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DEPARTMENT OF SOCIOLOGY

**Has agent-based modelling already
solved the problems of complexity?
An analysis based on exemplar
models**

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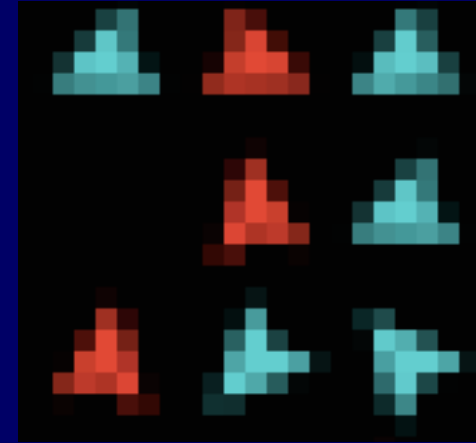
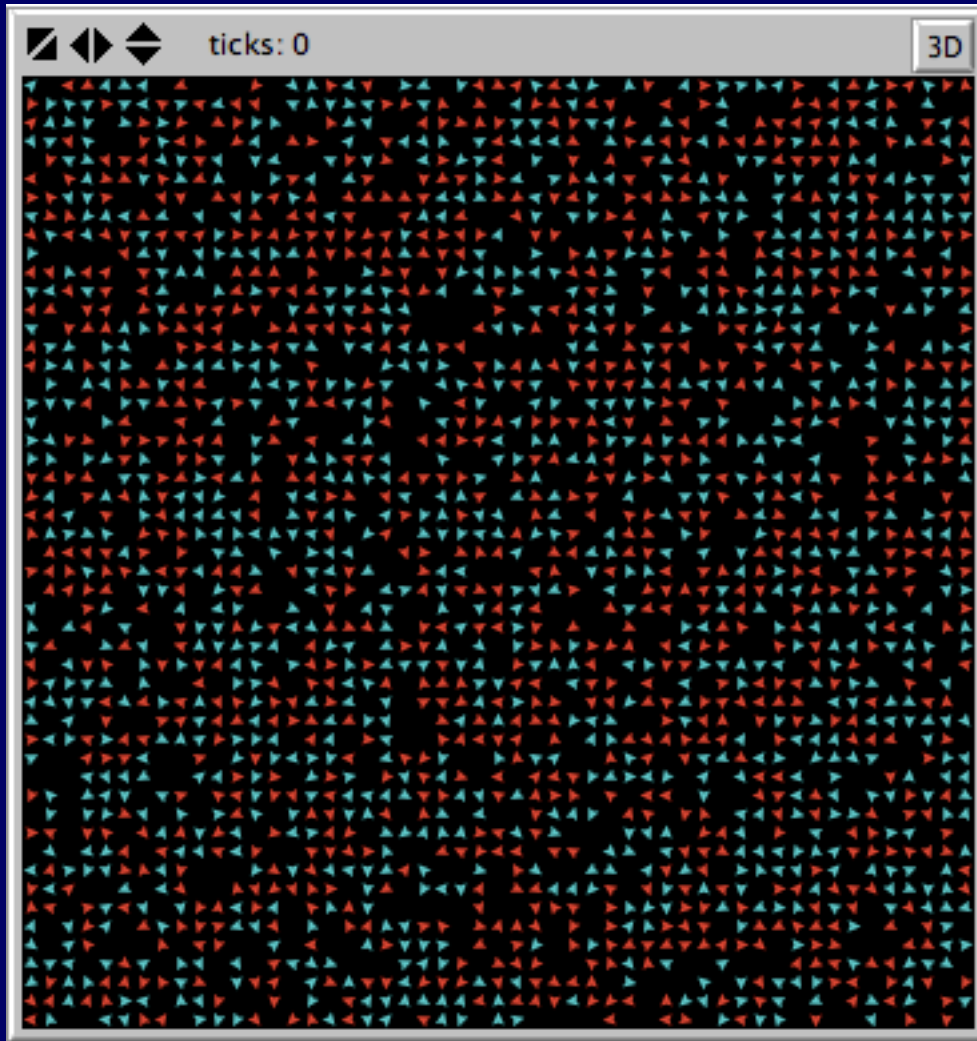


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Two contentious claims

- All the problems of complexity have now been solved.
- The only problems that remain are technical or result from unscientific thinking.
- A meta claim: Social science needs to get back to clear contentious claims.

