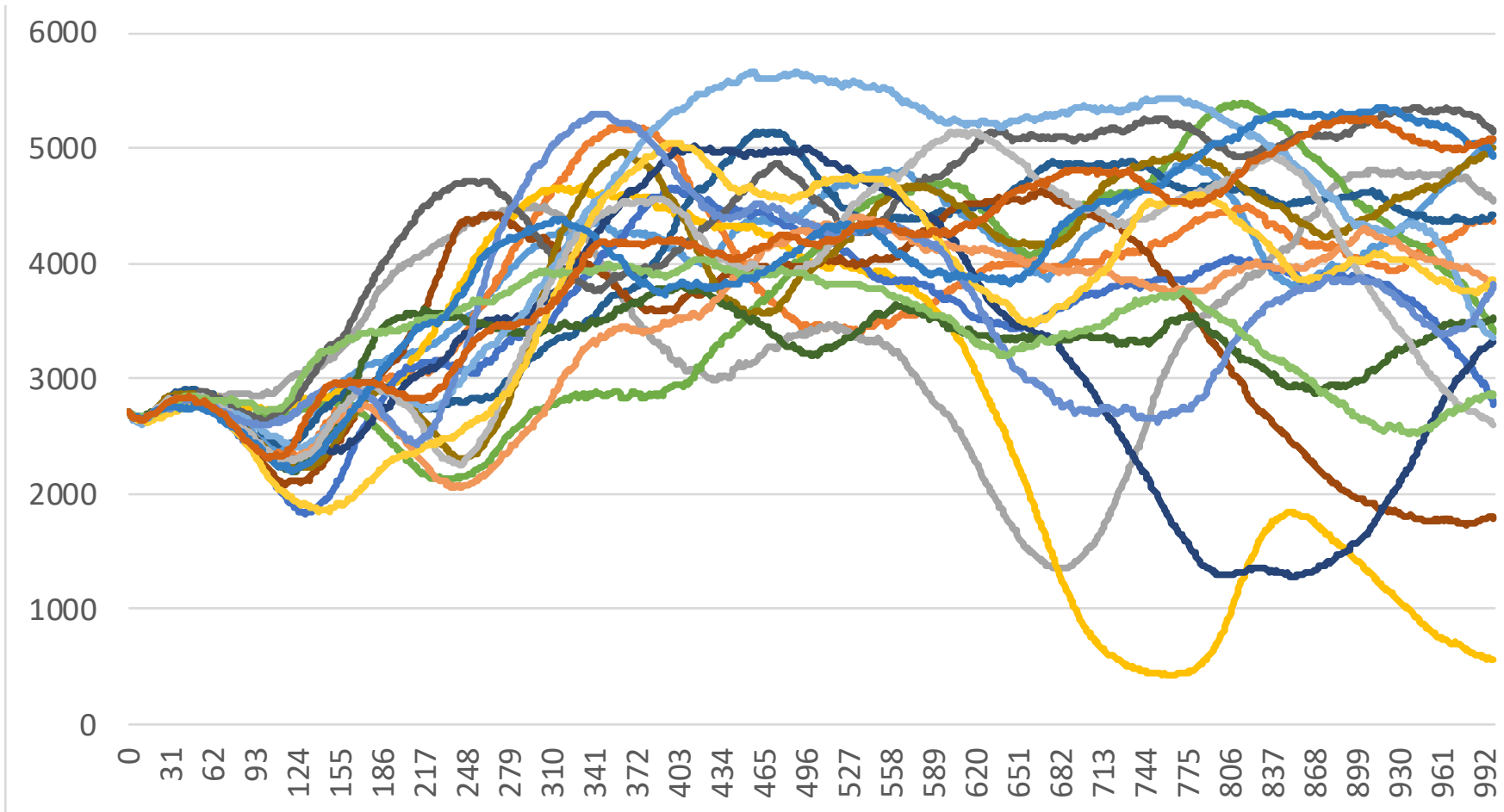


- Complex aquatic plant ecology evolved
- Herbivore fish injected into ecology and whole system further evolved
- Once a complex ecology with higher-order predators then system is fixed as starting point
- Different (i.e. fishing) policies can be enacted on top of this system, e.g.:
 - How much fish is extracted each time
 - Whether uniformly at random or patch-by-patch

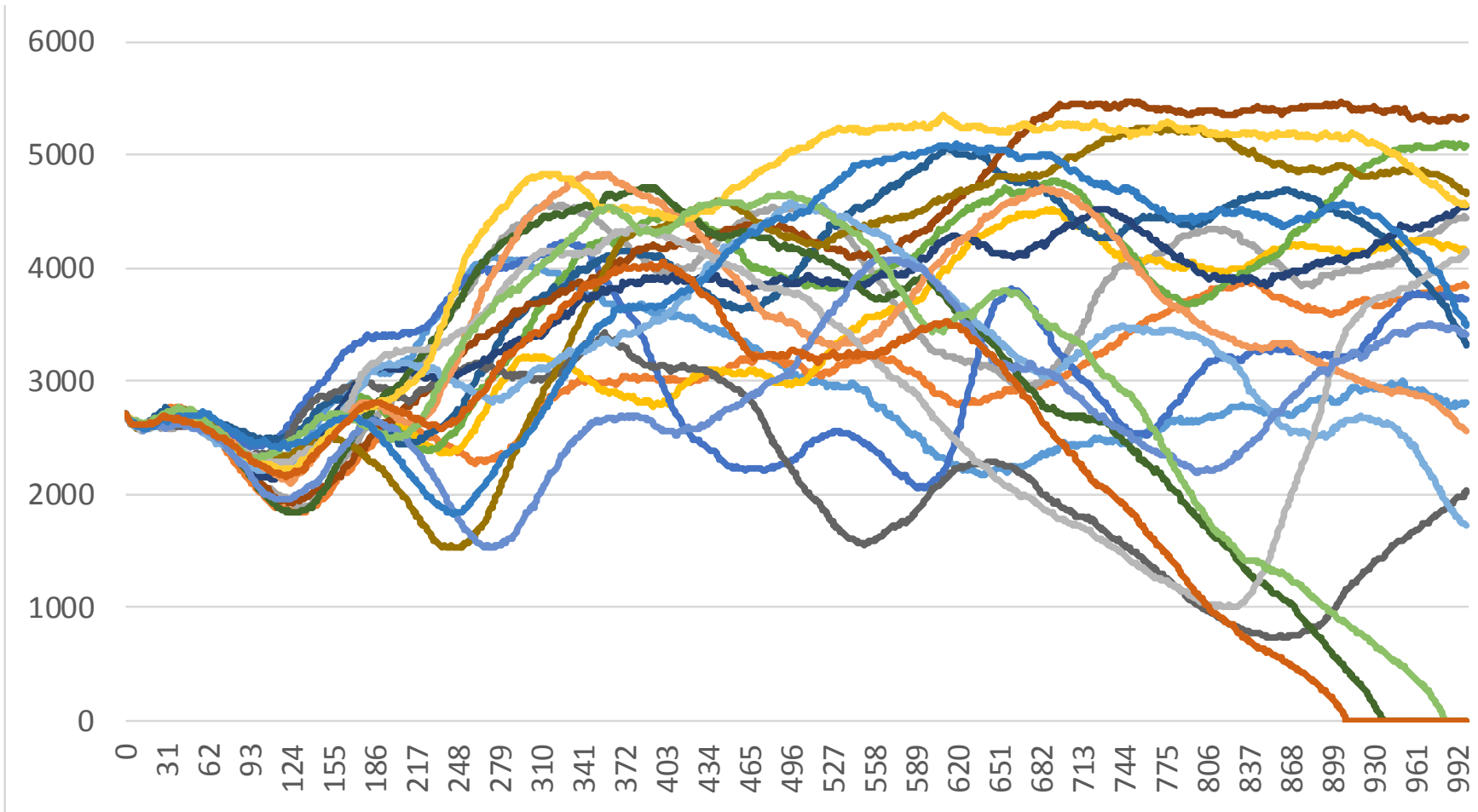
Total Extinction Prob. & Av. Total Harvest (last 100 ticks) for different catch levels



