Mapping Individual Level Belief Systems: Testing the Influence of Attitude Centrality, Belief

System Density, Individual Differences, and Political Identity in Within-Person Political Attitude

Dynamics

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All data and materials located at:
https://osf.io/tc5rf/?view_only=1df54afb189f4de198cc9fbe9ff71450

Preregistration for Study 4 located at:
https://osf.io/5vc7e/?view_only=f1b86c6b07e340a0b53710bc89df79c2

CRediT Author contributions
AC: conceptualization, methodology, software, formal analysis, investigation, data curation, writing- original draft, visualization
MB: conceptualization, methodology, resources, data curation, writing- review & editing, supervision, funding acquisition

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Abstract

Belief systems are an individual-level construct. Scholars have been unable to study them as such. As a result, key predictions from prominent theories of belief systems and inter-attitude structure have been left untested at the appropriate level of analysis. In four studies (N Study 1 = 387, N Study 2 = 389, N Study 3 = 598, N Study 4 = 1156), we use the conceptual similarity task to measure individual-level belief systems, allowing us to directly test key predictions from theories of political belief systems and inter-attitude structure. In line with hypotheses, we find that identity-based elements are more central to belief systems than policy-based elements, that those who are higher in political knowledge and political engagement have denser belief systems than those who are lower in political knowledge and political engagement, and that attitudes that are more central to belief systems are more stable over time than attitudes that are peripheral to belief systems. In contrast, our results are mixed with respect to whether those higher in political knowledge and political engagement have symbolic elements as more central to their belief systems than those lower in these constructs, and whether those with dense belief systems have more stable attitudes over time. Taken together the mixed support we find for the predictions of prominent theories of belief systems and inter-attitude structure at the individual level of analysis underscores the importance of testing theories at the theoretically appropriate level of analysis.

Statement of Limitations

The main limitations of this research are that all studies consist of samples of U.S. Americans, that we do not study how belief system structure and its implications vary across identity groups within the U.S and that the theory of belief system dynamics we build on makes causal assumptions that we do not test as part of our work. These limitations and their implications are discussed in more detail in the "Limitations" section in the general discussion,

and we provide an overview of them in Table 4 in the general discussion. As readers engage with our work, they should bear these limitations in mind.

Mapping Individual Level Belief Systems: Testing the Influence of Attitude Centrality, Belief System Density, Individual Differences, and Political Identity in Within-Person Political Attitude Dynamics

Social scientists frequently debate and investigate the structure of political belief systems and their effects on political beliefs and behaviors (e.g., Ansolabehere et al., 2008; Boutyline & Vaisey, 2017; Brandt & Sleegers, 2021; Campbell et al., 1960; Converse, 1964; Conover & Feldman, 1981; Eagly & Chaiken, 1993; Fishman & Davis, 2022; Goldberg & Stein, 2018; Goren et al., 2009; Mondak, 1993; Zaller, 1992). These debates are pivotal because belief systems shape how people perceive and engage with politics, and influence attitude stability and change (Bakker et al., 2020; Brandt, 2022; Brandt & Sleegers, 2021; Converse, 1964; Coppock & Green, 2022; Goldberg & Stein, 2018; Kam, 2005; Van Zomeren, 2013).

Until recently, there has not been methods to empirically study belief systems as *systems*, meaning that key theories lack direct tests of their predictions. A first step towards studying belief systems as systems has used tools from network science (e.g., analysis of centrality, density) to explore structural properties of political attitudes and identities (e.g., Boutyline & Vaisey, 2017; Brandt et al., 2019; Van Noord et al., in press). This approach often relies on correlations or partial correlations crafted from cross-sectional data, which does not capture the within-persons associations theoretically relevant when studying belief systems (Brandt & Morgan, 2022). As a result, most research on belief systems cannot properly evaluate core questions of the field. A newly validated method, the conceptual similarity task, measures individual-level belief systems (Brandt, 2022). Here, we apply this measure to address long-standing questions about belief system structure and attitudinal dynamics.

Why Does Belief System Structure Matter?

Belief systems are networks of interconnected attitudes and identities that help people navigate the political world (Converse, 1964; Jost, 2006). The idea is that belief system elements (e.g., political attitudes and identities) are connected to each other for at least some people and that these connections are meaningful. For example, one model (Brandt & Sleegers, 2021) suggests these connections are causal, meaning changes in one element require changes in connected elements (and vice versa), following Converse's notion of dynamic constraint (Converse, 1964). For example, if someone's attitude about the Democratic party is connected with their attitude about abortion, these two attitudes will influence each other and a change in one could precipitate a change in the other. This connected network of political attitudes and identities is the lens people use to interpret and understand their political world.