An unreal world with a real point

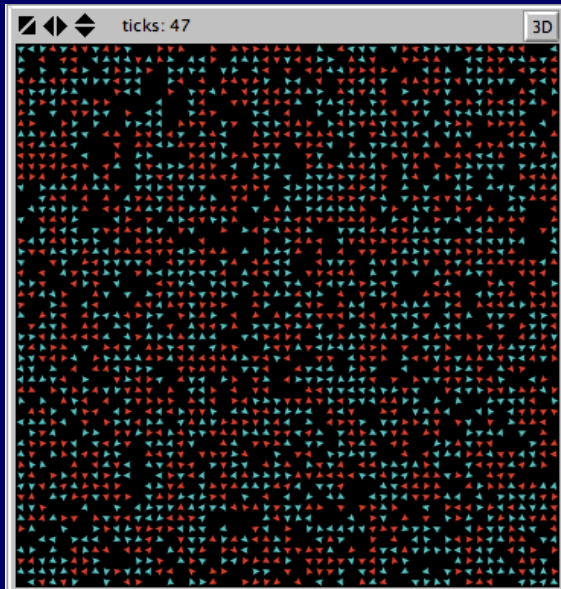
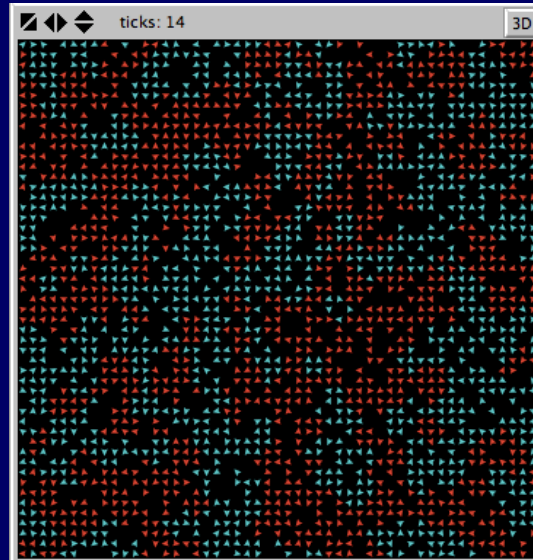
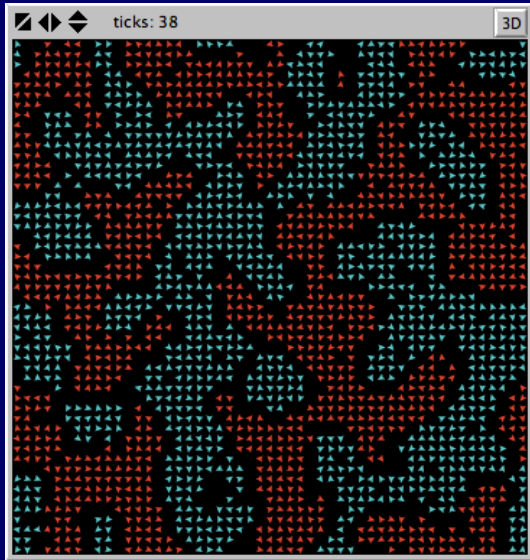


Count same type neighbours over all neighbours, compare with PP and move (or not). Repeat.

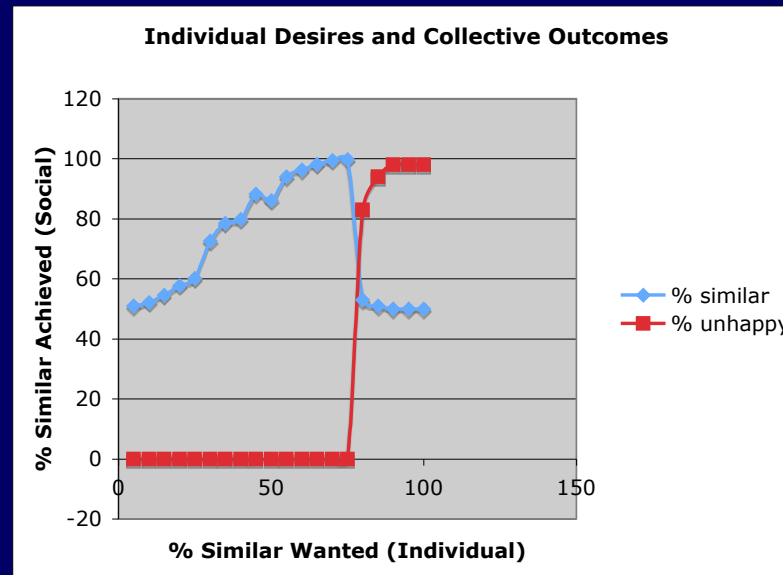
Real point 1

- A completely unambiguous “theory” with no artificial “constructs” (like “class”, “cognitive dissonance” or “discount rate”.)
- Call this a Social Process Specification (SPS).
- Trust me (or ask): Because of the way ABM operate (no “solving” or “fitting”) an SPS can be made arbitrarily complicated and still function.