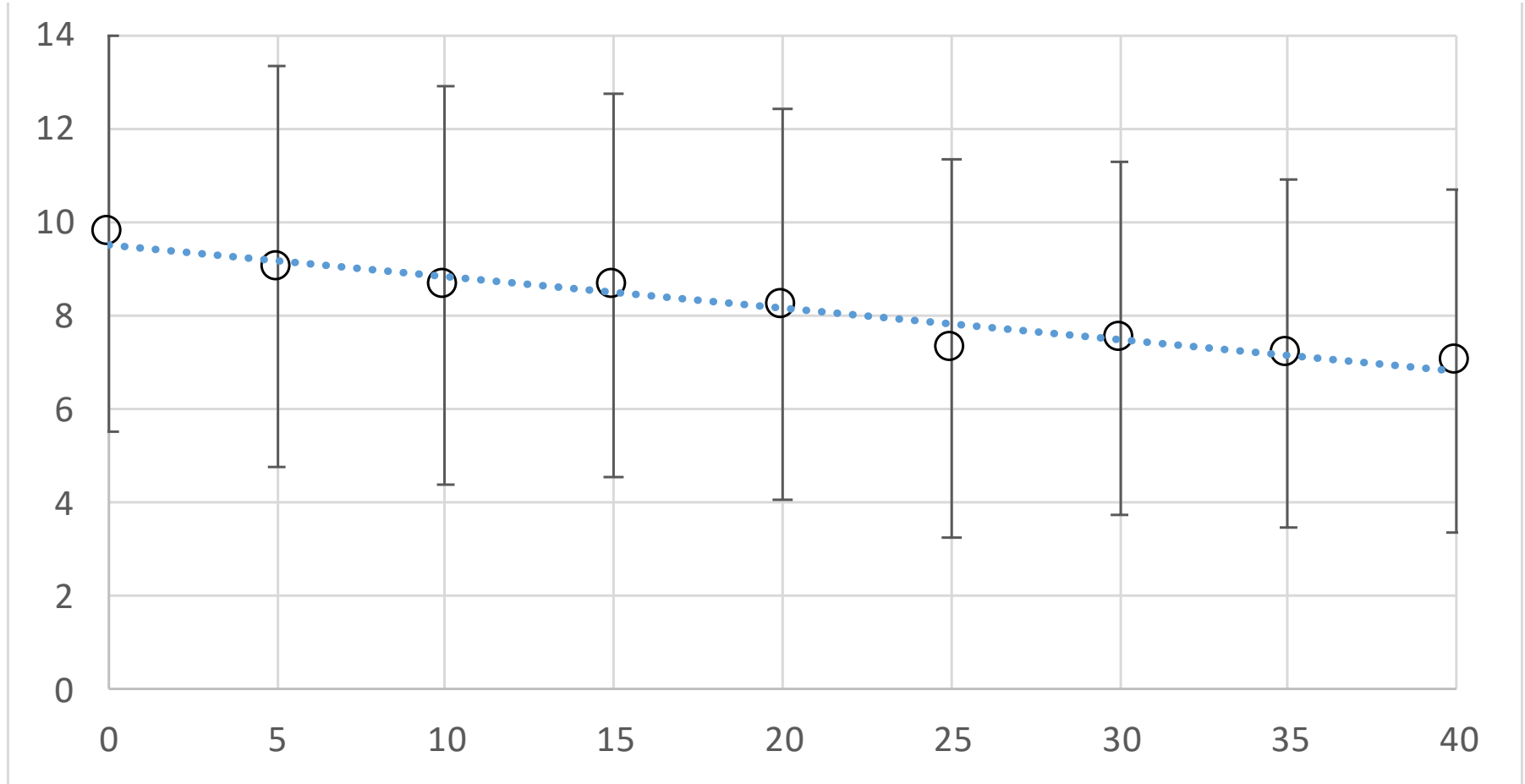
Num Fish (all species, 20 runs) – catch level 25 – each line is a different model run



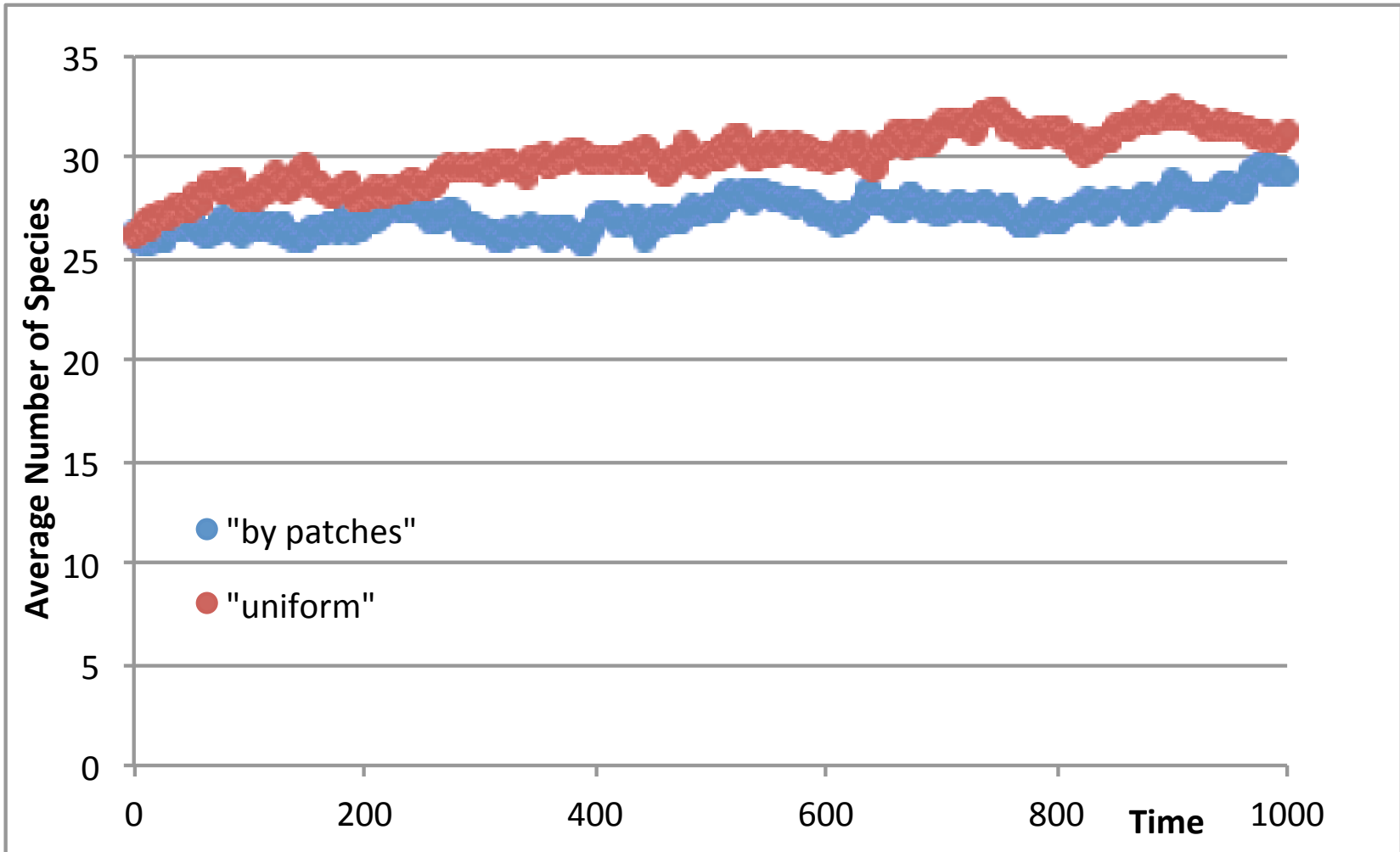
Num Fish (all species, 20 runs) – catch level 35 – each line is a different model run