This conceptualization of belief systems as networks underscores the importance of studying belief system structure. If elements of a belief system are connected and influence one another, then differences in belief system structure will result in different political and attitudinal dynamics. For example, a classic question in the belief system structure literature is what is central to belief systems (Converse, 1964; Ellis & Stimson, 2012)? If operational elements (or issues) are more central (i.e. strongly interconnected with the rest of the belief system), then it would suggest that operational elements are the key for understanding the dynamics of people's political attitudes. However, if symbolic elements (or identities, such as partisanship) are more central, then it would suggest that symbolic elements are key for understanding these dynamics. Similarly, belief system elements that are more central should have different dynamics over time, exhibiting greater stability as their neighbors in the belief system hold them in place. To the extent people differ in their belief system structures, they will also differ in their belief system dynamics. In what follows, we expand upon prominent ideas regarding belief system structure

and its theorized implications. We then test these ideas at the individual-level of analysis for the first time and discuss their implications for political attitudes longitudinally and cross sectionally.

What is Central to Political Belief Systems?

A core debate about belief system structure revolves around what is central to belief systems (e.g., Ansolabehere et al., 2008; Brandt et al., 2019; Campbell, 1960; Conover & Feldman, 1981; Converse, 1964; Downs, 1957).[2] Some argue that symbolic or identity-based elements, like partisanship and ideological labels, are central (Campbell et al., 1960; Converse, 1964; Kinder & Kalmoe, 2017). This would be consistent with findings from partisan-framing experiments, where people adjust their policy positions to align with their party's stance (Ditto et al., 2019). Others, however, suggest that operational elements, or attitudes about policy issues, hold greater centrality (Ansolabehere et al., 2008; Chen & Goren, 2016; Devries et al., 2013).

Recent advancements in network methods (Epskamp & Fried, 2018) offer new tools to examine this question. Brandt et al. (2019) applied these methods to survey data in New Zealand and found that symbolic elements were more central than operational ones. These symbolic elements were more predictive of socio-political behaviors like voting, pro-environmental actions, and religious behaviors than operational elements were. Scholars found similar results in the U.S. (Boutyline & Vaisey, 2017; Fishman & Davis, 2022) using similar approaches.

Despite these insights, previous work is limited by its reliance on cross-sectional correlations. These studies (e.g., Boutyline & Vaisey, 2017; Brandt et al., 2019) estimate between-person relationships, which do not reflect the within-person dynamics theoretically relevant when studying belief systems (Brandt & Morgan, 2022; Hanmaker, 2012).

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[2] Central versus peripheral attitudes in inter-attitude structure refer to their *structural position* in the belief system. This is different from central and peripheral *routes to persuasion*, as elaborated on in the Elaboration Likelihood Model (Petty & Cacioppo, 1986).

Consequently, they cannot fully test key predictions about belief systems, or account for individual level variation in belief system structure. For instance, population level analyses makes it impossible to detect if some people have operational elements as central to their belief systems. Therefore, the first question we address is whether symbolic elements are indeed more central to individual belief systems than operational elements, and how much variation exists around general trends. It is possible that nearly all individuals have symbolic elements as central to their belief systems. However, it is also possible that a sizable minority of individuals have operational elements as central to their belief systems, a pattern past approaches to the study of belief systems would not be able to detect.

If variation in symbolic vs. operational centrality exists, what drives it? One hypothesis is that politically knowledgeable and engaged people are more likely to center their belief systems around symbolic elements. Consistent with this idea, politically knowledgeable and engaged people are more likely to have coherent alignment between their partisan identities, ideological identities, and substantive policy positions compared to less politically knowledgeable and less politically engaged people (Converse, 1964; Kinder & Kalmoe, 2017). Similarly, a comprehensive review (Malka & Federico, 2023) concludes that the politically engaged are more likely to adopt the packages of issue positions forwarded by in-party elites (see also Boutyline & Vaisey, 2017). Taken together, this work suggests that when symbolic element centrality is examined at the individual level, those who are politically knowledgeable and politically engaged should be more likely to have symbolic elements as central to their belief systems than those who are less politically knowledgeable and politically engaged. This is the second prediction we test.[3]

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[3] In our Study 4, we also preregistered the hypothesis that people who have symbolic elements as most central will have more stable political attitudes overall. We do not find support for this idea (see supplemental materials) and

Implications of Attitude Centrality for Belief Stability Versus Change

The debate about what is central to belief systems is important because theories of inter-attitude structure suggest that central attitudes have special properties. Central attitudes, being more connected to other attitudes, are held in place by these connections, making them more stable over time compared to peripheral attitudes (Eagly & Chaiken, 1993; Rokeach, 1968; Scott, 1959). The more connections an attitude has, the more resistant to change it should be.