Real point 2



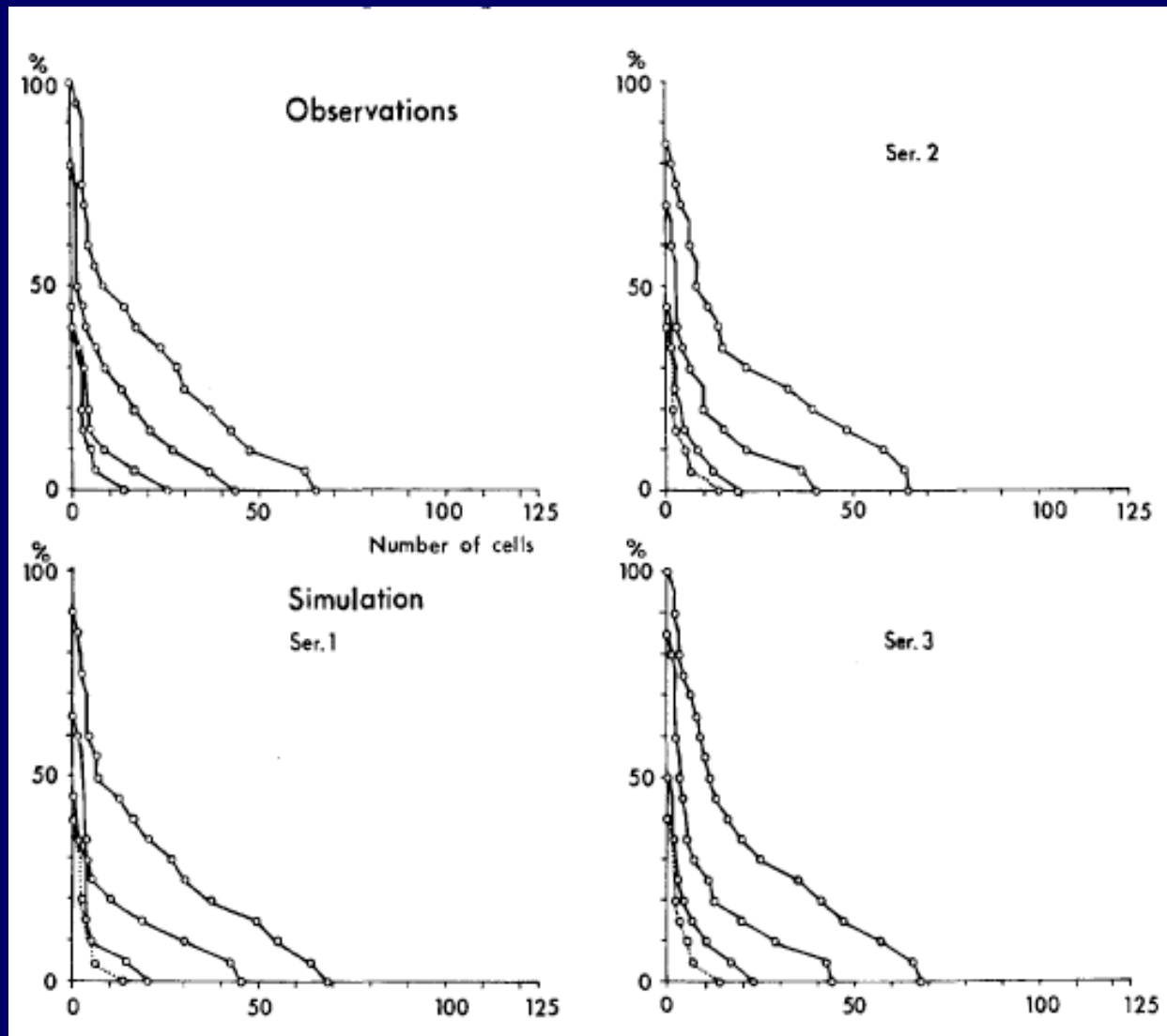
We can't infer individual behaviour from aggregate patterns (PP=0.3) or vice versa (PP=1). Uh-oh! (Emergence, complexity, non linearity, yada yada!)