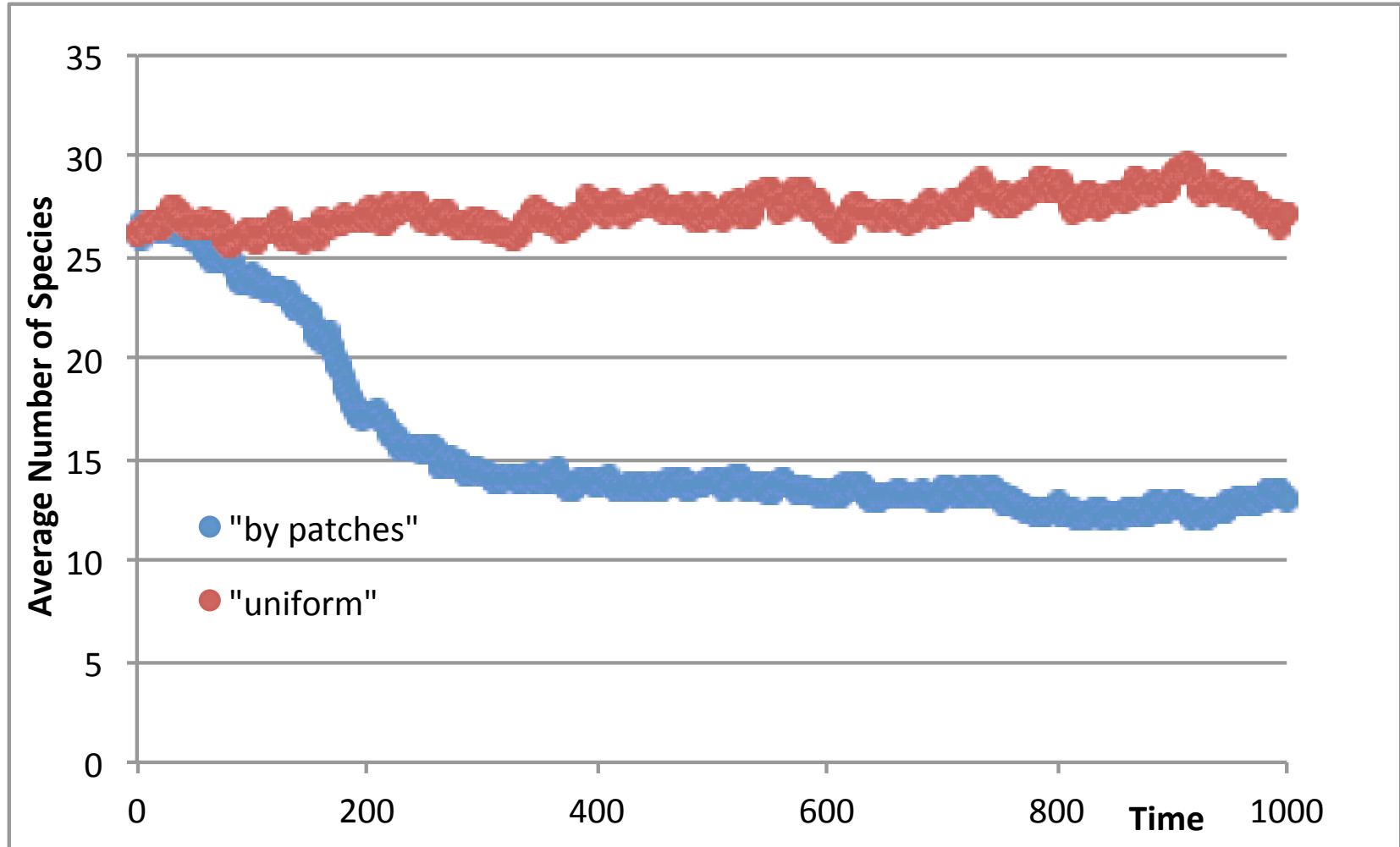
Average Number of Species vs. Catch Level (from a different starting ecology)



Average Number of Species, Catch=30



Average Number of Species, Catch=40



Conclusions – part 1



- Many existing models that claim to predict the effect of particular policies do not reliably do so
- Rather a more honest approach is to accept the impossibility of reliable prediction (in all but the simplest of issues&situations)
- But ABM could be a useful part of a process for checking what *could* go wrong with a policy before it is enacted – ‘*stress testing*’ it
- And maybe be part of resilience procedures so we might be ready for when things go wrong



