CINDERELLA'S SLIPPER

Inverse Modelling of Energy Transition Votes in Opinion Dynamics

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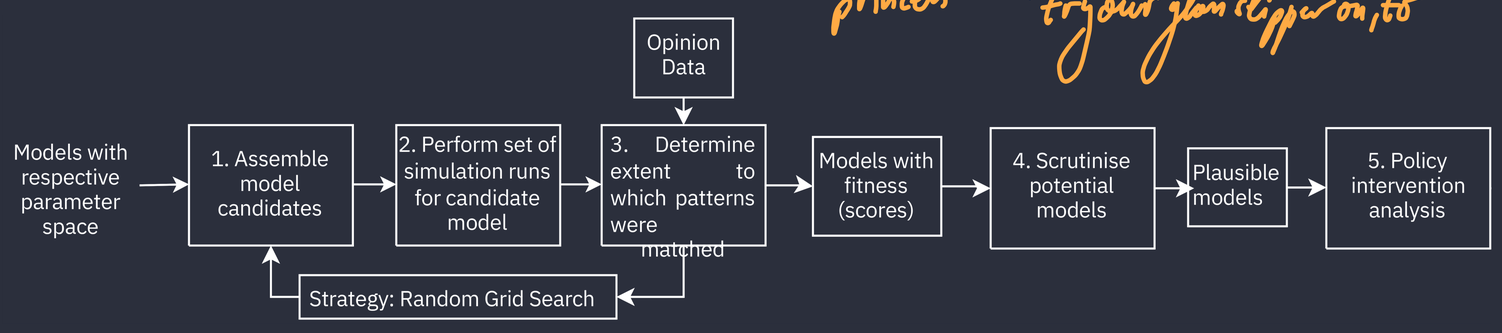
In the Cinderella story, the glass slipper is a one-size-fits-one miracle. But what if it fit more like a stretchy sock, kind of conforming to every foot in the kingdom? Similarly, in social simulation, we're often on a prince-like quest for the 'just-right' model.

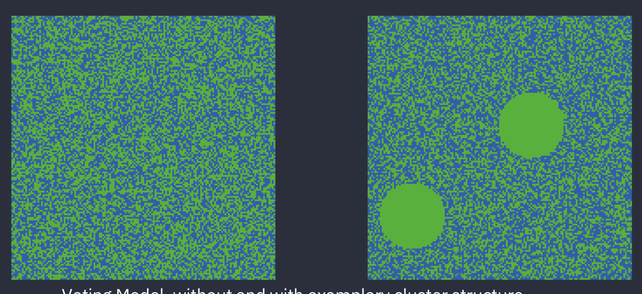
Opinions matter in the energy transition, and opinion dynamics models (claim to) simulate such social phenomena. However, the focus is on mathematical exploration rather than validating or calibrating them empirically. Thus, can opinion dynamics models be a glass slipper to fit and explain real data?

princes — Fr your glass slipper on, to

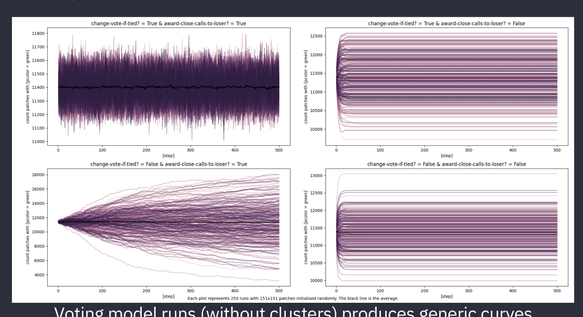


Three Models Considered

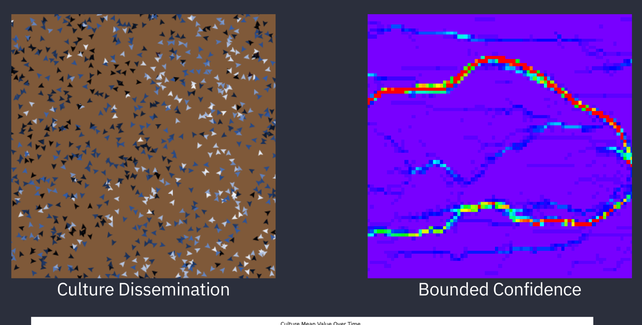
- Voting: Agents swayed by their neighbours' (binary) opinion.
- Culture dissemination: Exert positive influence based on agents' cultural similarity (Hamming distance).
- Bounded Confidence: One single continuous 'culture', fixed boundary for interaction differences.



Voting Model, without and with examplary cluster structure

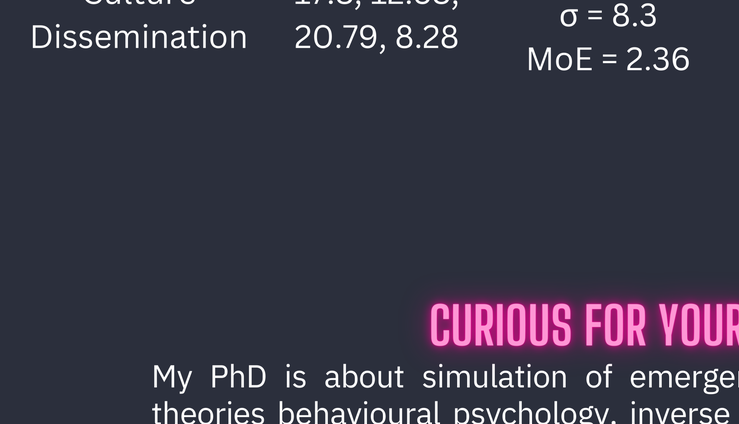


Voting model runs (without clusters) produces generic curves



Culture Dissemination

Bounded Confidence



Model	Real Data Errors	Random Data
Bounded Confidence	3.5, 11.37, 10.11, 0.96	μ = 21.49 σ = 10.92 MoE = 3.07
Culture Dissemination	17.8, 12.58, 20.79, 8.28	μ = 5.534 σ = 8.3 MoE = 2.36

Example run of cultural dissemination fit

Interpretation of Results

- Models indeed show flexbility, but surprisingly, one is better with random, the other with real data.
- Neither model provides qualitative pathway for explaining the social phenomenon studied.
- Bias in culture dissemination model due to no internal 'punishment' for complexity.

Discussion Points

- Critique: Lacking a 'sole' with no behavioural or systemic component to embed interactions.
- Slipper useful then? Fit field-specific shades of grey? Not one size fits all.
- Abandoning models is not an option. But 'growing it doesn't mean you explained it'. We need to be able to derive a qualitative explanation. For this, the slipper's 'make', the assumption that goes into the model, matters.
- A way out? Try multiple slippers (models and datasets and ...), but is that enough?
- Inverse modeling only fits if the 'shoe is well-made' (validated assumptions), avoiding a 'stretchy sock' scenario (model moulded into mindless over-fitting). Truly interdisciplinary approach!

CURIOUS FOR YOUR IDEAS AND THOUGHTS!

My PhD is about simulation of emergent phenomena in the energy transition using theories behavioural psychology, inverse modelling, and machine learning techniques. I work closely with modellers and behavioural psychologists. I am eager to hear what you think would be interesting approaches and pathways to this topic !
Do get in contact !

GitHub Repository

Email me !

Energy Transition Lab

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