A WEIGHTED BALANCE MODEL OF OPINION HYPERPOLARIZATION

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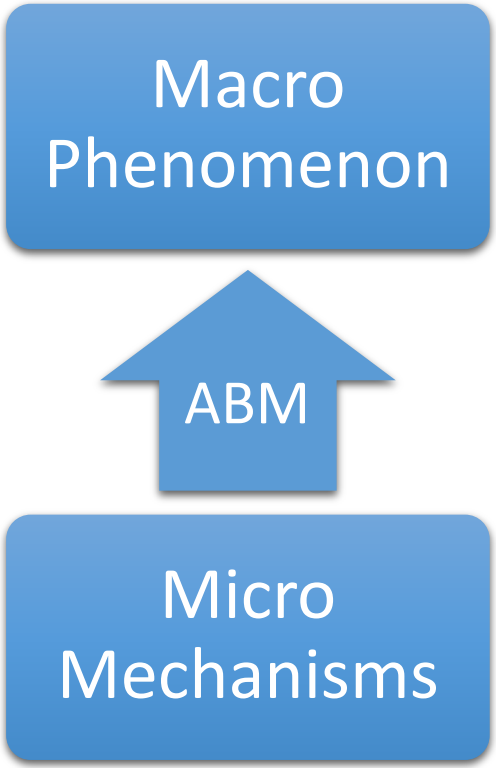
Purpose of Agent Based Models



Economic inequality, segregation, fashion trends, …., political polarization!

→ **'Stylized Facts'** (Kaldor, 1961)

Are micro-mechanisms **sufficient** to generate the stylized macro-phenomenon?
Is every mechanism **necessary**?
→ **'Generative Sufficiency'** (Epstein, 2012)

Optimally taken from **theory** (psychology, behavioral / micro-economics, rational choice political science), but often **ad-hoc**

Macro Phenomenon: Hyperpolarization

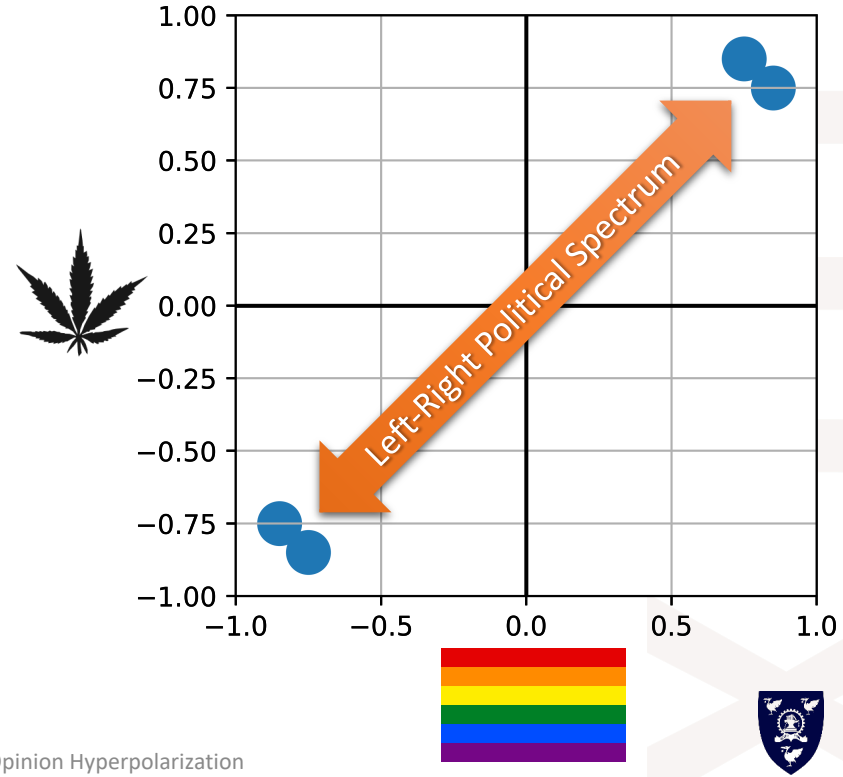
- **'Polarization'** often equated with **'extreme opinion'**
- **BUT:** many **policy dimensions** (inheritance tax, vaccination mandates, LGBTQ rights, infrastructure investment, cannabis legalization….)