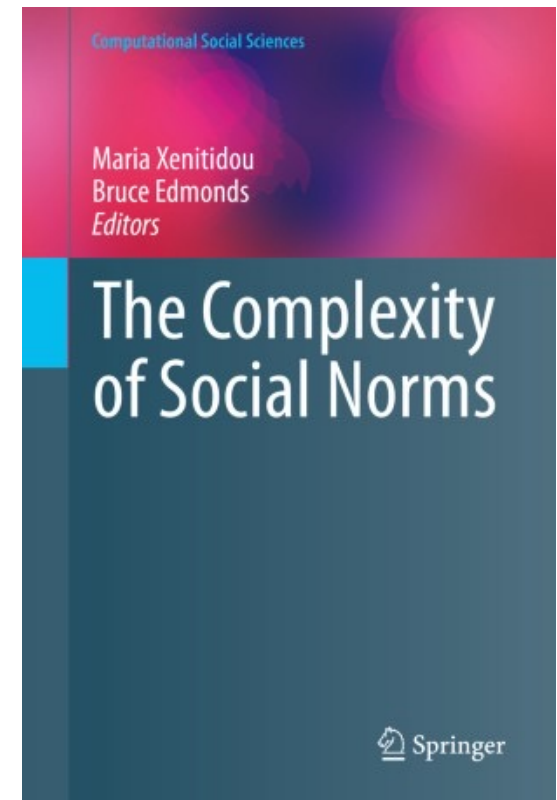
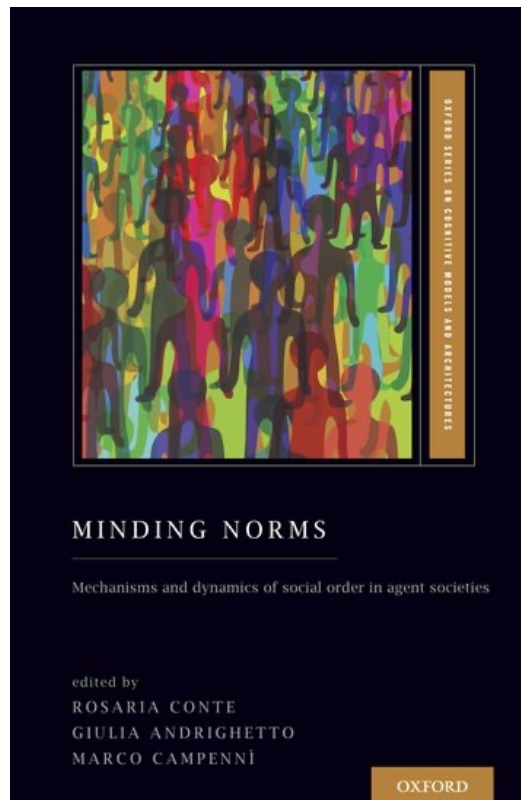
Part 2:

How ABM might start to understand legal and normative compliance

Acknowledgements



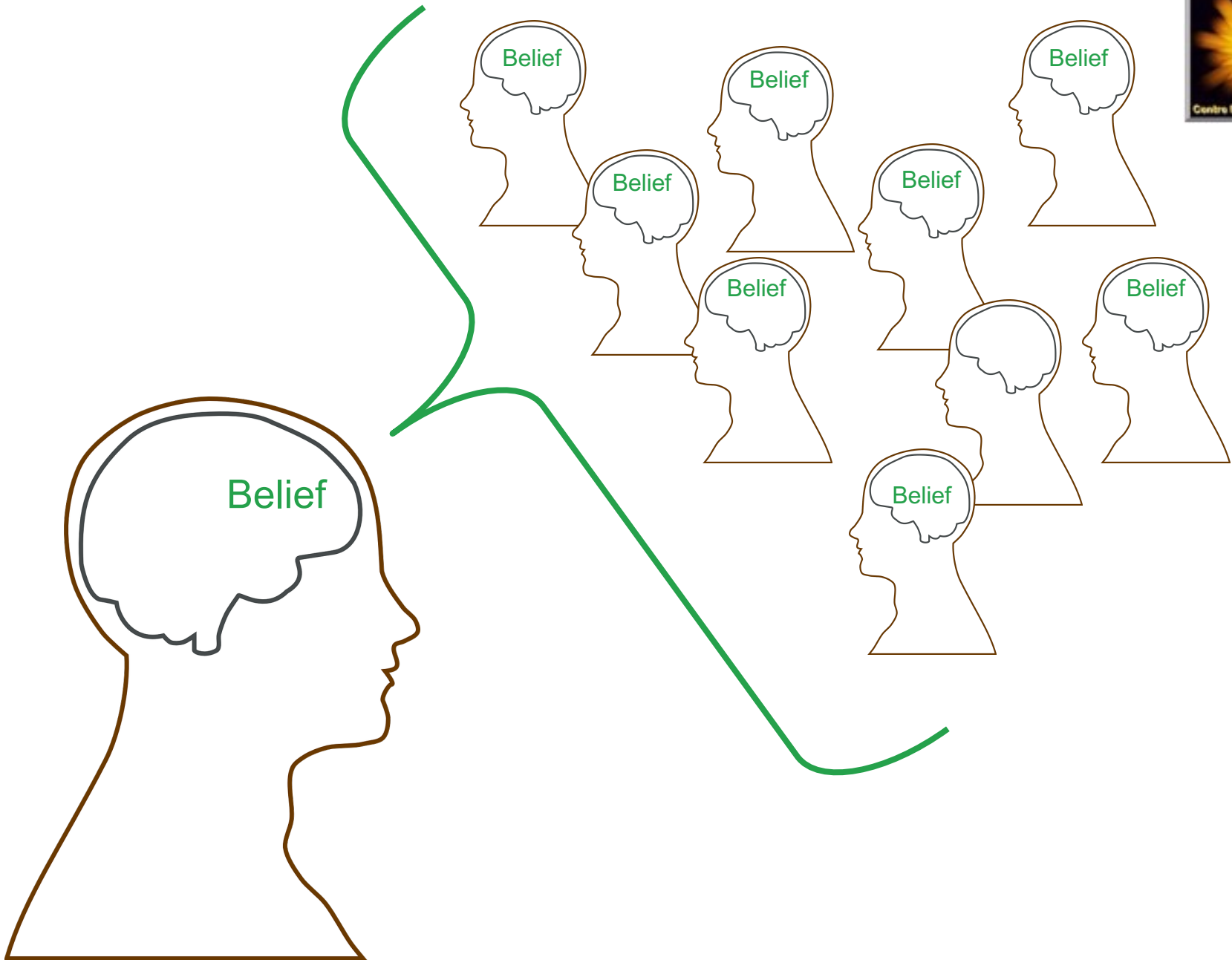
This part derives from the results of an EU project (EMIL – emergence in the loop) led by ***Rosaria Conte*** (1954-2016)



About Social Norms



- An alternative to the economic model of choice...
- ...where the choices made are constrained by what they believe is/isn't socially acceptable
- Social norms are an emergent phenomena resulting from the *interaction* between:
 1. Cognitive processes within each individual – perceptions of what the relevant social norms *are*
 2. Social processes between individuals – development (or absence) of observable conventions