“Technical type” problems

- How do we convert interviews and ethnographic data into a SPS? A variant of grounded theory.
- How do we know that very different models couldn't produce the same observed data? Critics always raise this but we almost never see it unless the system is empirically trivial. (A different problem.)
- How alike is alike? Non question: What is the “objective” significance level for a significance test?
- How well is “alike” defined? It depends on domain.
- What if we don't have the data? A scientific theory has to be testable *not* tested.

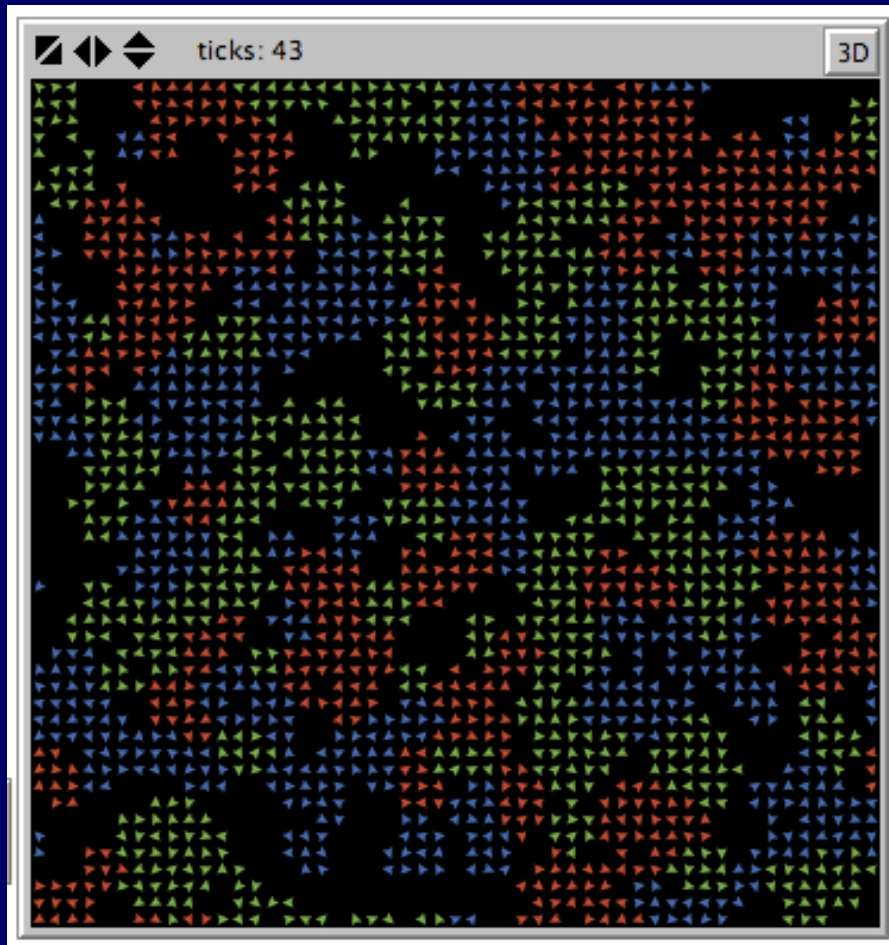
Historical aside



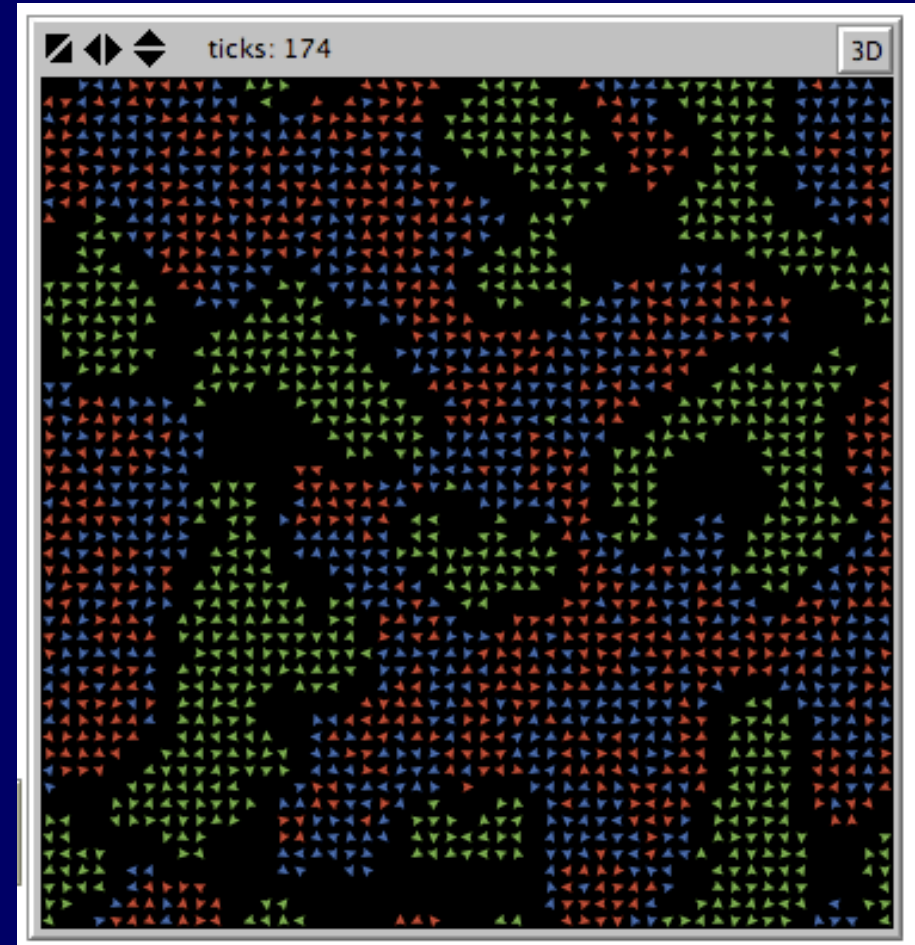
Hägerstrand,
Torsten (1965) 'A
Monte Carlo
Approach to
Diffusion',
*European Journal
of Sociology*, 6(1),
May, pp. 43-67.



Higher “information content” in target?

