Measuring Individual-level Belief System Networks Using Surveys

Ted Hsuan Yun Chen[1,2], Dianna Belman[1]

[1]Department of Environmental Science and Policy, George Mason University
[2]Helsinki Institute of Sustainability Science, University of Helsinki

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Belief Systems and Network Analysis

Belief systems

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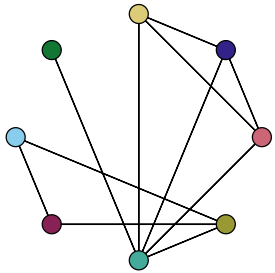

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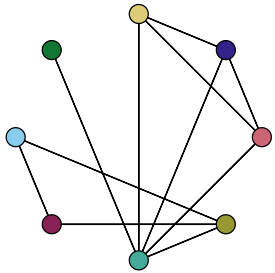
- Edges: perceived connections



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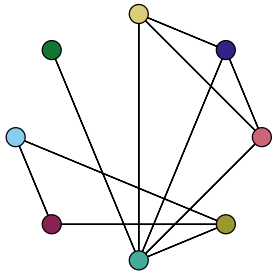

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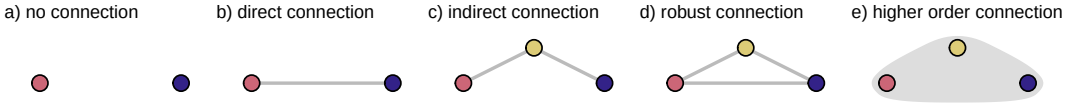
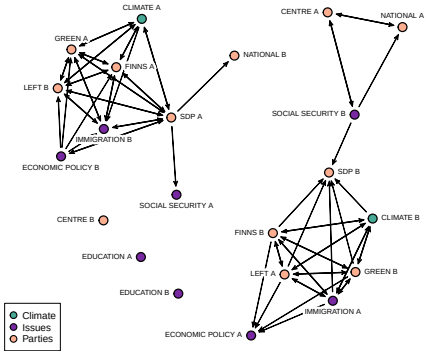
Even if you only care about pairwise constraints, networks matter.



Why do we need these measurements at the individual level?

Existing approaches tend to consider constraints at the aggregate level (e.g., correlation, mutual information).



Chen et al. 2021. "Polarization of climate politics results from partisan sorting: Evidence from Finnish Twittersphere." *Global Environmental Change* 71: 102348.

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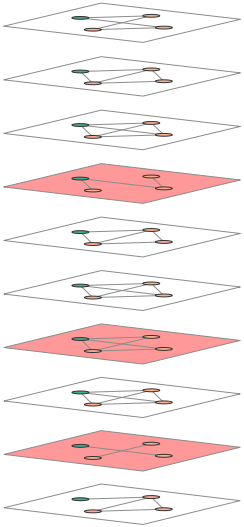
But...

- What is the aggregate capturing?
  Or we want the ability to specify what the edges are.
- Often, mental constructs are not positional.
- Individual-level approach fits nicely into the survey sampling and experimentation framework.
  Also extendable to a network of networks approach.



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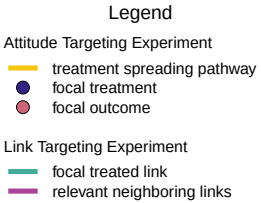

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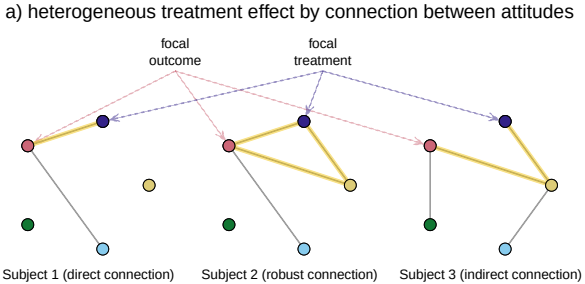