Norm Dynamics

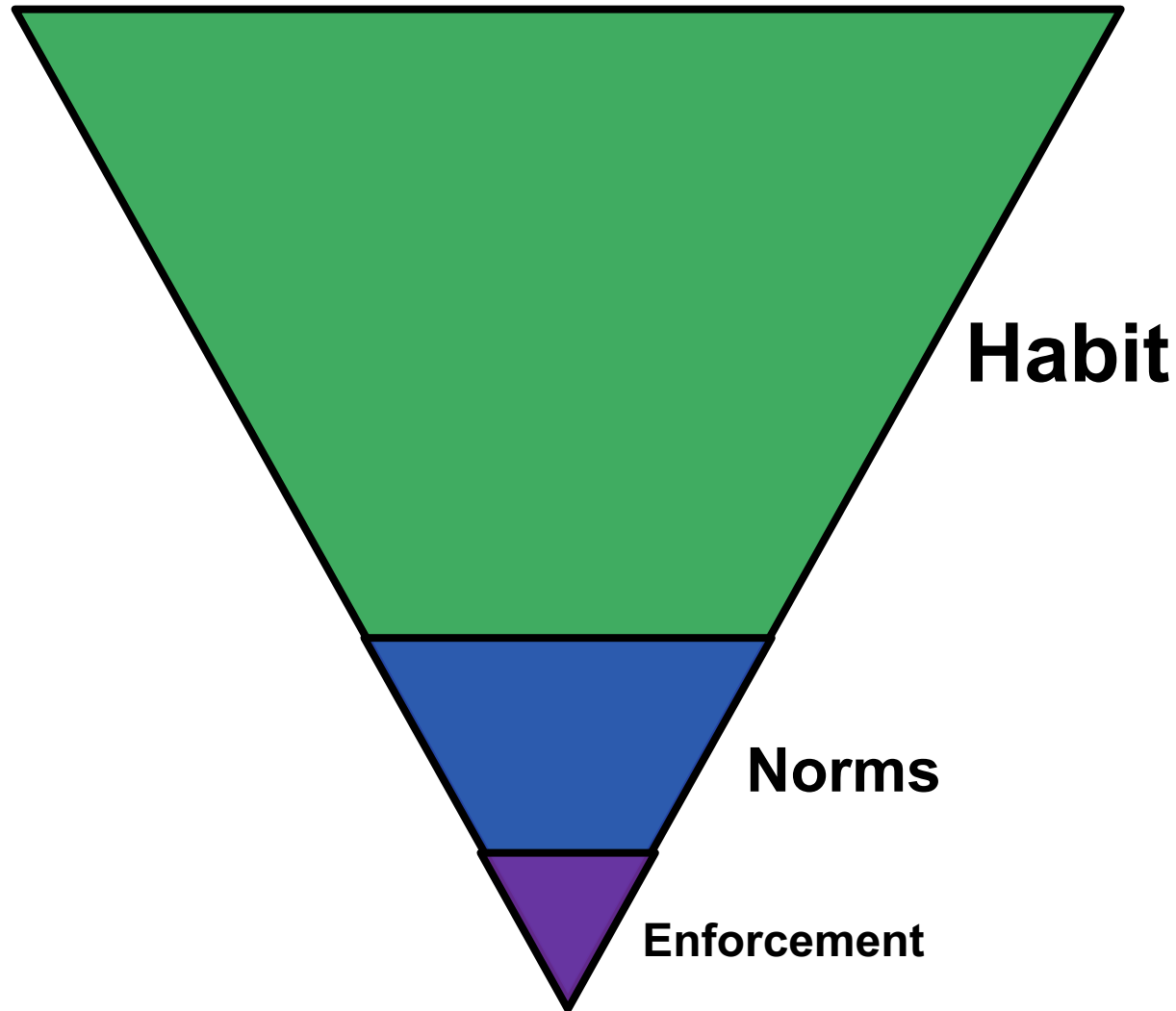


The two-way interaction between the cognitive and the social can result in interesting dynamics, e.g...

- Actors might mis-perceive a norm (e.g. that all students smoke) so start to behave that way, even though others were *not* doing this (originally)
- Actors might pay lip service to a norm (e.g. it is bad to drop litter) but no one behave according to that, so that the norm loses all force

Thus norms can come into being and disappear over time in complex ways

Norms combine with other mechanisms in terms of compliance





The Social Complexity of Immigration and Diversity was a 5-year project with the *Institute for Social Change* and the *Department of Theoretical Physics* at University of Manchester. It was funded under the “Complexity Science for the Real World” initiative of the EPSRC from July 2010 to Jan 2016.

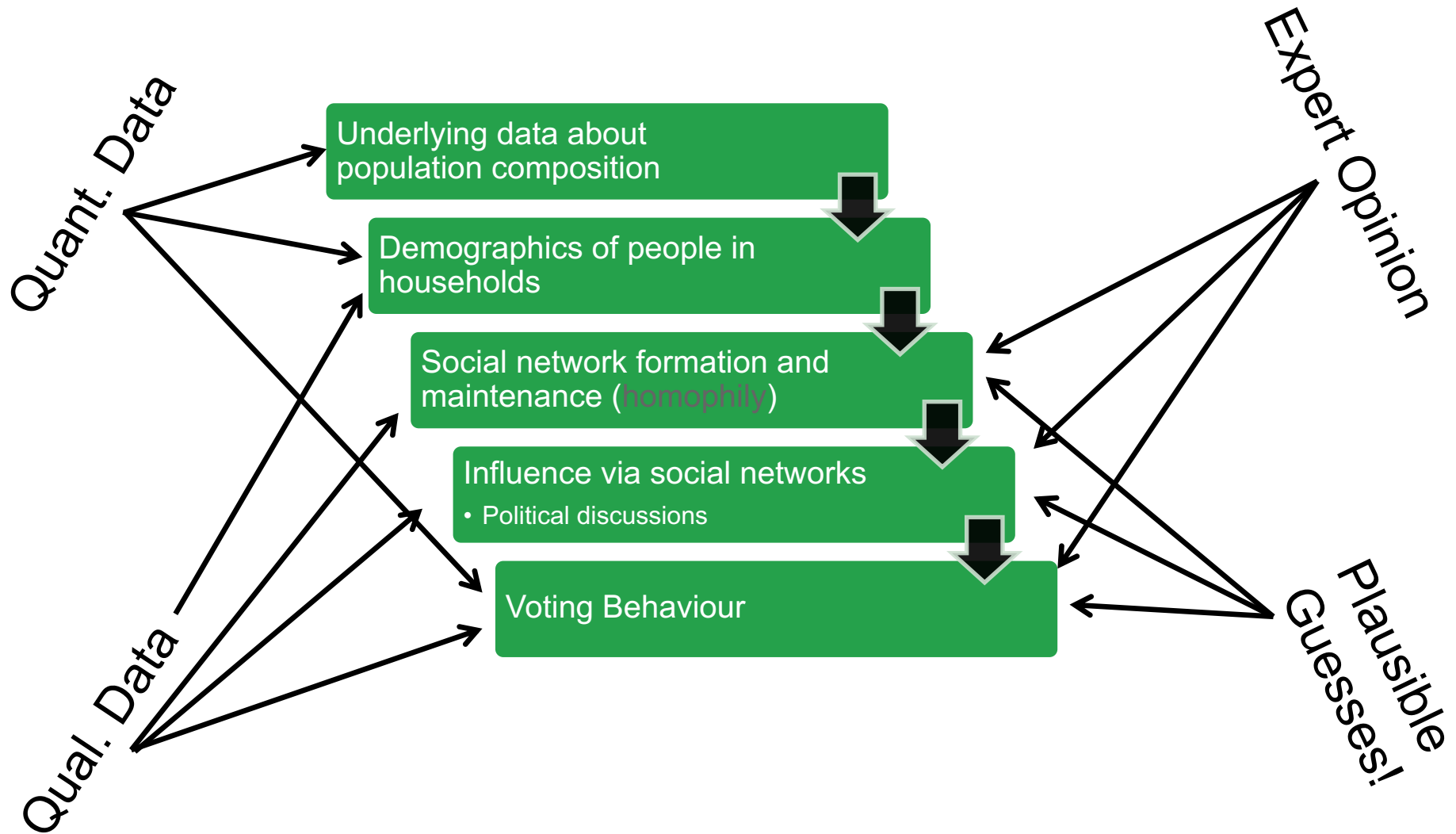
The idea of SCID was to apply the techniques and tools of complexity science to real world issues, in this case of immigration and diversity. The project focussed on: (1) why people bother to go out and vote and how social influence within/across different communities affects this (2) how people use social networks to find employment, e.g. how the impoverished networks of immigrants may limit this and (3) inter-community trust.