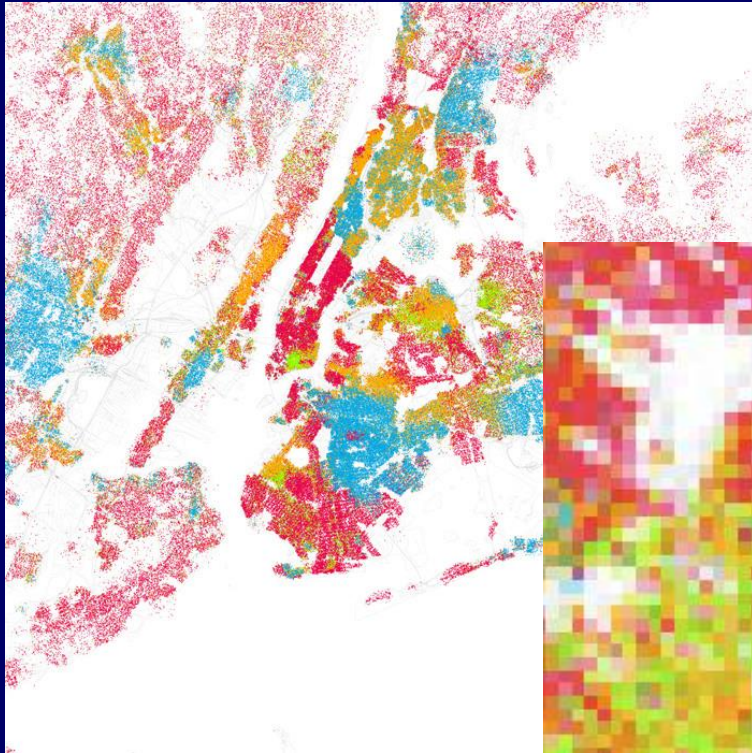


All avoid all

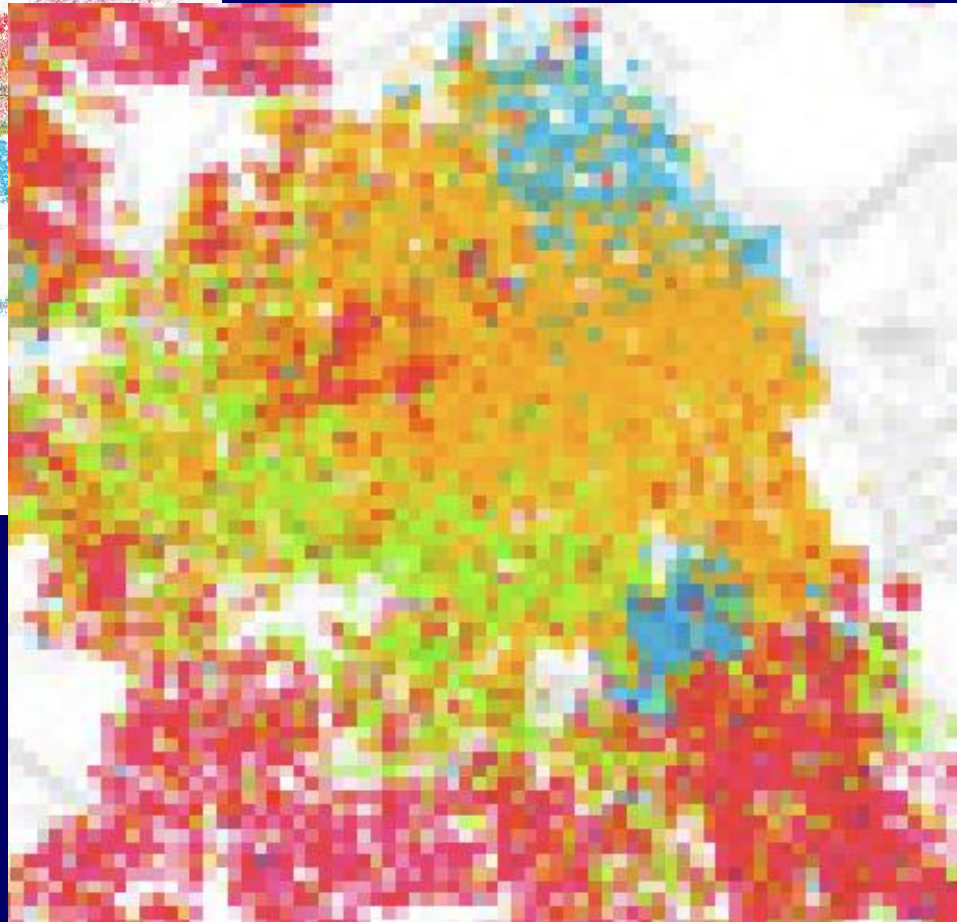


Red and blue both avoid
green but not each other

Get (any) data: NY residential segregation



One dot equals 25 people
(White: red, Black: blue,
Hispanic: orange, Asian: green.)



