Ideology-ology

Diagnostic Perspectives and Reality-Seeking Dynamical Modeling of the US Political Ecosystem

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UM AIM Seminar Series

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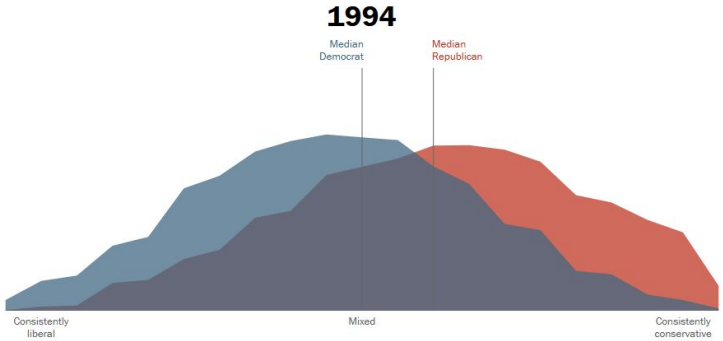
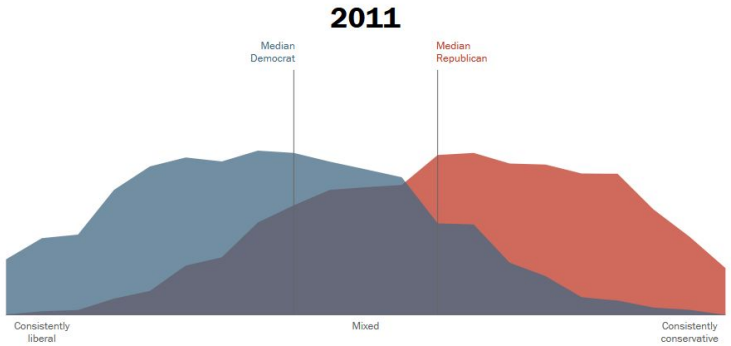
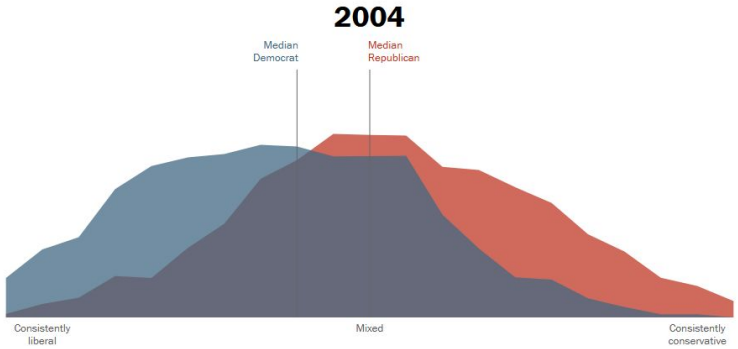
Roadmap

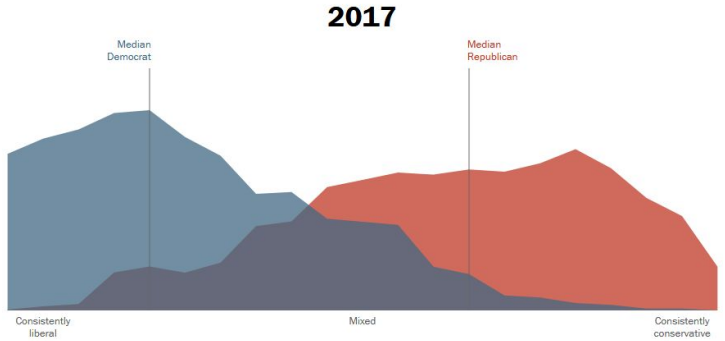
- Introduction
  - Motivation
  - Modeling Philosophy
  - Conceptual Framework/Model Structure
- The Data
  - Robustness and Measurement of the Spectrum Itself
  - Acceptance Trends in Political Space
  - Political Information Ecosystem
- The Theory
  - Dynamical Results
  - Remaining Questions/Next Steps

Motivation









Source: Pew Research (2017)

Motivation: A Dynamical Connection?

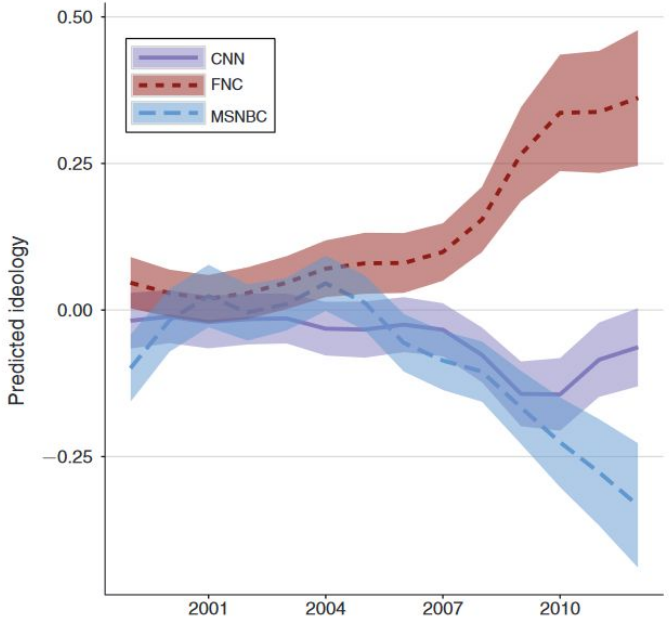
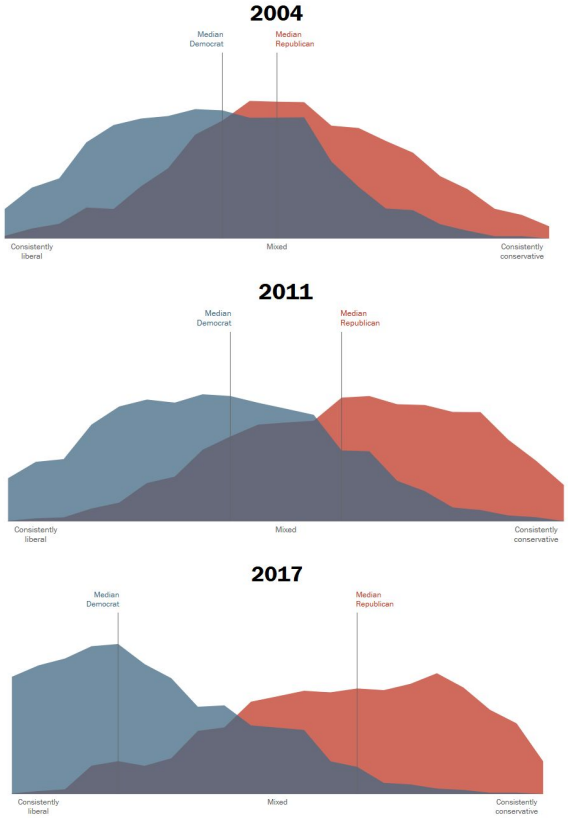


FIGURE 3. ESTIMATED IDEOLOGY BY CHANNEL YEAR

Martin/Yurukoglu (2017)



Core Modeling Philosophy

Hypothesis: It is possible to capture a significant and useful amount of political reasoning and influence with mathematical trends.

- We seek the largest-order shared psychological/societal trends, while leaving room for individual nuances

Claim: We should seek to model this reality as accurately as we can, and improve those models over time by informing them with data

- Urgency for realism/prediction like epidemiology, not *just* toy models for intuition
- “Reality-seeking” (scientific) modeling mindset

Core Modeling Philosophy

Corollary: Reality-seeking models should be constructed with realistically-attainable data in mind

Roadblock: explicit individual-to-individual interactions (e.g. agent-based models) often demand many parameters which would be difficult to elucidate even with “big data” access

- Frequency/strength/type of network connections
- Spatial interaction and movement rules?
- etc.

Also, these simulations scale badly with population size

⟶ **Sidestep** by coupling individuals to a (systematically biased, probabilistic) *environment*, not each other

Simplifying Assumptions

Ideology is one-dimensional, finite

- Very common in literature
- More is hard to gather data for
- Hunch: “Us vs Them” is main dynamic
  - ~1D manifold in High-D space
  - 2-party game theory encourages
- Normalized by
  - Language (“left-wing”/“right-wing”)
  - Simple, enticing/motivating media narratives

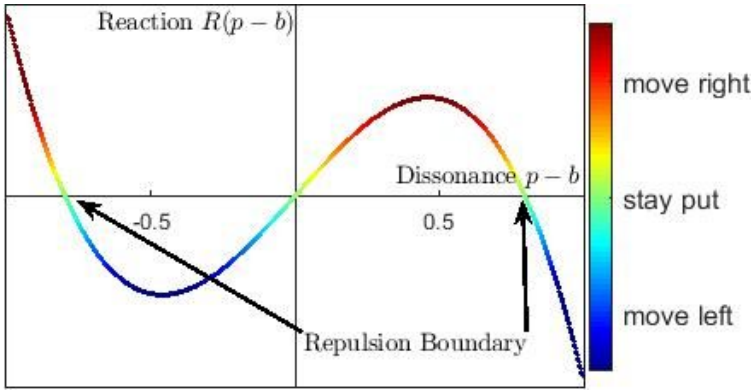
Ideological motion is continuous

- Large discrete-jump real-world events like “child enlists in military” or “child comes out as gay” not easily capturable
- Individuals have vastly different political involved-ness, frequency of influence
  - Take continuous-time limit
  - Relaxing this may be interesting when we have the relevant data!