This idea is rooted in cognitive consistency theories (Heider, 1946; Festinger, 1957; Gawronski & Strack, 2004; Gawronski, 2012; Newby-Clark et al., 2002), which propose that cognitive inconsistency is psychologically uncomfortable, and thus will be avoided. When a central attitude shifts and becomes inconsistent with its neighboring attitudes, the resulting discomfort discourages change holding the attitude in place. For example, if an individual's negative attitude towards the Republican party is central to their belief system, if this attitude were to change to become positive, it would come into conflict with many other attitudes. In contrast, if this same individual's attitude towards same-sex marriage is peripheral to their belief system then changing this attitude should be easier. Because the attitude isn't closely tied to many other attitudes, the change creates much less inconsistency in the belief system, and so is psychologically easier to make.

The straightforward prediction from this idea is that central attitudes will be more stable overtime (a hallmark of strong attitudes; Luttrell & Sawicki, 2020) than peripheral attitudes. This longitudinal hypothesis has not been tested before. However, scholars have tested if central

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with additional time and consideration, we are not confident in our original reasoning behind this hypothesis (see supplemental materials). Therefore, we do not mention this hypothesis further in text. In the supplemental materials on OSF, we provide results pertaining to this hypothesis, and detail why we now think our original reasoning is fundamentally flawed.

attitudes of a belief system are harder to persuade in the short-term than more peripheral attitudes (Brandt & Vallabha, 2023). This work found that central attitudes are no more resistant to persuasion than peripheral attitudes, which is generally inconsistent with frameworks that predict centrality should correspond to increased attitude stability. Notably, these authors did not examine people's political identities (they only looked at issues). If political identities (i.e., symbolic elements) are most commonly central to belief systems as past work suggests (e.g., Boutyline & Vaisey, 2017; Brandt et al., 2019), then these authors missed core elements of the belief system and their estimates of the effect of centrality on attitude stability versus change may be inaccurate.

Belief System Network Density

While individual attitudes vary in their centrality to a belief system network, people's belief systems as a whole also vary in how interconnected their elements are at an aggregate level. Put differently, overall belief system connectivity exists as a meaningful, person level variable. Some individuals have dense, coherent belief systems, resembling Converse's (1964) "ideologues," with strong connections between their identities and issue positions (Boutyline & Vaisey, 2017; Kinder & Kalmoe, 2017). Others perceive little connection between their attitudes and identities.

Theory predicts political knowledge and political engagement are key factors in driving belief system density. The politically knowledgeable and political elites tend to have more coherent and connected belief systems than less knowledgeable citizens (Converse, 1964; Federico & Malka, 2018; Kalmoe, 2020). Studies employing network methods also show that during election campaigns, belief system density increases more for those high in political knowledge (Fishman & Davis, 2022), and politically engaged individuals consistently exhibit

more coherent connections between belief system elements that should in expectation be related

(Brandt, 2022; Federico & Malka, 2023; Kinder & Kalmoe, 2017; Zaller, 1992). We test whether

higher political knowledge and political engagement are associated with greater belief system

density (i.e., more interconnected belief system elements).

Consistent with this prediction, evidence from a study using the same method and some

of the same data (Brandt, 2022) we use shows that politically knowledgeable and engaged

individuals are more likely to view ideologically consistent attitudes as linked and ideologically

inconsistent attitudes as oppositional. We expand on this by focusing on the overall density of the

belief system, rather than just individual pairwise connections. This is important as the

relationship between overall belief system connectivity and political knowledge and engagement

is one of the most consistent predictions offered by theories of belief systems and individual

differences (Converse, 1964, Kinder & Kalmoe, 2017, Malka & Federico, 2023), yet

methodological limitations have prevented complete empirical tests of the claim.

Belief network density, and the individual differences that predict it is of both theoretical

and practical interest as greater belief system density has been linked to increased attitude

stability over time in simulation studies (Brandt & Sleegers, 2021). In a dense belief system,

each attitude is more strongly tied to others, creating a network where changes in one attitude

would require corresponding changes in many other interconnected attitudes. This is

psychologically taxing and so the more interconnected elements are at the network level, the

more likely attitudes in the network are to remain stable, resisting external influences (Brandt &

Sleegers, 2021). In contrast, attitudes in less dense belief systems, where fewer connections exist,

have more freedom to change without disrupting the overall system. Therefore, we test whether

people with denser belief systems show greater stability in their political attitudes over time compared to those with less dense belief systems.