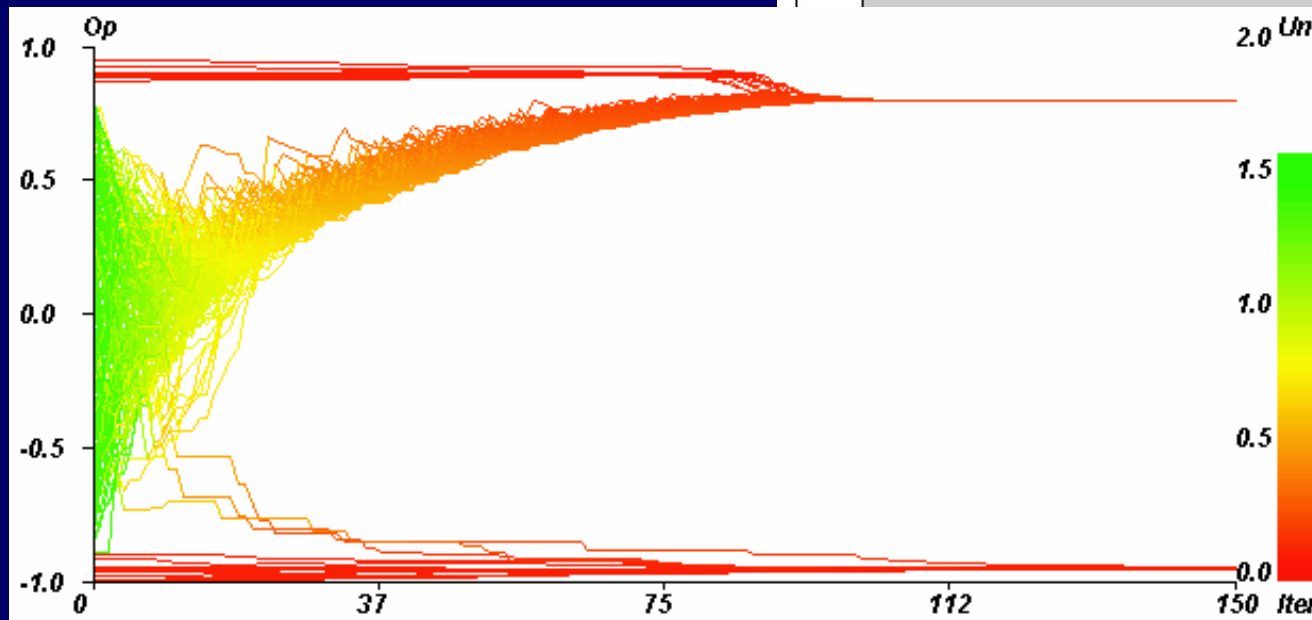
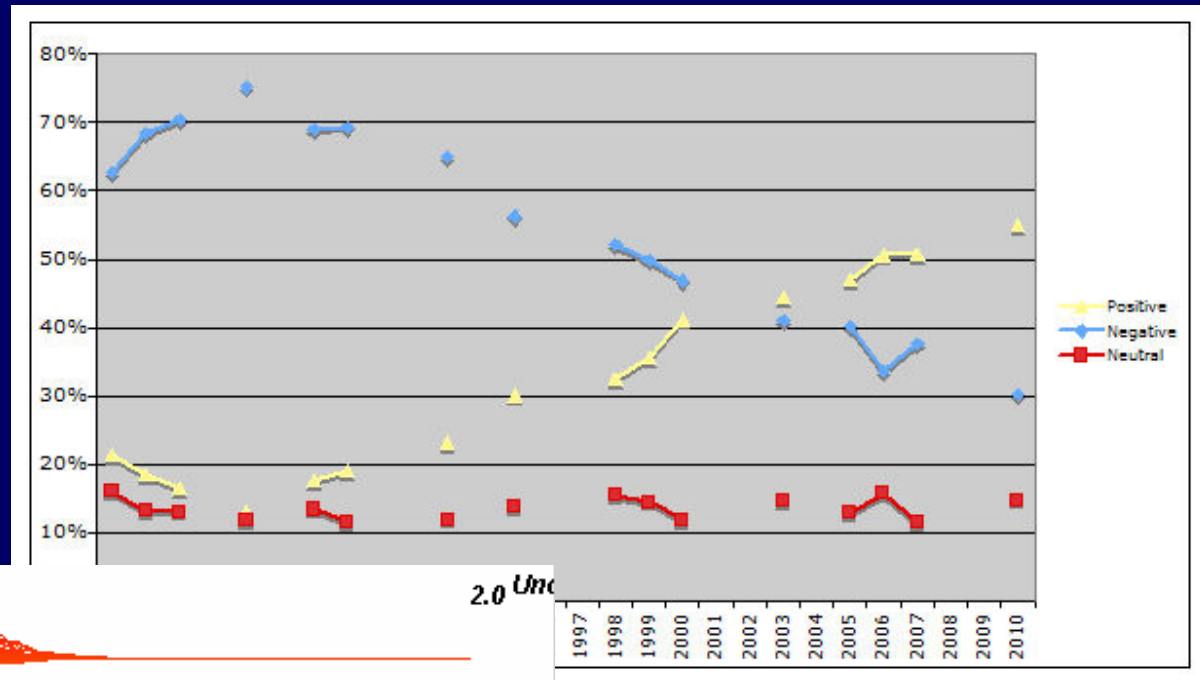
What we
usually
have to
explain is
mixtures of
course.



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Another model: Zaller-Deffuant and data

A well known (and much cited) ABM looks *nothing like* data you can get free off the web. I want my slightly better ABM to be “beaten”. If I lose I win!



Summing up

- ABM is not a panacea. It is just another research method albeit an intriguing one.
- It is surprising how many of its apparent weaknesses seem to be contingent/self inflicted.
- ABM and (**very important**) its methodology provide sufficient tools for analysing complex systems.
- Here endeth the first contentious claim.

Bad science 1: Institutional issues

- If an ABM is fitted to data (particularly “simple” data) then it can prove anything because it has so many free parameters. ABM folk would register this if they had more background in social science statistics.
- If there is no data at all (not calibrated or validated) then how do we tell if a model even applies? (See lots of “neat” complexity models like sand pile, minority game and NK.)
- No compulsion to progressive research: Millions of fragmentary (some with networks, some with memory, some with ...) models of the Iterated Prisoner’s Dilemma which probably just show the outcome that the researcher happens to “like”.