Conceptual Framework

1) Individuals ideologically drift as they react to political things they experience (*percepts*)

Plausible example theory:



$$R(p-b;d) = (p-b)\left[1 - \frac{(p-b)^2}{d^2}\right]$$

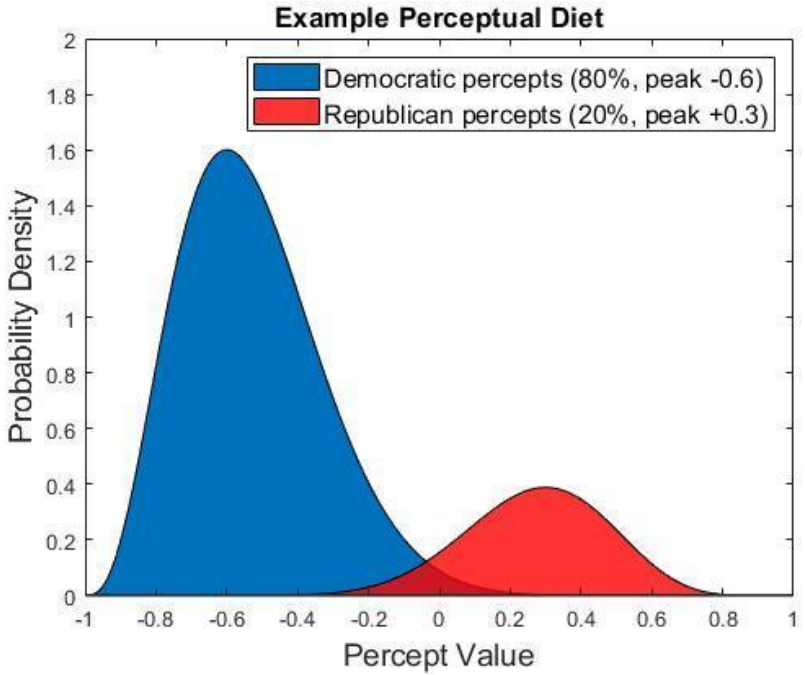
"Dissonance" "Agreement"

Conceptual Framework

1) Individuals ideologically drift as they react to political things they experience (*percepts*)

2) What individuals experience is systematically biased by their current ideology (and possibly party affiliation)

- Probability distribution of content —> no assumption on influence type or structure



Conceptual Framework

1) Individuals ideologically drift as they react to political things they experience (*percepts*)

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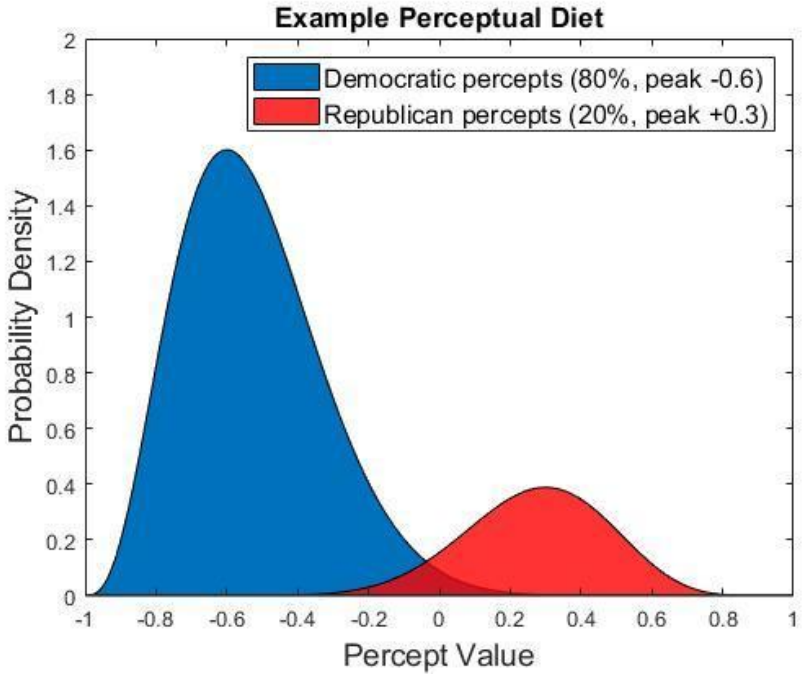
3) (Optional) Political content's partisan source may act as a significant cognitive primer for the impact of political content

- Ex: Same proposal from your side sounds better



Model Proof-Of-Concept (2020)

Conjectured Dynamics:

- cubic function of dissonance (=d*a | a quadratic)

Conjectured Information Ecosystem:

- Beta-distributed diets from each party
- Peak of distribution = sigmoid function of ideology

Wiggle room: 8 parameters (two sigmoids)

Can match real-world data:

- Dem and Rep equilibrium distributions
- Intervention dynamics

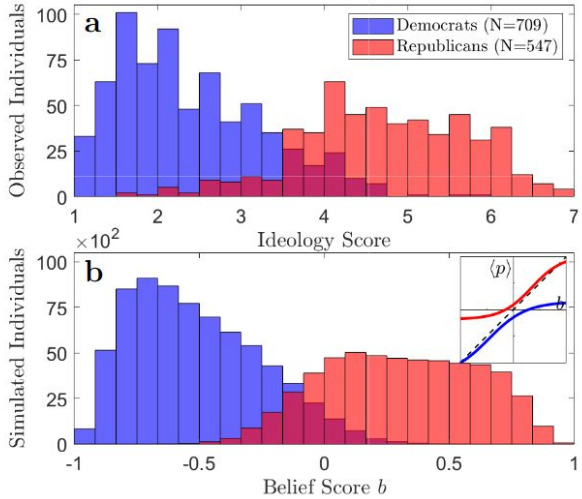


FIG. 1. **(a) Empirical ideological distributions by U.S. political party.** Average ideological position score from 1 (strongly liberal) to 7 (strongly conservative) on social, economic, and military issues for 1256 U.S. Twitter users. Data from [38]. **(b) Model predictions.** Steady state for our simulated population of 70,900 Democrats and 54,700 Republicans, with party perception curves shown in the inset. See Results section for details.

Survey! (2023-24)

(Thank you to Kwan/Tiu Postdoctoral Fellowship Fund!)

Part 1a: Sorting Hat

- Self-estimate ideology
- Other measurements of ideology
- Party identification (SD, LD, I/O, LR, SR)

Part 1b: Feelings About The Political Parties

Part 2: Opinion Statements (pool of 68)

- Estimate ideology
- Positive/negative emotional sentiment
- Agreement

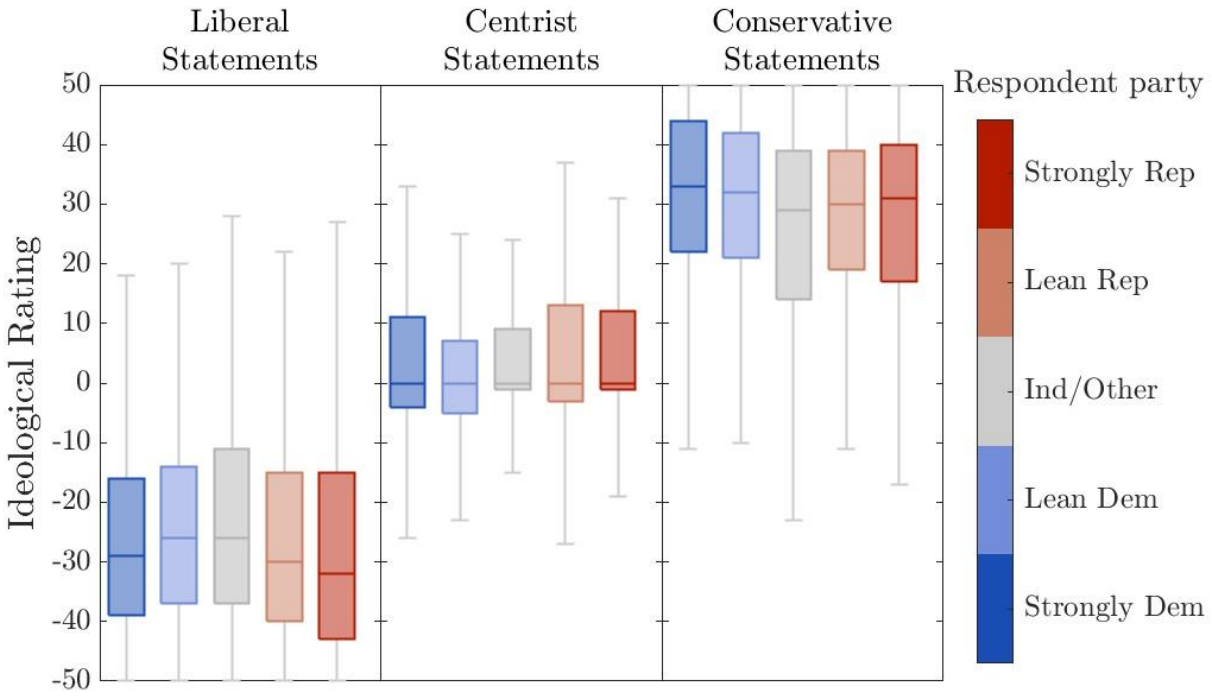
Part 3: Information Environment Estimation