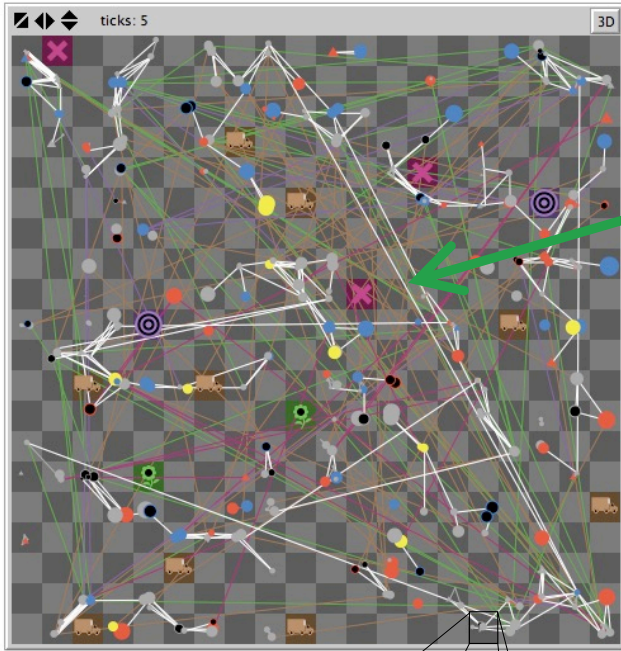


Copy of Project Website:
<http://cfpm.org/scid>



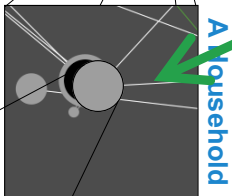
Model 'layers' and the different kinds of data used to support these



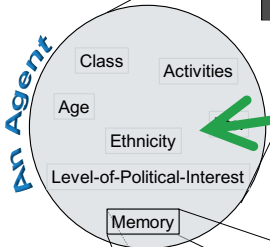


Changing personal networks over which social influence occurs

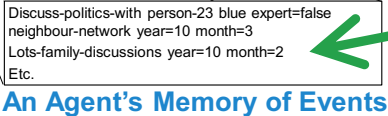
Composed of households of individuals initialised from detailed survey data



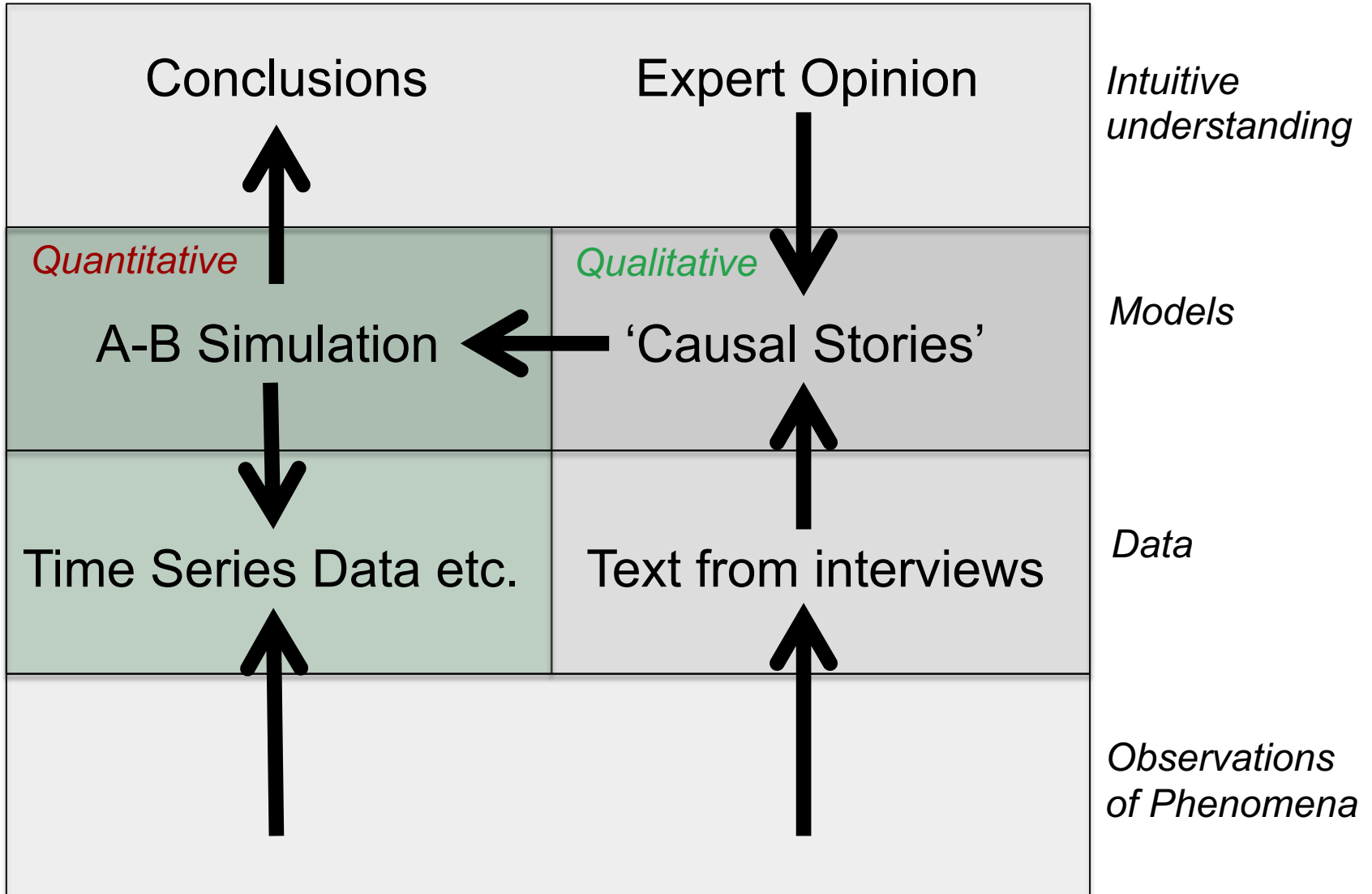
Each agent has a rich variety of individual (heterogeneous) characteristics