→ Extreme opinions **not enough**

→ Opinions have to **correlate**

- **Hyperpolarization =** extreme **and** correlated opinions

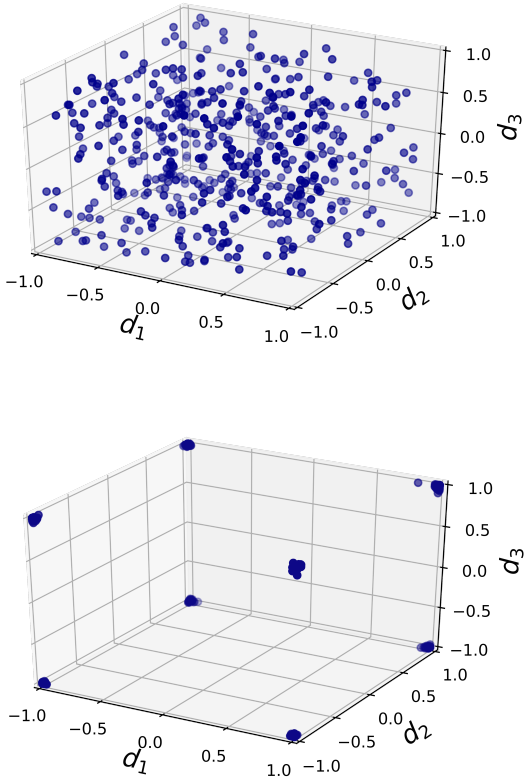
→ What **micro-mechanisms** can generate hyperpolarization?

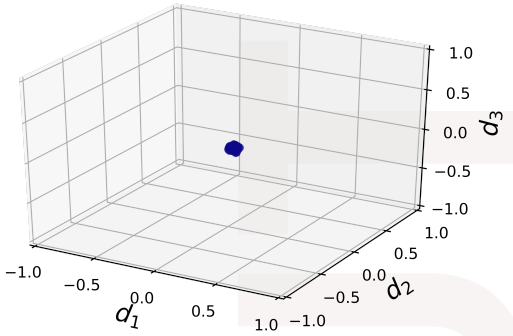


The Problem: Simple Mechanisms are not Sufficient

- **All ABMs:**
  - Agents are represented as d-dimensional **opinion vectors**
  - Every time step, random agents **exchange opinions** according to some mechanism
- If mechanism = **attraction**, complete consensus emerges
- If mechanism = **repulsion**, 2^d opinion clusters emerge

→ **No Hyperpolarization**



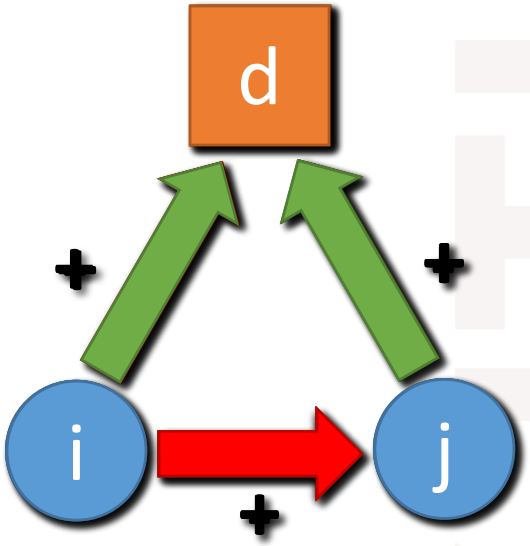


Micro-Mechanism: Balance Theory

- **Balance Theory** (Heider, 1946):
  - Both **opinions** and **interpersonal relations**
  - Triadic relations between **ego**, **alter**, and **policy dimension**
  - **Balanced** Triads: Agree with friend, disagree with enemy
  - **Unbalanced** Triads: Disagree with friend, agree with enemy