Data: 804 respondents:

- August 2023: 166 US Mechanical Turk "Masters" ($4)
- Sept 2023: 130 Volunteers (incl. 90 UM students)
- May 2024: 508 Prolific participants ($5)
  - nationally representative sample
  - (confirmed all the patterns from our previous samples!)

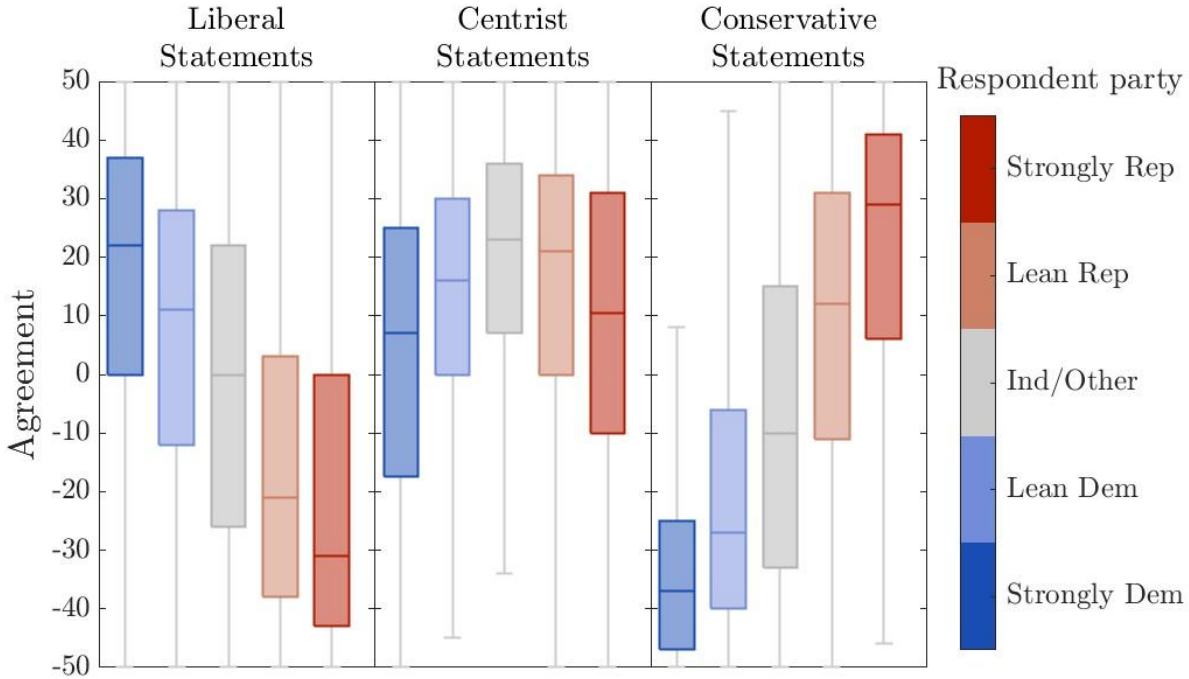
- Each sees 30 statements (or some volunteers: 68)
  - 24,576 observer-statement events

The Political "Spectrum": Shared Meaning

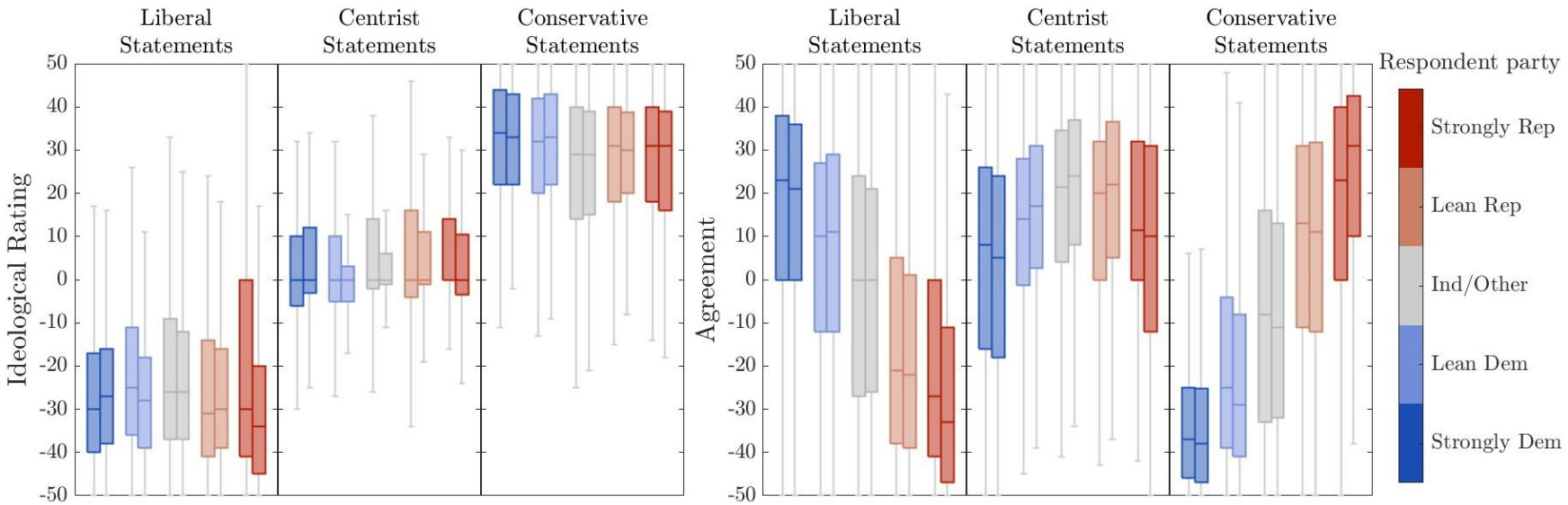


- Relatively *shared* 1D spectrum (across party/ideology)
- Still significant differences in interpretation, but subjective interpretation is operative for impact on each individual

Not Shared Acceptance!



(Non-)Effect of Speaker's Party Declaration



Not Declared (control, left bars) vs Declared (e.g., "A Democrat says, '...'", right bars)

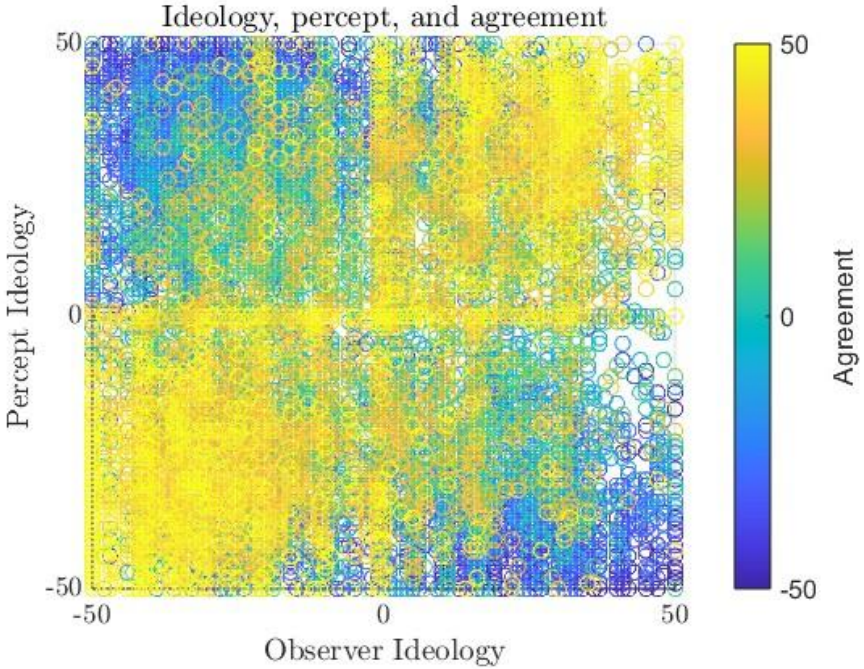
Political Opinion Agreement Data

For each observer/statement pair, get an agreement value

Plot: **Observer Ideology (X)** vs **Estimated Percept Ideology (Y)** vs **Agreement (Z/color)**

Diagonal symmetry signature!