Including a (fallible) memory of events and influences



Evidence schema

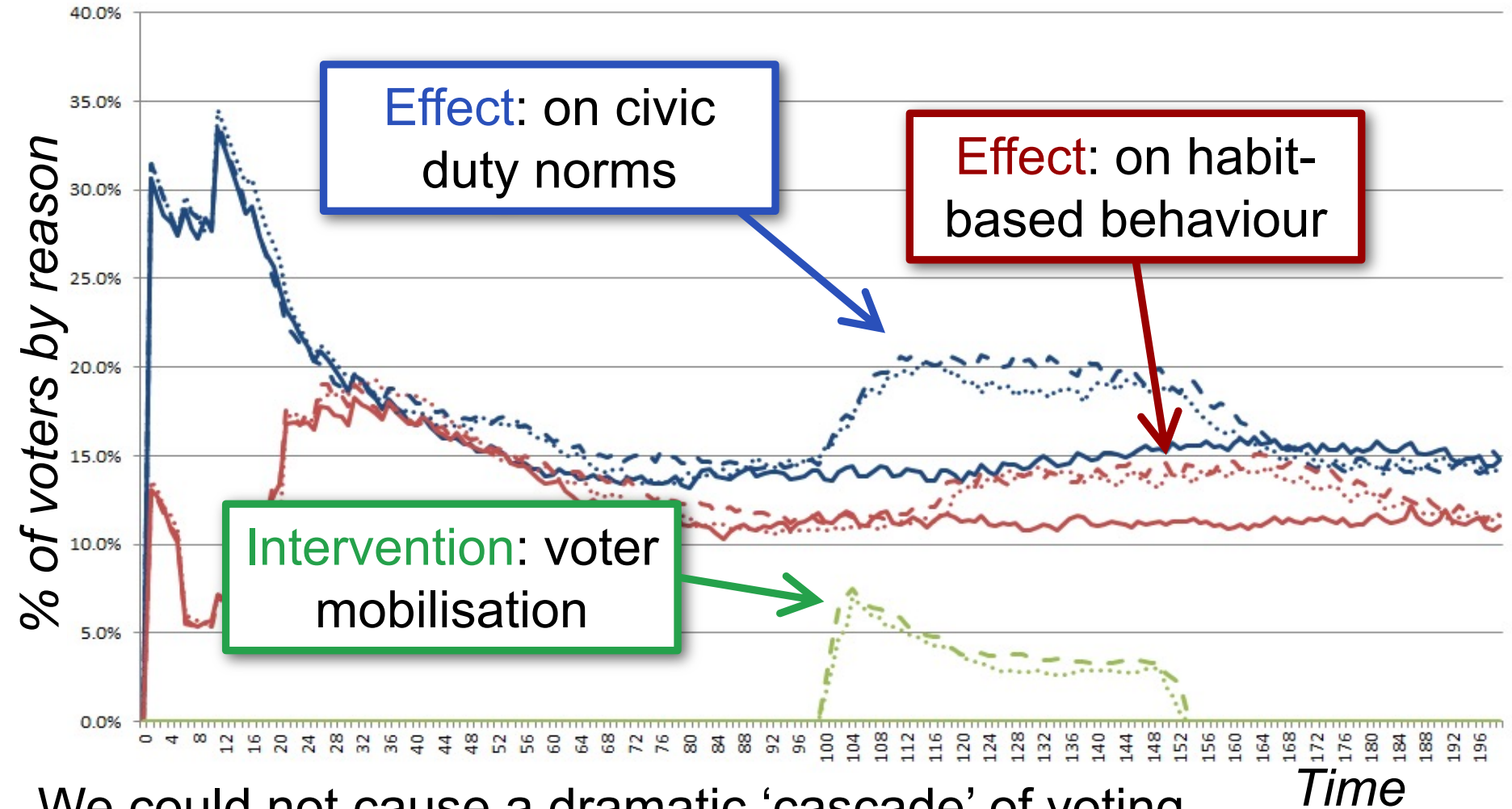


One use of this model



- Key issue to be investigated was “*why do people bother to vote?*”
- In particular to look at how the different motivations and processes that lead people to vote might interact
- Previous work had claimed that persuading people to vote would result in a ‘cascade’ effect, resulting in much more participation than just those directly contacted

Example Output: why do people vote (if they do)



We could not cause a dramatic 'cascade' of voting resulting from interventions without strong assumptions