→ **Tendency towards balance**

→ **BUT**: Only binary opinions / relations in original theory



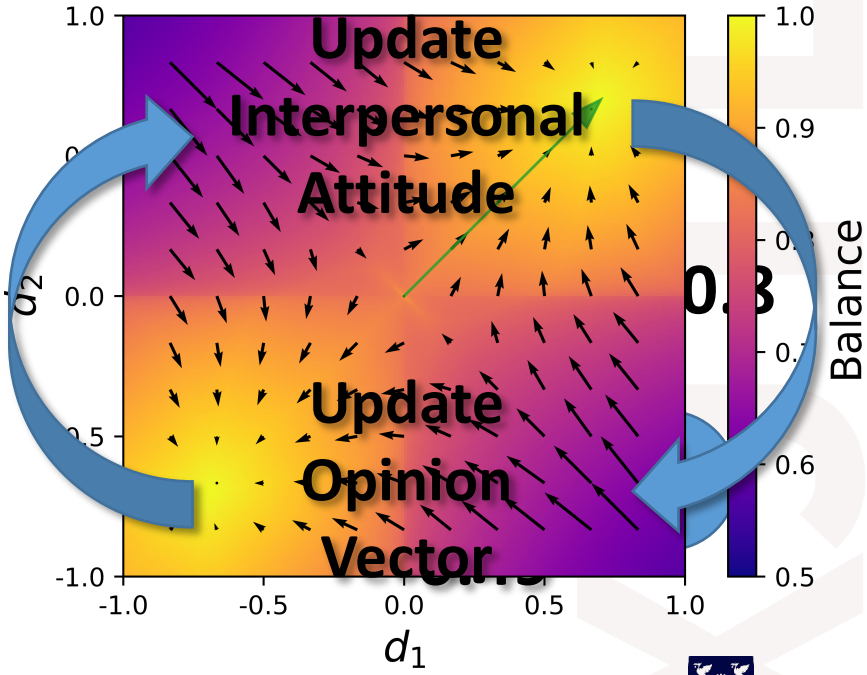
Weighted Balance Theory

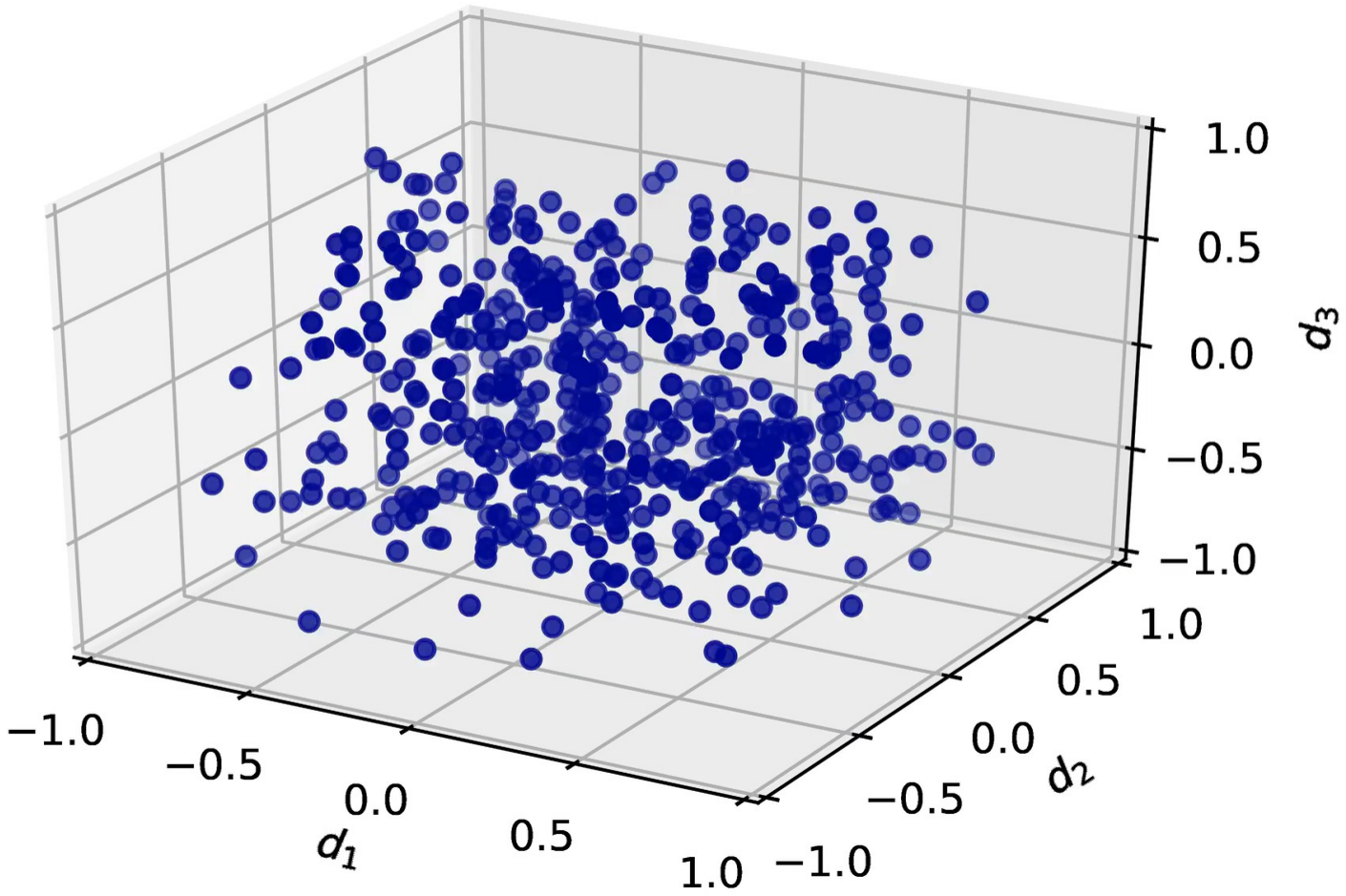
- What if opinions / attitudes not binary, but **weighted**?
- Attitude: Signed Geometric Mean:

$$\mathcal{A}(i,j) = \underbrace{sign(\mathcal{A}(i,d)) \cdot sign(\mathcal{A}(j,d))}_{\text{Sign: Product Rule}} \cdot \underbrace{\sqrt{|\mathcal{A}(i,d)| \cdot |\mathcal{A}(j,d)}}_{\text{Weight: Geometric Mean}}$$