- Supports use of just *dissonance* (distance from Y=X diagonal) instead of depending on observer and percept ideology separately



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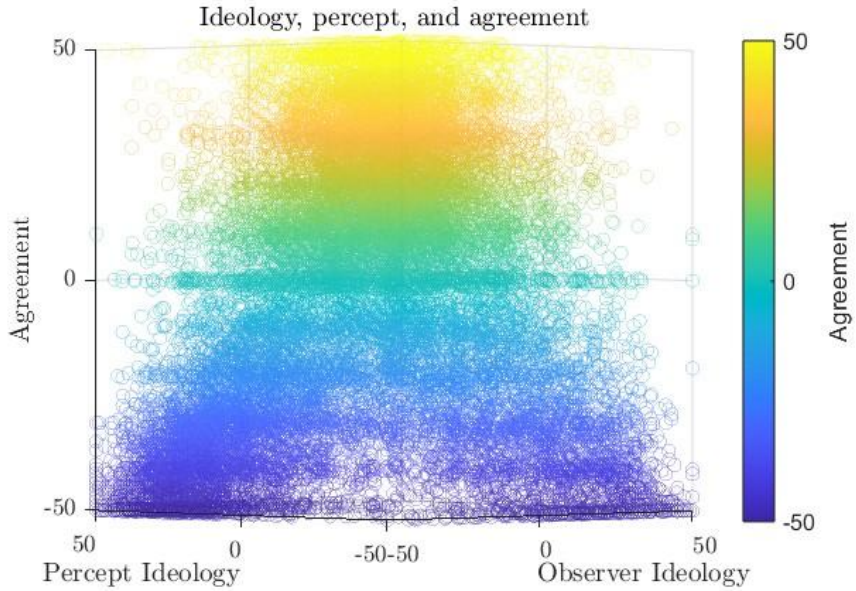
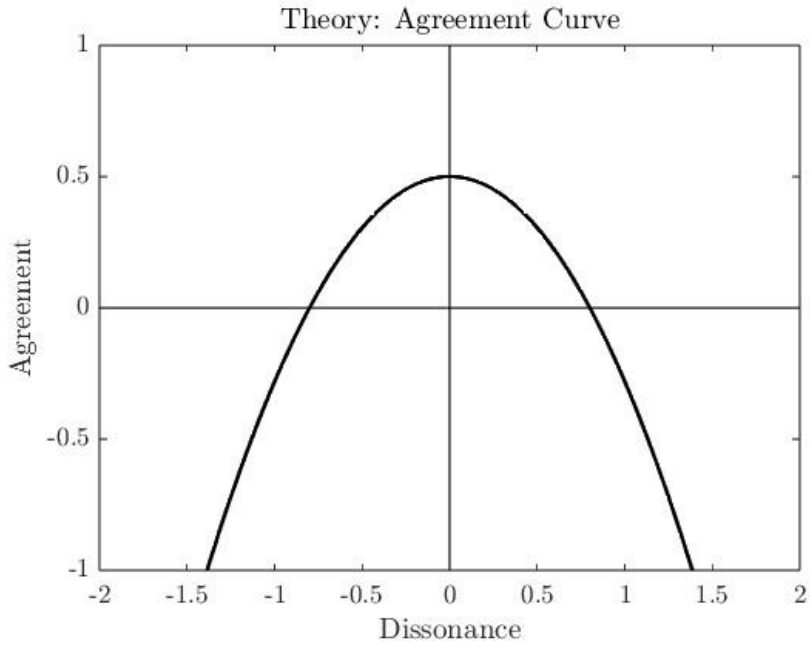
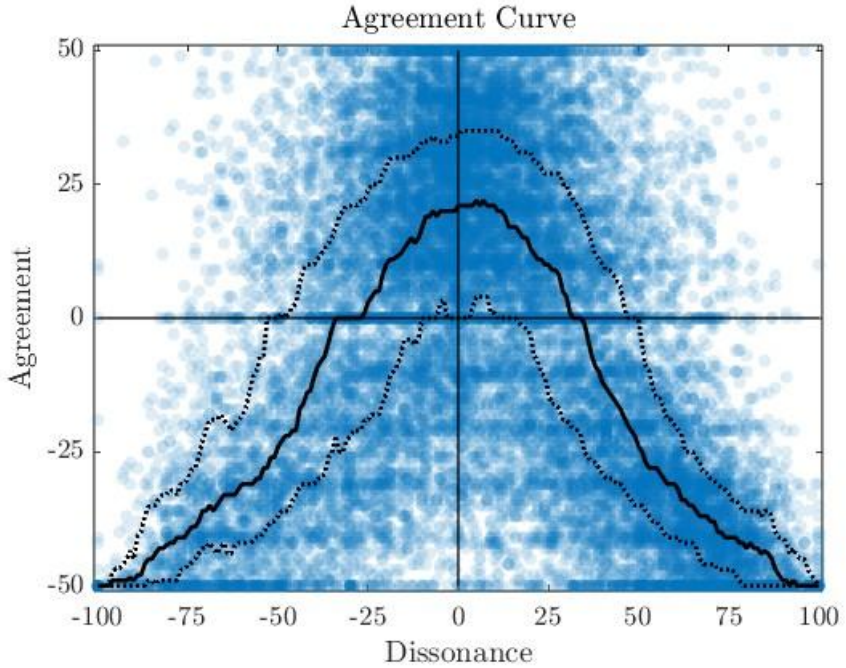
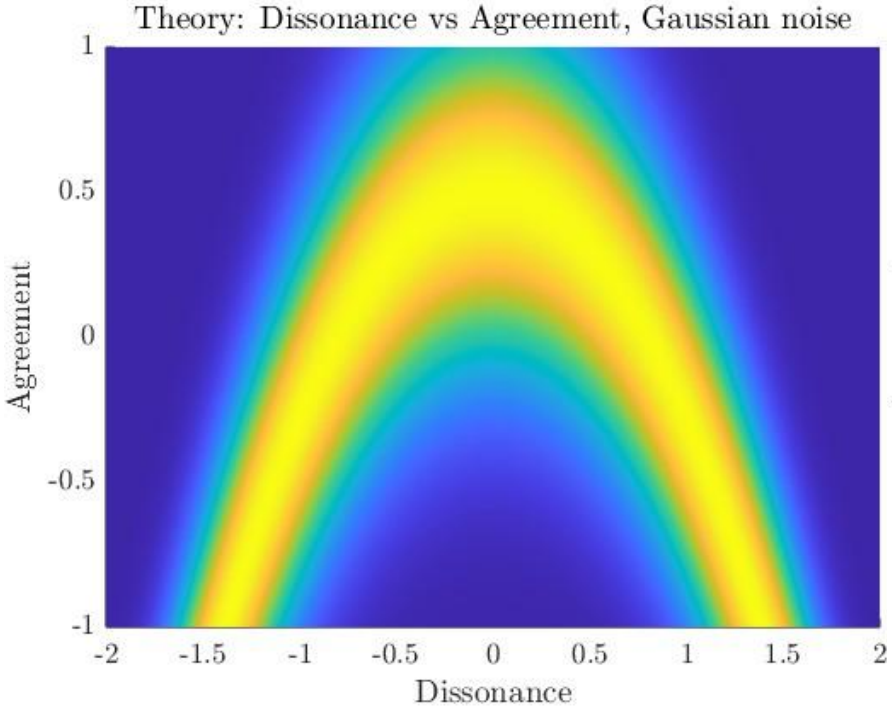