Legend

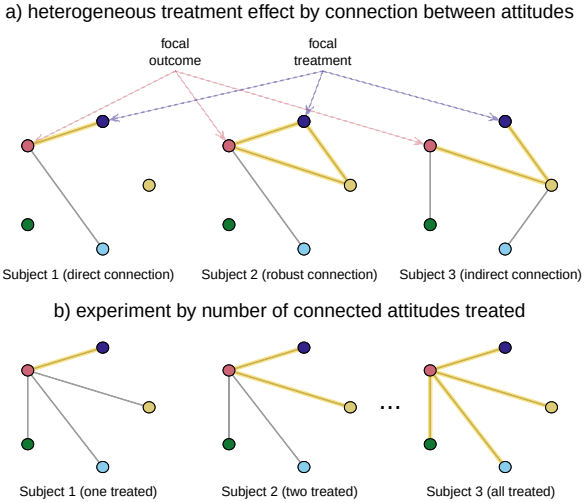
Attitude Targeting Experiment

- treatment spreading pathway
- focal treatment
- focal outcome

Link Targeting Experiment

- focal treated link
- relevant neighboring links

What can we do with this?



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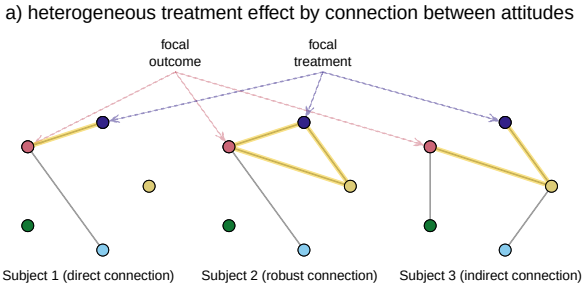
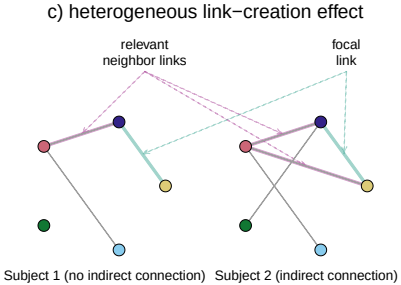




How to extract these networks from individuals?

Just ask them?

How to extract these networks from individuals?

Instructions:

In the grid below, click the box if your attitude toward the topic listed on the left side influences your attitude toward the topic listed on the top side.

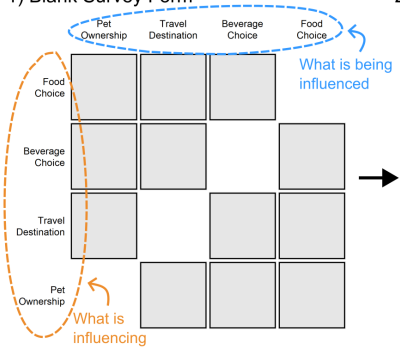
- When you click a box to connect two topics, the box will turn green.
- If you leave two topics unconnected, the box will stay gray.

= connected

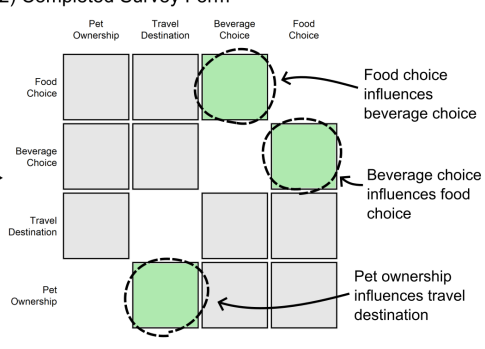
= not connected

Example:

1) Blank Survey Form



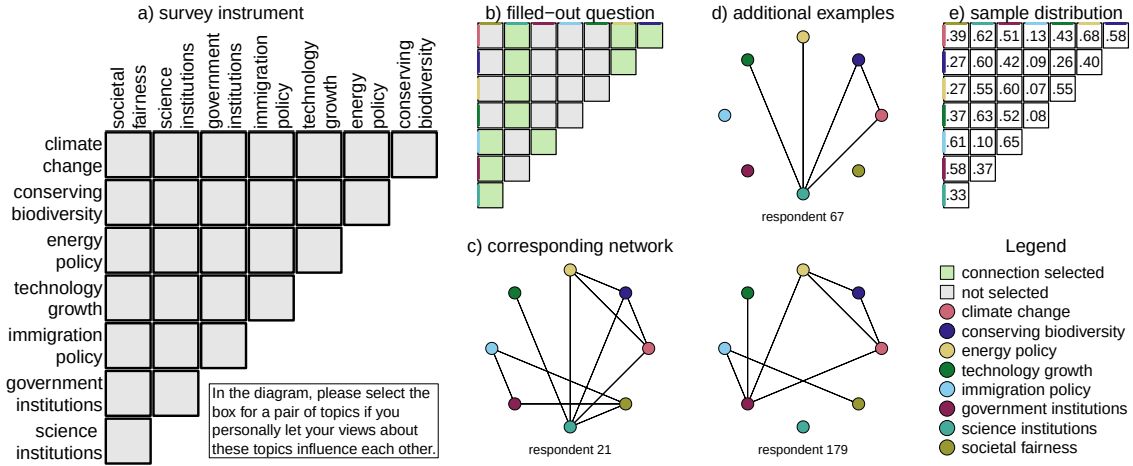
2) Completed Survey Form



In progress work

	Study 1	Study 2
Description	Exploratory implementation of graphical instrument	Factorial experiment of different instrument designs
Number of attitudes	8	4 or 5
Attitudes	climate change, biodiversity conservation, energy policy, technology growth, immigration policy, government institutions, science institutions, societal fairness	climate adaptation, renewable energy, biodiversity conservation, technology governance, science education
Edges asked about	Personal and perceived societal	Personal
Sample	220 U.S. Southeast Coast adults, gender and partisanship stratified	576 U.S. adults, gender and partisanship stratified
Field date	Jan. 2024	Jun. 2024

Data overview: Study 1



Experiment design overview: Study 2

(Almost) fully crossed experiment

1. Are edges directional?
2. Two different ordering of attitudes
3. Is one attitude omitted? (i.e., 4 or 5 attitudes)
4. Are edges weighted?
5. Graphical or non-graphical

Group	Directed	Order	Omitted	Weighted	Graphical
1	0	0	0	0	0
2	1	0	0	0	0
3	0	1	0	0	0
4	1	1	0	0	0
5	0	0	1	0	0
6	1	0	1	0	0
7	0	1	1	0	0
8	1	1	1	0	0
9	0	0	0	1	0
10	1	0	0	1	0
11	0	1	0	1	0
12	1	1	0	1	0
13	0	0	1	1	0
14	1	0	1	1	0
15	0	1	1	1	0
16	1	1	1	1	0
17	0	0	0	0	1
18	1	0	0	0	1
19	0	1	0	0	1
20	1	1	0	0	1
21	0	0	1	0	1
22	1	0	1	0	1
23	0	1	1	0	1
24	1	1	1	0	1

How did subjects interact with the graphical instrument?

People are not mindlessly clicking.

"I like the "green box" exercise, forces you to think."

"Everything is connected." [This person clicked everything.]

"My thoughts about one topic didn't influence any other, so I didn't make any connections in the previous question." [This person clicked nothing.]

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Study	Remember instructions	Interpret example correctly	
1	0.99	0.65	
2	0.99	0.84	← improved instructions

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Accessibility issues

> *"I am blind so I could not click the boxes in the topic thing."*

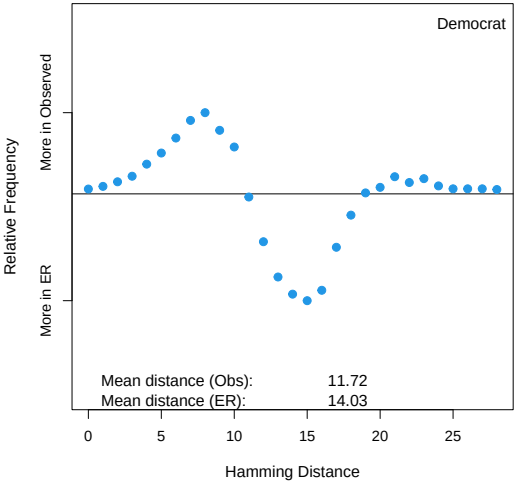
Is there some coherence to the elicited networks?

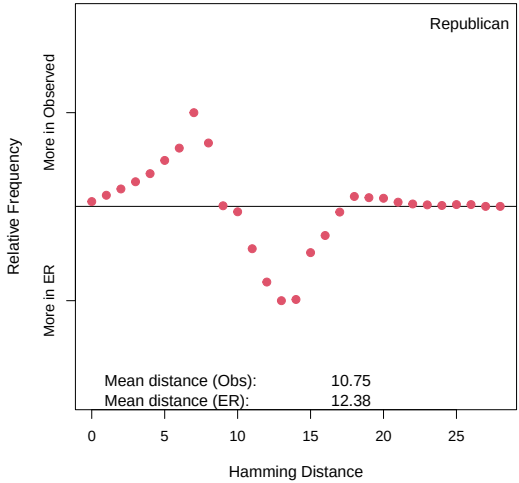
Take all observed networks (i.e., from respondents) and see how different they are from each other (e.g., Hamming distance).