Bad science 2: Evidential criteria

- Example: Talk of Marxism and Rational Choice as “theories”. They don’t actually have a heck of a lot in common.
- Alternative: Rather than wrangling about semantics (what does “theory” mean?) state your evidential criteria for the “entity” you are discussing. Entities are grouped by evidential criteria not by semantic wrangles.
- Rational choice: Fits outcomes of suitably designed laboratory experiments.
- Marxism: Generates diverse theories which survive empirical testing. (aka meta theory, heuristic theory, paradigm?)
- A minimum conception of “scientific” talk is that it must clearly state its evidential criteria. Not all social science currently meets this criterion. (Narrative complexity theory? PoMo?)
- Note this approach does not “impose” evidential criteria (as in boring quals and quants squabbles). It only requires researchers to commit **themselves**.

Et tu?

- An ABM explains an aspect of social behaviour if the most effectively calibrated model we can produce generates “convincingly” similar simulated patterns (networks, statistical associations, biographies) when formally compared with equivalent real patterns.

So what is left to talk about?

- Where evidential criteria meet (or don't meet) a SPS.
- Example 1: Structuration.
- In what sense is (or isn't) Schelling a model of structuration?
- Agency: Moving. "Social" structure: The configuration of neighbours. Each "gives rise" to the other in a well defined temporal sequence.
- Plainly not what Giddens means. No "physical" structure like mountains or workplaces. No creation of "institutions" or innovation. (But there *are* other ABM like that. Hägerstrand has "mountains" and Chattoe-Brown and Gabbriellini has self reproducing networks as stylised "institutions".)

Some contentious thoughts

- Is theory without evidential criteria part of the problem rather than part of the solution? Do partial narrative theories “fighting to the death” really produce a workable synthesis? (This is an empirical question.) Ditto disciplines!
- What constrains narrative theory to compatibility with empirical testing?
- Do existing research methods (experiments, regression, ethnography) make such a synthesis possible even in principle? We can’t just keep adding variables to a regression or (probably) “tease out” the nonlinear implications of a detailed ethnography to resolve quals/quants debates about whether (how much?) “detail matters”.
- Whatever else we say about statements without evidential criteria, we can’t be too polite to say they are just less effort to make.

Archer: “Morphogenesis vs. structuration”

- “However successive theoretical developments have tilted *either* towards structure *or* towards action, a slippage which has gathered in momentum over time.” (Nope: Not this one.)
- “In other words the ‘central notion’ of the ‘structuration’ approach fails to specify when there will be ‘more voluntarism’ or ‘more determinism’.” (Try adding house prices and “gossip” about neighbourhoods to Schelling.)
- “What most of us seek instead of these truisms are theoretical propositions about when (more) recursiveness or (more) transformation will prevail – a specification which would necessitate unravelling the relations between structure and action.” (We’re on it. Next!)

Theory “meets” ABM

- I can't find anything in Archer incompatible with an ABM of structuration (although exactly which one remains on the table).
- I'm also not sure I can find anything that would “resolve” her debate with Giddens. Sorry.
- In an ABM, agents really do have agency but **so does the environment**.
- ABM doesn't have to abstract “arbitrarily” for solubility (i. e. strong assumptions like common knowledge in game theory.)
- SPS is Occam's Razor for theoretical concepts that may not be “load bearing”. Possible example: “This specification of the strength of constraints is both impossible in Giddens's conceptualization and unacceptable to him.”



The horns of a dilemma?

- ABM should take treat respectfully all claims about social processes as long as they have associated evidential criteria (and ideally evidence too).
- Example: Social construction.
- *Could* mean no more than that “conversation sequences” take place about attitudes rather than simple (Z-D) averaging.
- What could we mean by “meaning” in an ABM? Is that “taking action A” or “defection?” Are those “legitimate excuses” or is he a “conniving alcoholic?” Truth maintenance systems?
- This is where ABM (and theory) will develop but only provided social theories of certain kinds are prepared to commit to evidential criteria.

In other words ...

- You specify it clearly and we can build it.
- This may be surprisingly uncomfortable though. There seems to have been a lot of “theoretical wiggle room” in existing empirical approaches being obviously inadequate. (Theory does what methods can’t but what if methods can do anything? There is no “harm” in theory if methods can’t fix the problem either but what is left if they can? More value in false dichotomies?)
- Beyond a certain point we can’t *make* people provide evidential criteria. We just have to agree to ignore those who don’t.
- Now Johnny’s handwriting has improved we discover that his spelling is terrible.

In one slide ...

- Relative to ABM, much of the “coolest” quantitative complexity is “toy models” and most narrative complexity isn’t science at all.
- Boss and apology joke.
- Let battle commence 😊

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