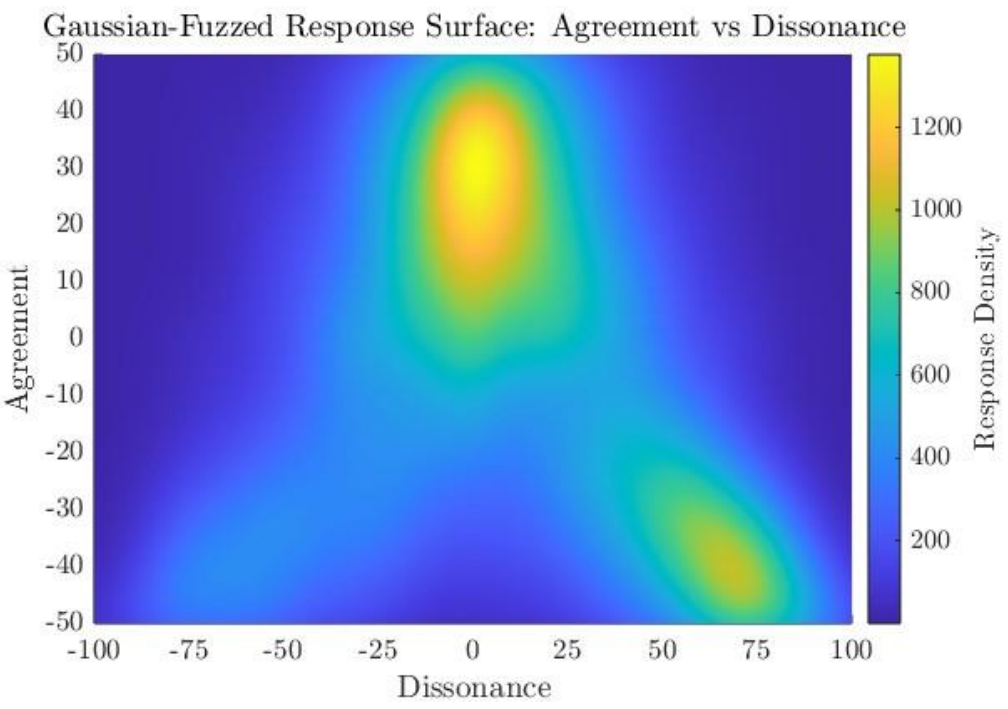
Political Opinion Dissonance vs Agreement





Political Opinion Agreement Surface





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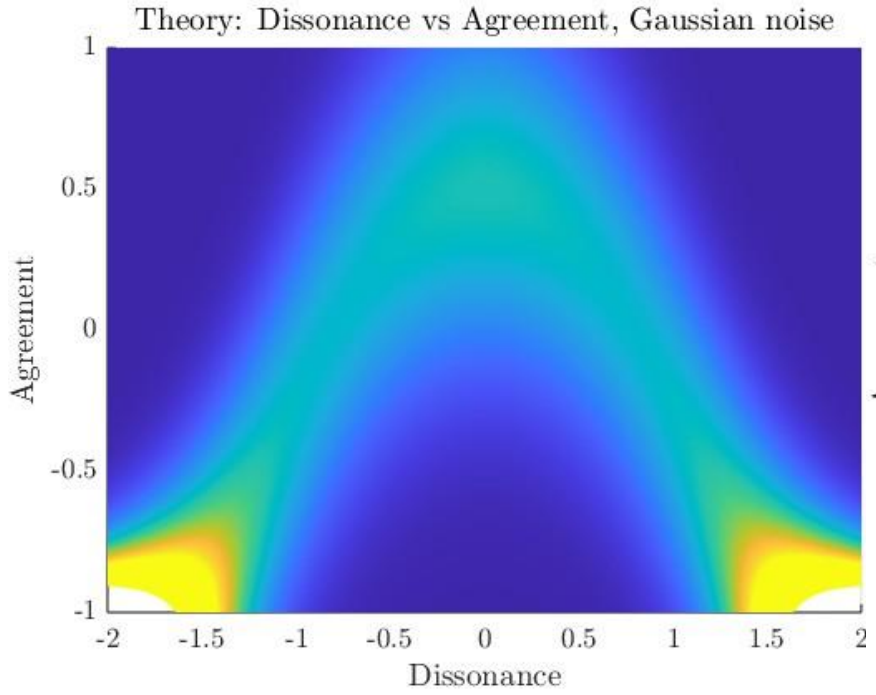
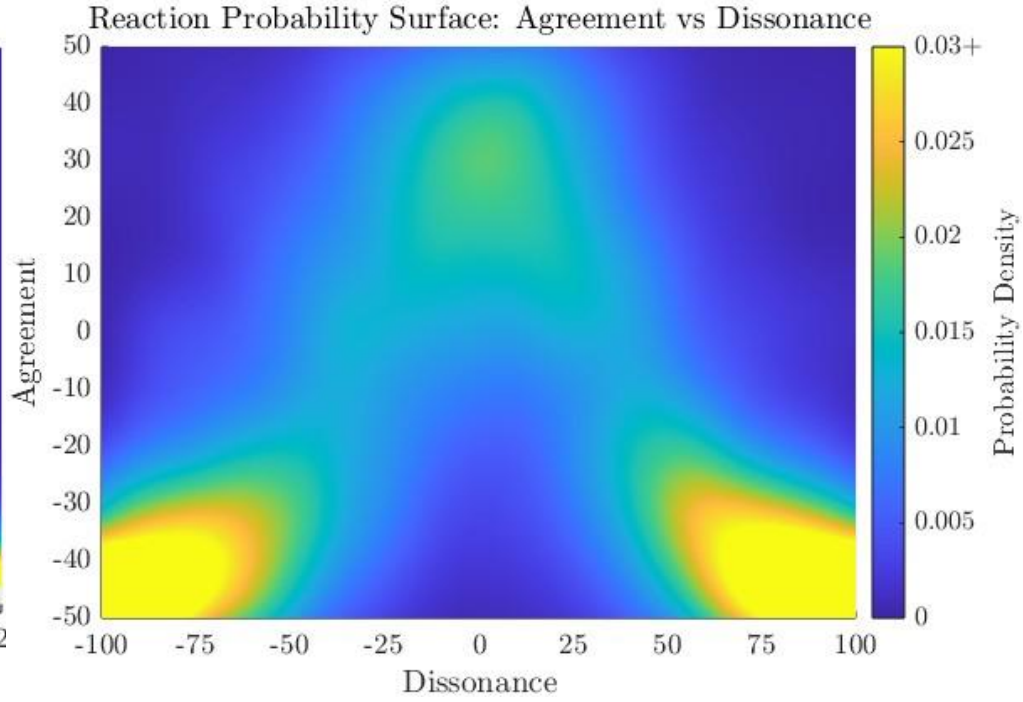
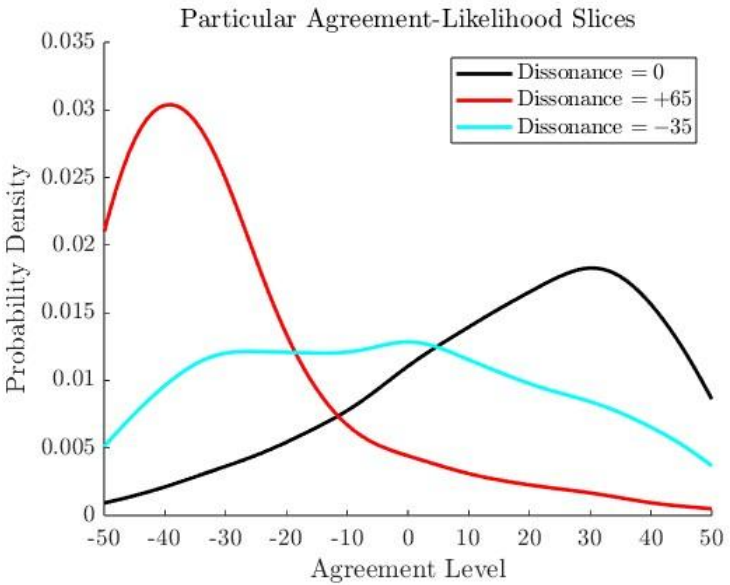
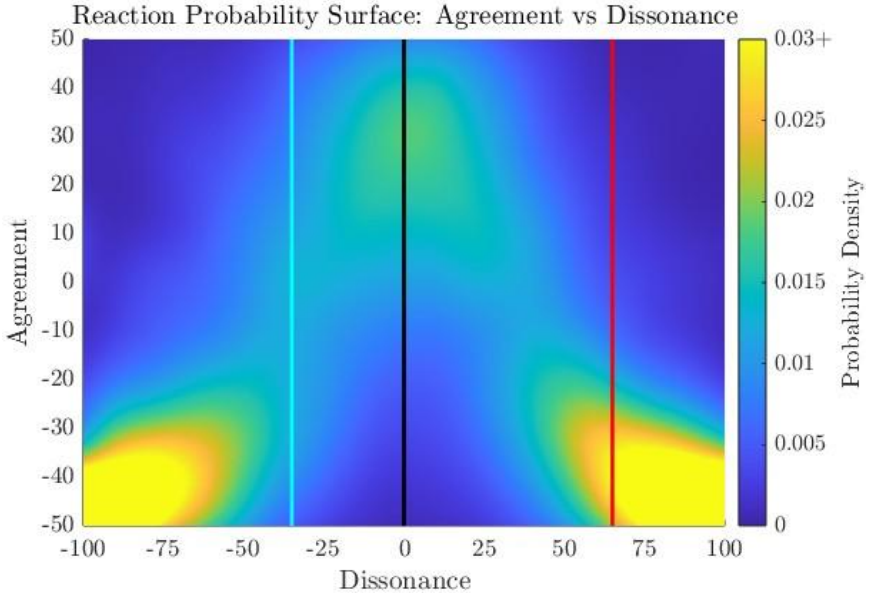