Then, compare the observed distribution of distances to a null distribution of what random responses would look like.

Is there some coherence to the elicited networks?

Hamming distance: all observed networks versus ER networks (p = observed)





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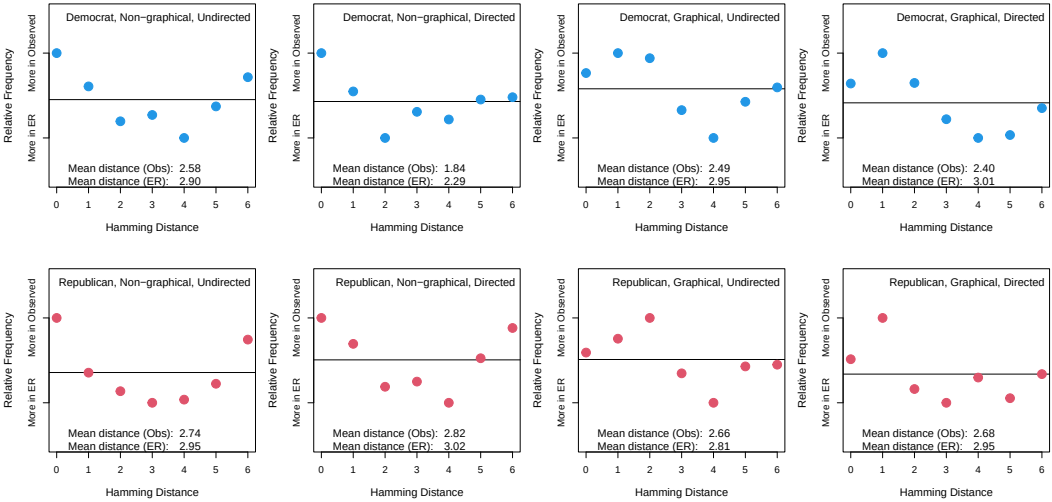
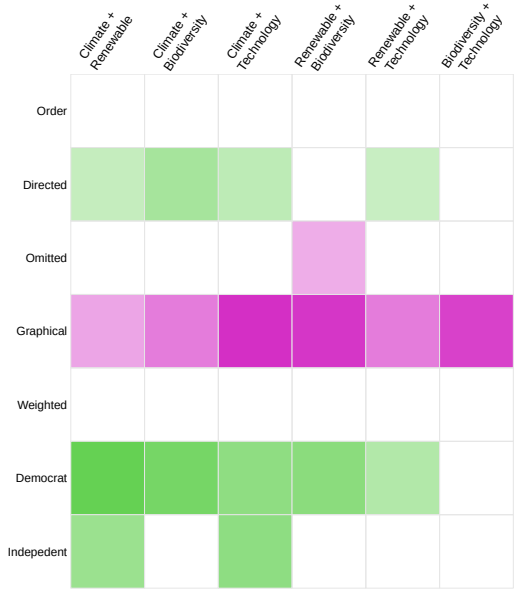


Does instrument design matter?

Experimental results from study 2:

- Cells: Effect of design choices
- Columns: Models for edge between two attitudes
- Rows: Variable for instrument design and party id