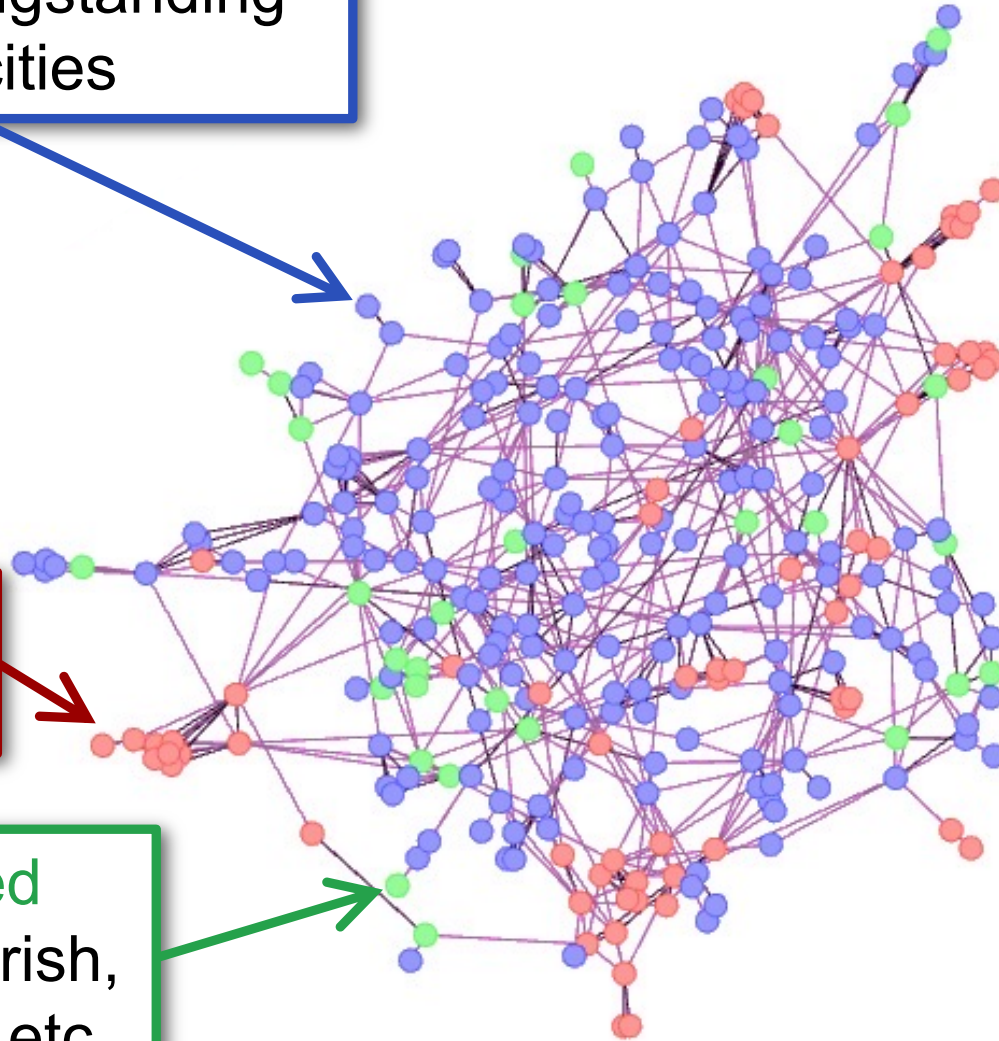
Simulated Social Network at 1950



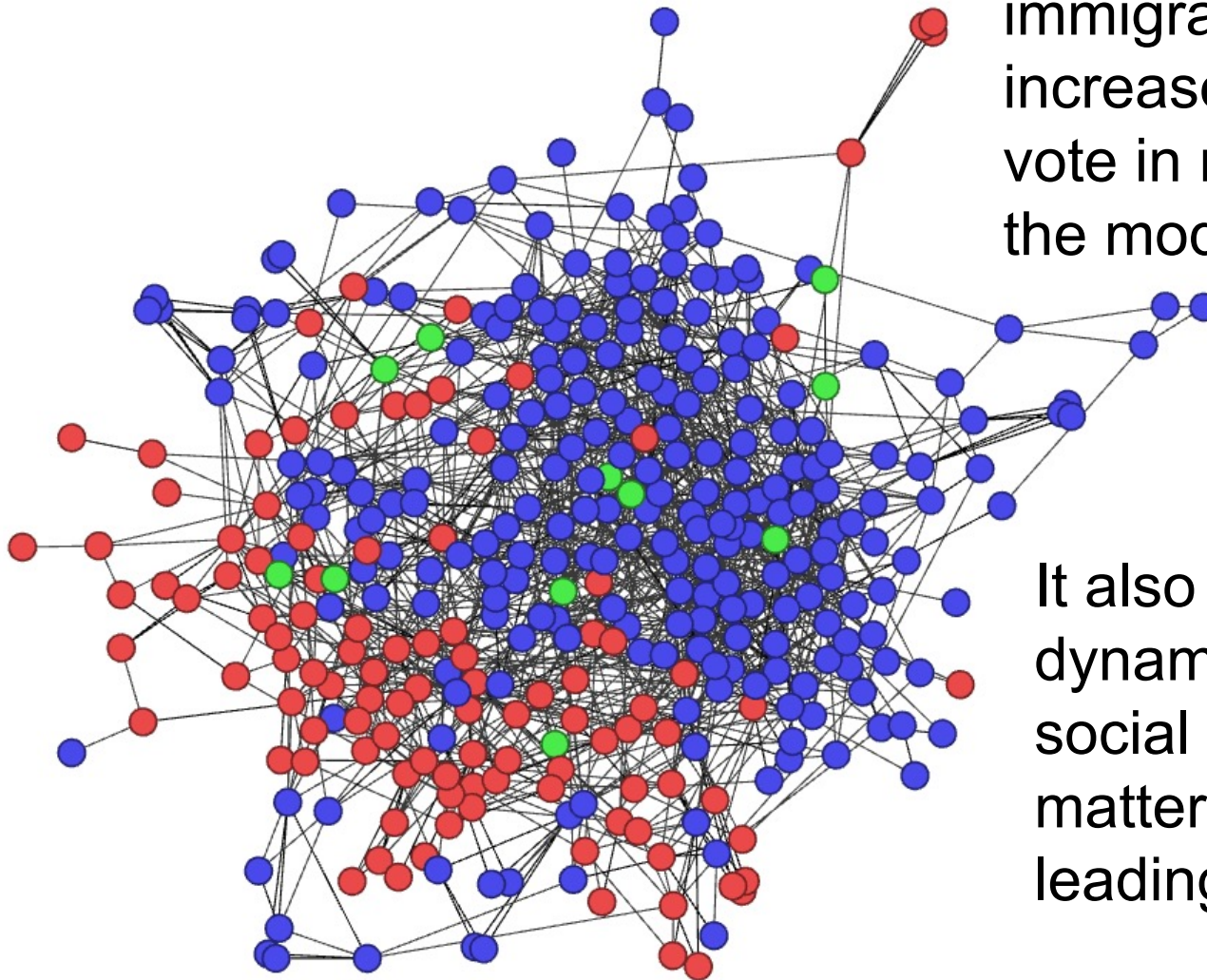
Majority: longstanding ethnicities

Newer immigrants

Established immigrants: Irish, WWII Polish etc.



Simulated Social Network at 2010



One impact of immigrants was that it increased the norms to vote in nonimmigrants in the model

It also turned out that the dynamic nature of the social network mattered in the model, leading to more voting

Conclusions – part 2



- Legal adherence is not just a matter of rules
- ...but also of the social support for the law
- ...and the habits that result from these
- These sorts of issue are possible to simulate and explore
- ...and could (*in the future*) be part of the assessments of laws, interventions etc.
- Decision-making in ABMs does not have to be based upon that of economic rationality

Some relevant references



Conte, R., Andrighetto, G., & Campennl, M. (Eds.). (2014). *Minding norms: Mechanisms and dynamics of social order in agent societies*. Oxford University Press.
<http://doi.org/10.1093/acprof:oso/9780199812677.001.0001>

Xenitidou, M. & Edmonds, B. (2014) *The Complexity of Social Norms*. Springer.
<http://doi.org/10.1007/978-3-319-05308-0>

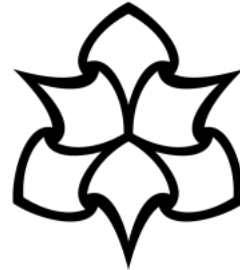
Fieldhouse, E., Lessard-Phillips, L. & Edmonds, B. (2016) Cascade or echo chamber? A complex agent-based simulation of voter turnout. *Party Politics*. 22(2):241-256.
DOI: [10.1177/1354068815605671](https://doi.org/10.1177/1354068815605671)

Edmonds, B. & Adoha, L. (2019) Using agent-based simulation to inform policy – what could possibly go wrong? In Davidson, P. & Verhagen, H. (Eds.) (2019). *Multi-Agent-Based Simulation XIX, 19th International Workshop, MABS 2018*, Stockholm, Sweden, July 14, 2018, Revised Selected Papers. Lecture Notes in AI, 11463, Springer, pp. 1-16. DOI: [10.1007/978-3-030-22270-3_1](https://doi.org/10.1007/978-3-030-22270-3_1) (see also <http://cfpm.org/discussionpapers/236>)

Edmonds, B. (2019) A Socio-Ecological Test Bed. *Ecological Complexity*, Vol 40 part B. DOI: [10.1016/j.ecocom.2018.10.003](https://doi.org/10.1016/j.ecocom.2018.10.003) (See also <http://cfpm.org/discussionpapers/221>)

Loughran, T., Fieldhouse, E., Lessard-Phillips, L. & Bentley, L. (2020) Disruptive Norms: Assessing the Impact of Ethnic Minority Immigration on Nonimmigrant Voters Using a Complex Model. *Social Science Computer Review*, 38(4):422-442.
<https://doi.org/10.1177%2F0894439318824264>

Thanks



These slides at: <http://cfpm.org/slides>

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Bruce Edmonds: <http://bruce.edmonds.name>