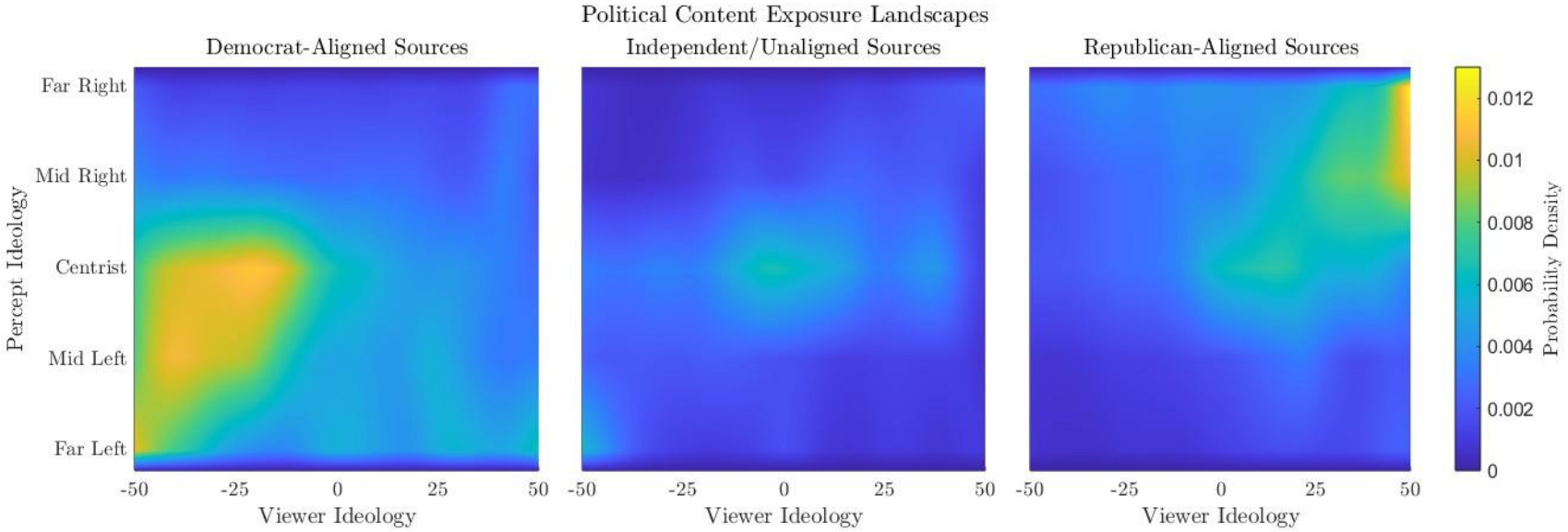
Political Opinion Agreement Surface

With this agreement surface, given a particular level of dissonance we obtain a probability distribution of likely agreement outcomes:





Self-Reported Political Information Ecosystem

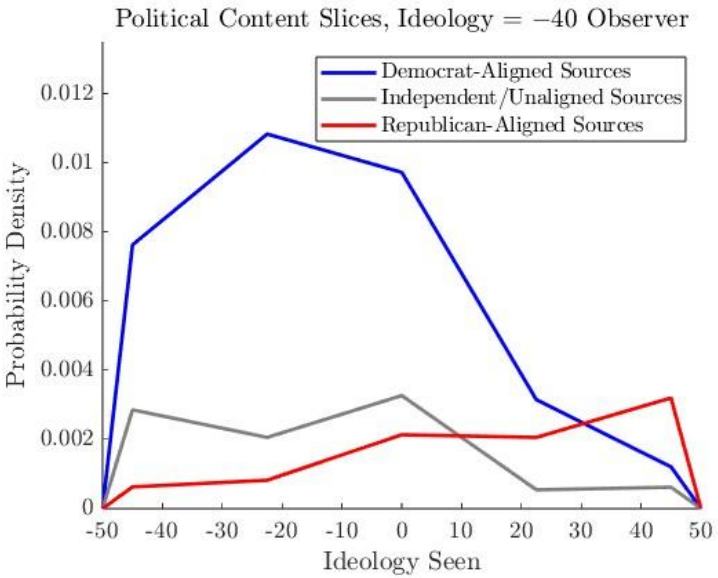


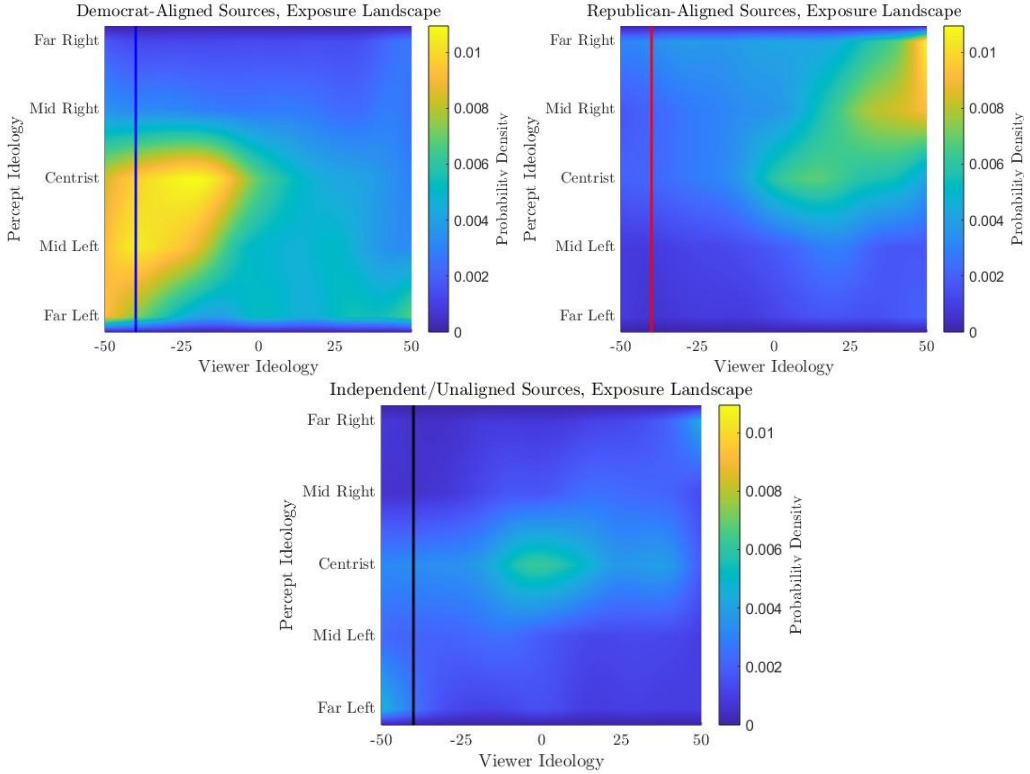
Very rough initial estimate, but pretty clear patterns!