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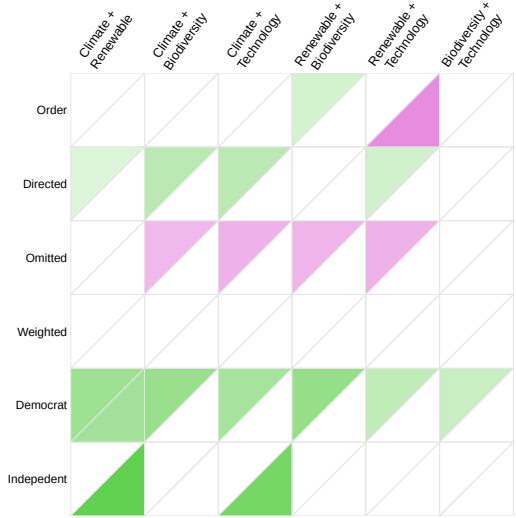
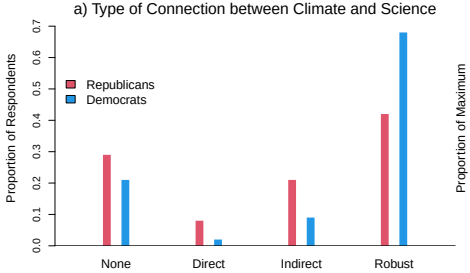
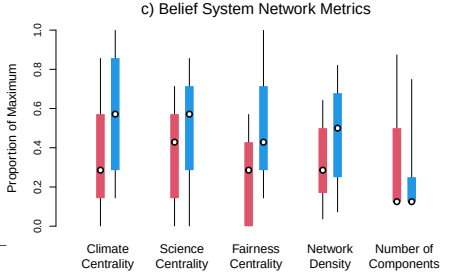
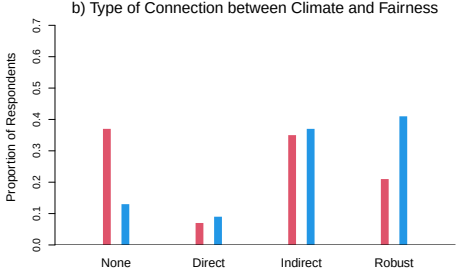
- Top left: non-graphical
- Bottom right: graphical

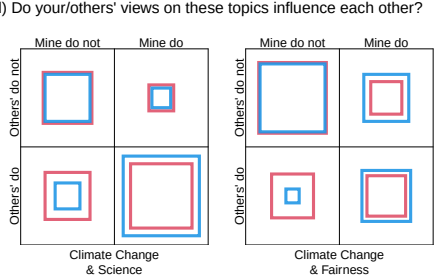


Some initial exploratory analysis









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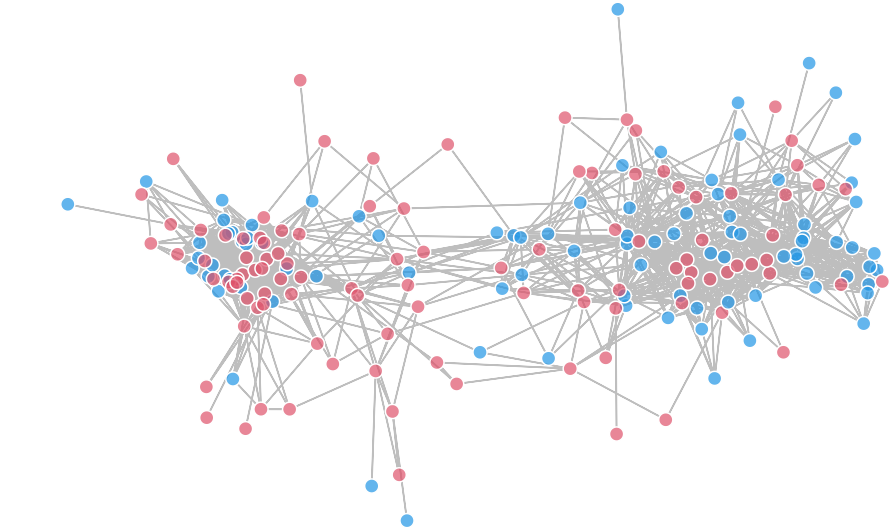
Network of networks approach



Additional analysis to come...

- Beyond edgewise similarities
- Comparison to aggregation approaches
- Predictive validation with respondent characteristics

Overview of follow up studies

	Study 3	Study 4
Description	Factorial experiment of different instrument designs (extension of study 2's design)	Application to American National Election Studies attitudes
Number of attitudes	4 or 5	7 or so
Attitudes	climate adaptation, immigration policy, housing policy, technology governance, social welfare	ANES attitudes + climate change
Edges asked about	Personal	Personal and perceived societal
Sample	500-600 U.S. adults, gender and partisanship stratified	1000-1200 U.S. adults, gender and partisanship stratified
Field date	Jul. 2024	Oct.-Nov. 2024

Related work that will build on this

- Links between renewable energy and biodiversity conservation among U.S. farmers (funded by the CSSN)
- Climate adaptation and related beliefs (funding proposal under review)
- Climate migration, NIMBYism, and concepts of fairness

Ted Hsuan Yun Chen
ted.hsuanyun.chen@gmail.com
https://tedhchen.com