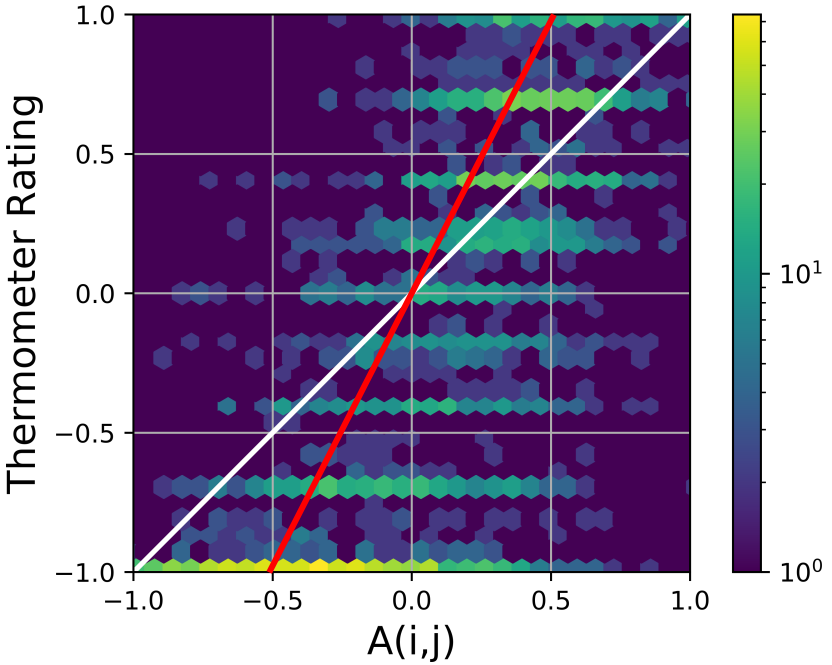
- Opinion update:

$$\Delta \mathbf{o}_d^i = \alpha(\underbrace{SGM(\mathbf{o}_d^j, \mathcal{A}(i,j))}_{\text{Perfectly Balanced Vector}} - \mathbf{o}_d^i) + \mathbf{z}$$

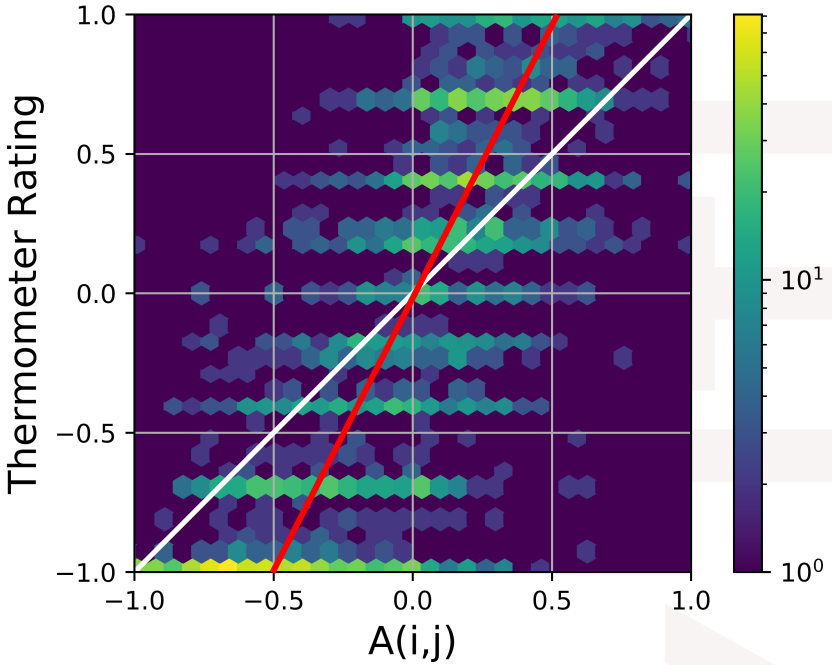



1.0
0.5
0.0
−0.5
−1.0
d_3
1.0
0.5
0.0
−0.5
−1.0
d_2
−1.0
−0.5
0.0
0.5
1.0
d_1

Comparison with ANES Questionnaire Data



Trump



Clinton

THANK YOU

- **My email:** Simon.Schweighofer@xjtlu.edu.cn
- **Our Paper:** Schweighofer, S., Schweitzer, F., & Garcia, D. (2020). A weighted balance model of opinion hyperpolarization. *Journal of Artificial Societies and Social Simulation*, *23*(3), 5. https://www.jasss.org/23/3/5.html

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