(Saves many parameters relative to hypothesizing three surfaces)

Information Ecosystem: Implications

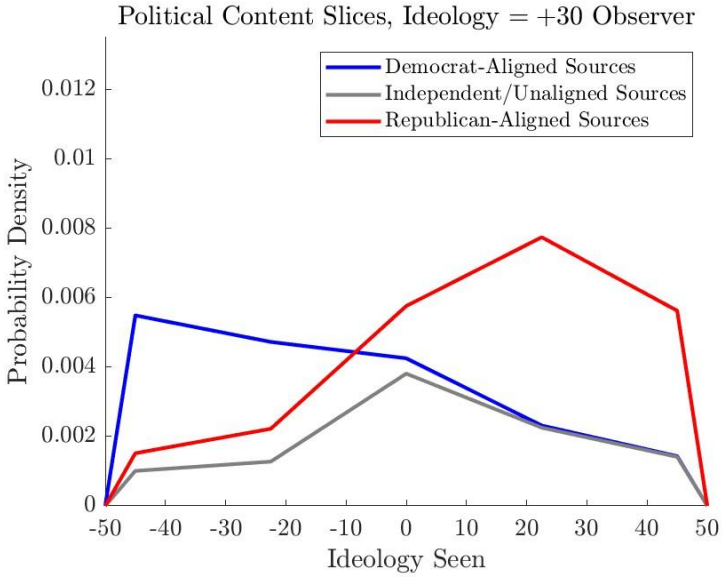
b = -40 (aka -0.8 on [-1,1] scale)

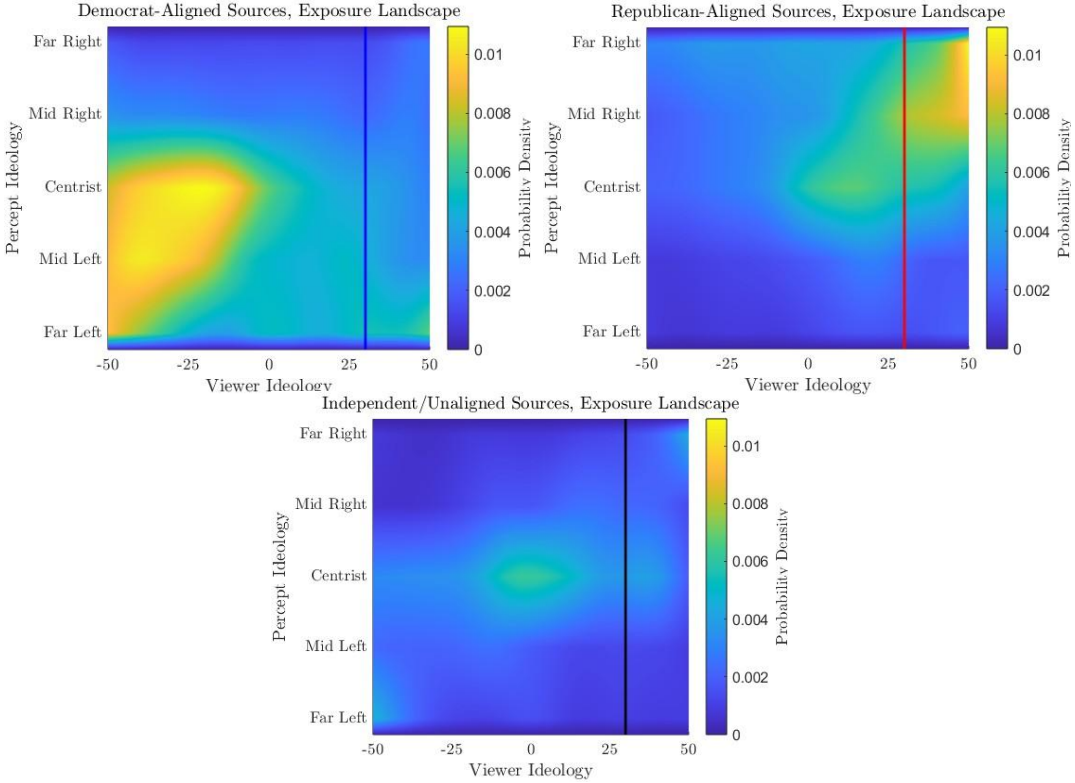




Information Ecosystem: Implications

b = +30 (aka +0.6 on [-1,1] scale)





Model Results Driven by Data

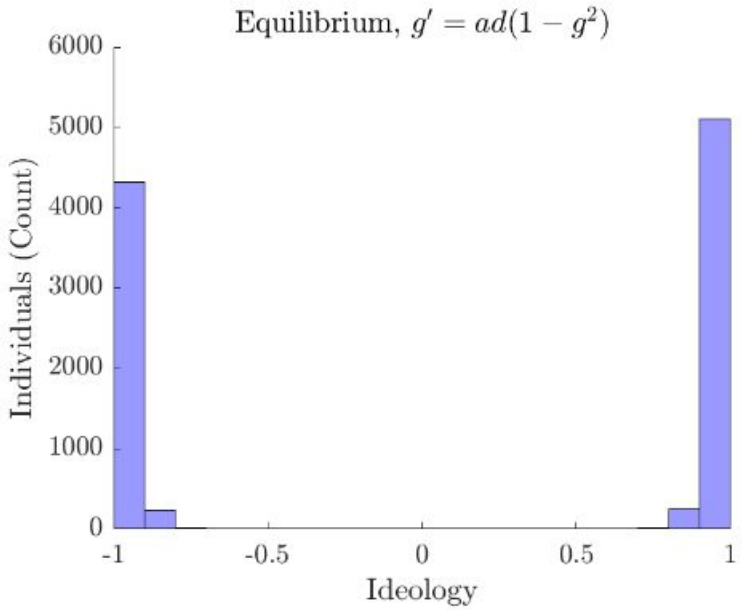
- Given a person's ideology, they see biased distributions of content of each **ideology value**
- Each bit of content implies a **dissonance**
- Each dissonance level implies a distribution of potential **agreement** levels to that content
    - Joint (2D) distribution of each dissonance and agreement: P(D, A)

→ Finally, put together into dynamical theory:

- Ideology Drift = Agreement * Dissonance

P(D,A)→**mean** drift and **stdev** of drift distribution at each ideo → SDE

So, what do the data say happens?



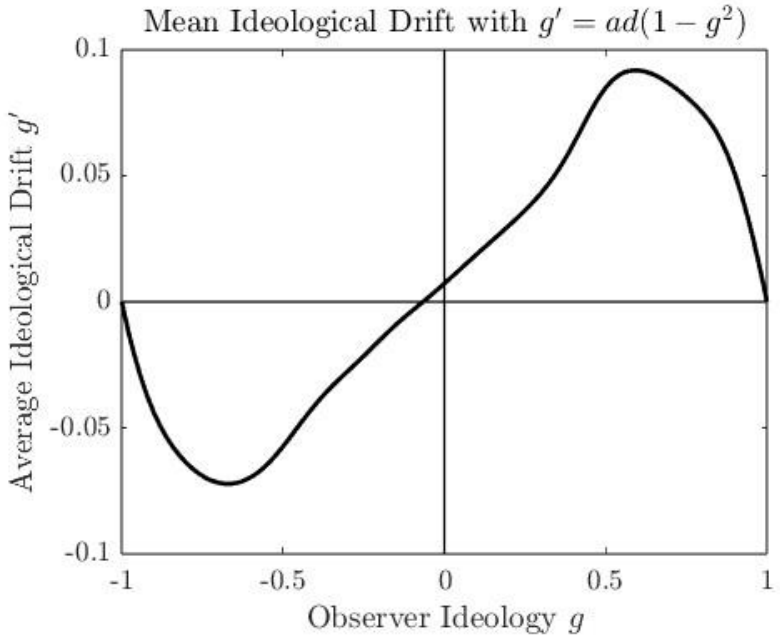
Model Results Driven by Data

This does NOT produce real-looking outcome distributions…

(everyone polarizes to ± 1)

Possible takeaways:

1. This is accurate, and people are actually polarizing like this, but *slowly*
2. We need to add more effects to our dynamical hypothesis of ideological forcing
3. We need more/better data, particularly for the content ecosystem



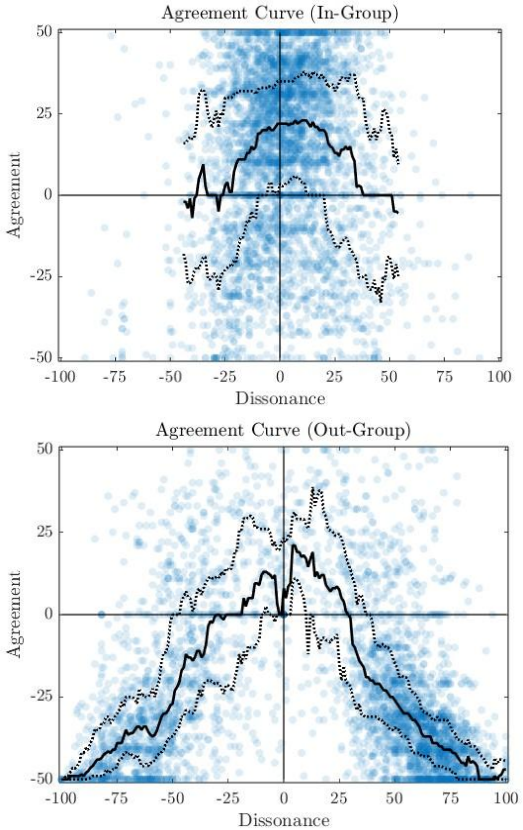
Our theory (as explanation for *current* distributions) was **falsifiable**! If we want to do better, we're forced to augment theory to reconcile with observations

Current Work: Alternate Dynamical Hypotheses

Can we come up with a new plausible theory which reproduces real-world ideology distributions as its equilibrium using only the data we have?

Challenge 1: In order to have different distributions for different parties, we need to have observer party matter

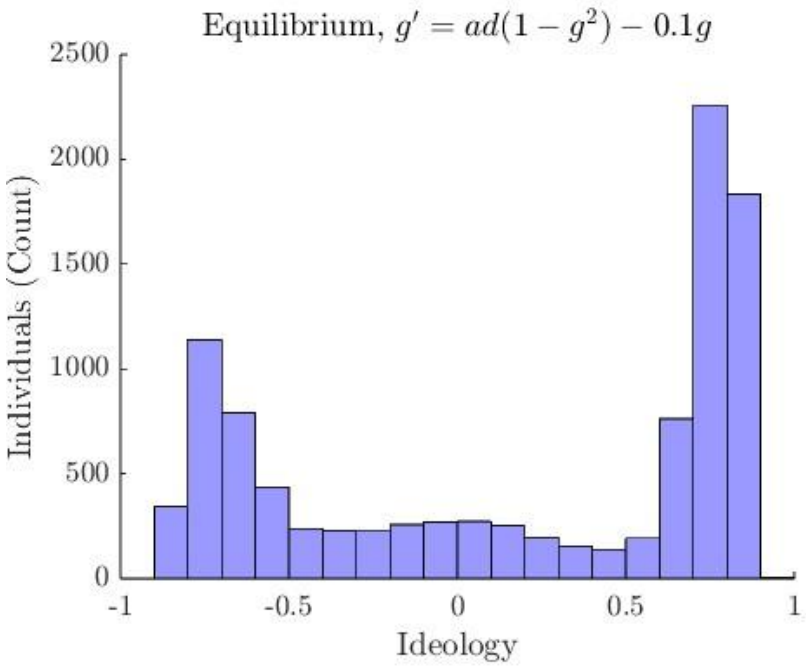
- But, hard to parse that from our data due to partisan segregation
  - Reaction and content surfaces are basically non-intersecting
  - So, must reintroduce free parameters to fit



Current Work: Alternate Dynamical Hypotheses

General observation: with basic theory, repulsion dominates

- First thought: centralizing bias
  - (e.g., social cost to being ideologically extreme)
  - try: linear attraction to center
- But this alone isn't enough:



Current Work: Alternate Dynamical Hypotheses

General observation: with basic theory,

repulsion dominates.

- Additional effect 2: **Saturating Dissonance**
  - The effect of dissonance (to attract or repel) saturates
  - hard-bound, or sigmoid
  - d $\rightarrow$ max(d, min(d, 1),-1)
- Additional effect 3: **Positive tribalism** (up-shift effective agreement towards in-group and one-step-away)
  - $a_{ij} = a + 0.15*(2-| i - j |)$

Current Work: Alternate Dynamical Hypotheses

General observation: with basic theory, repulsion dominates.

- Additional effect 4: **Cohesion bias**
  - Individuals feel pull towards current mean of their party
  - $g' = ad - 0.03(\mu_i - g)$

- Additional effect 5:

  out-group exposure estimation bias
  - As-is, Republicans mostly move due to large amounts of repulsive Democrat content, and Democrats are barely influenced at all by Republicans
  - Change:
    - Dems 40% more affected by Reps
    - Reps 45% less affected by Dems

Current Work: Alternate Dynamical Hypotheses

$$g'_{ij} = (\hat{a}_{ij}\hat{d} + 0.03 * (\mu_i - g))(1 - g^2) - 0.02g$$

$$\text{with } \begin{cases} g'_{DR} \to 1.4\ g'_{DR} \\ g'_{RD} \to 0.55\ g'_{RD} \end{cases}$$

$$\delta(g, i) = \sum_j P(g'_{ij}(g))$$

← probability distribution of g' for each type of observer i, at each ideology g

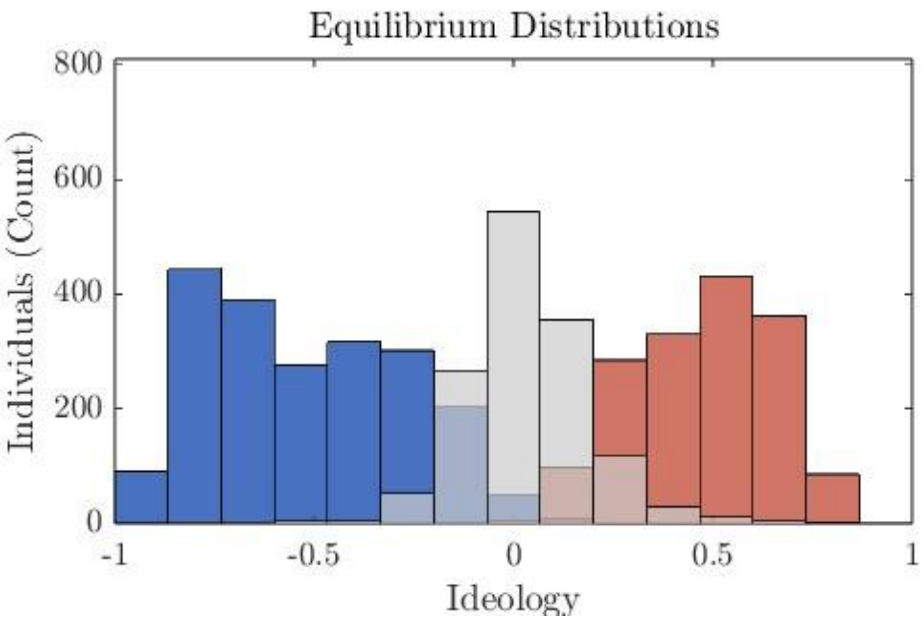
$$F(g, i) = \text{mean}(\delta(g))$$

$$G(g, i) = \text{std}(\delta(g))$$

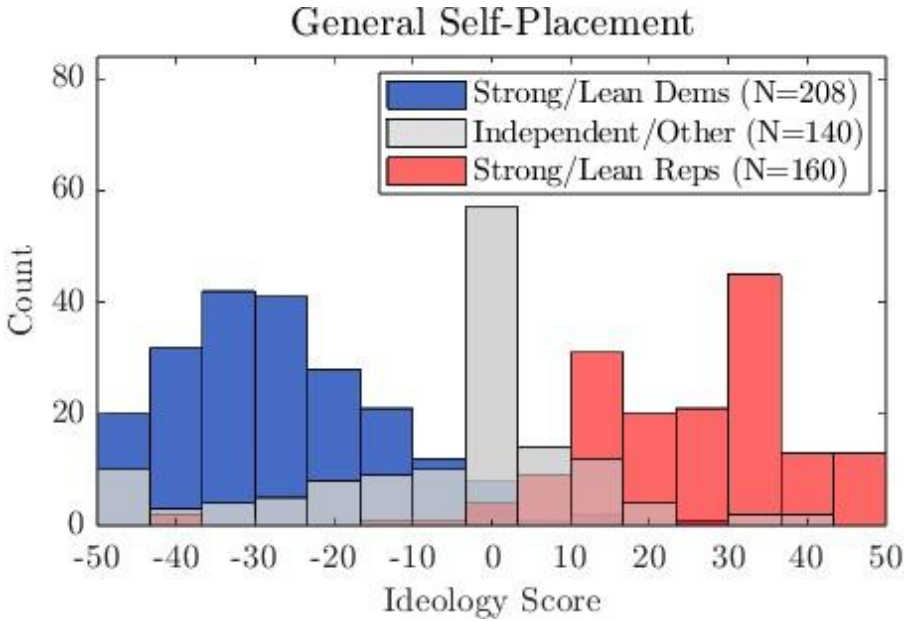
$$\text{d}g(g, i) = F(g, i)\text{d}t + G(g, i)\text{d}W$$

Current Work: Alternate Dynamical Hypotheses

Putting it all together (6 parameters, only 2 asymmetric):



(Simulated sample: 10x empirical sample)



Representative sample (Prolific platform)

Summary

Previously:

- assumed core functional forms (reaction, exposure), 5+ static parameters
- 8 fit parameters
- Idea for this experiment

Now:

- all core functional forms drawn from data
- 6 new fit parameters, possible crude moderating functions
- Ideas for where to look next
    - Refine exposure surface
    - Examine speaker-identity bias
    - See how close this gets us!

Big Picture

The hope for accurately modeling this system is severalfold:

- Predict undesirable outcomes
  - Hyperpolarization
  - Fractured/unrepresentative parties
- Inform interventions
  - Effective (consensus-building) political messaging
  - Responsible algorithm design
- Understanding confers resistance to manipulation tactics
  - Acknowledging personal biases = first step to seeing more clearly

Thank You!

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Complex Systems

Christopher Harding
University of Michigan
Physics/Complex Systems

Mary McGrath
Northwestern University
Political Science

LSA COMPLEX SYSTEMS
UNIVERSITY OF MICHIGAN

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Extreme Value Usage