The Current Research

We conducted four studies to test five theoretically derived predictions about individual level belief systems. For Studies 1-3, we reanalyzed existing data from Brandt (Studies 1-3, 2022). These studies were originally preregistered (see Brandt, 2022), but not for our purposes. For Study 4, we collected new data and preregistered our hypotheses, methods, and analyses. Studies 1 and 2 are cross-sectional, and allow us to test predictions regarding the extent to which symbolic and operational elements are central to people's belief systems, whether symbolic belief system elements are more central for those who are high in political knowledge and political engagement, and whether those who are politically knowledgeable and politically engaged have denser belief systems than those who are less politically knowledgeable and engaged. Studies 3 and 4 are longitudinal studies that allow us to replicate investigations of the cross-sectional predictions and to test predictions regarding attitude stability over time. Specifically, the longitudinal studies also allow us to test whether more central attitudes are more stable, and whether those with dense belief system have more stable attitudes over time.

Methods

Transparency and Openness

We report how we determined our sample sizes, provide relevant measures in text, and provide full study materials on our freely accessible OSF page. We take this approach because as part of our research, we conduct secondary analysis of existing data previously published by Brandt (2022). Only some measures are of theoretical interest to the present research questions. We follow JARS to the best of our abilities given our use of secondary data and the pre-

registered design for Study 4, as we preregistered that we would be studying the pure control condition of an omnibus study fielded by our lab (Appelbaum et al., 2018). All of our study data, analysis code, and materials are available at https://osf.io/tc5rf/?view_only=1df54afb189f4de198cc9fbe9ff71450. Data were analyzed using R version 4.3.0. Studies 1-3 were preregistered, but not for our purposes (see Brandt, 2022). Study 4 was preregistered for our present purpose, but non-normal distribution of a key dependent variable, and a recognition of flaws in our original logic necessitated some deviations from our preregistration. We report all preregistered results in our supplemental materials on OSF and explain all deviations from our pre-registration.

Samples and Recruitment

All samples were US Americans recruited from Prolific. Table 1 includes the demographic and sample size information from all samples. In all studies, sample size was determined by funding considerations[4]. Studies 1-3 were originally conducted and preregistered for the purposes described by Brandt (2022). Study 4 was conducted and preregistered in part for the purposes of the present research (see OSF page linked above). Because all 4 studies share a similar design, we describe them simultaneously. Key differences include the specific political attitudes studied and the number of longitudinal waves in Studies 3 and 4. Before data collection, all studies received appropriate IRB approval. Studies 1 and 2 were approved by the Ethics Review Board at XXXX University ("Individual Belief Systems," RP54). Studies 3 and 4 were determined exempt from full review at YYYY University ("Measuring the Belief Systems of a

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[4] Although sample sizes were determined by funding considerations, simulation-based power analyses conducted in simr (Green & MacLeod, 2016) suggested we are 80 to 100 percent powered to detect our effects of interest across all models in all samples, with most power calculations being near 100 percent power. We report these results in the Supplemental Materials and provide the code to replicate our analyses on our OSF page. Effect sizes were chosen based on previous research though all were small to moderate (.1-.15), except for the effects of centrality and density on stability as past work (e.g., Brandt & Sleegers, 2021; Eagly & Chaiken, 1998) suggests these effects should be moderate to large (.3 to .5 were used as effect sizes in simulations).

Person," STUDY00006894; "Moral Reframing Interventions and Belief System Structure,"

STUDY00009243).

Table 1
Sample and demographic information for all studies

Sample Information	Study 1	Study 2	Study 3 Time 1	Study 3 Time 2	Study 4 Time 1	Study 4 Time 2	Study 4 Time 3
N	387	389	598	536	1216	363	341
Response rate				89.7%		94.1%	85.0%
M_{age}	35.2	36.2	37.9	38.5	43.43	44.3	44.4
SD_{age}	12.6	13.5	13.9	14.1	14.3	14.36	14.36
Gender							
Female	—	—	291	252	579	184	173
Male	—	—	294	272	560	170	162
Sex & Gender Diverse	—	—	11	10	15	7	5
Missing	—	—	2	2	2	2	1
Ethnicity							
White	76%	77%	80%	80%	73%	74%	75%
Black	7%	8%	6%	6%	10%	11%	10%
Asian	5%	7%	5%	4%	4%	2%	3%
Hispanic	5%	4%	4%	4%	4%	6%	6%
Other ethnicities	7%	4%	6%	6%	8%	7%	7%

Note: Information for Studies 1-3 are from Table 1 in Brandt (2022). Gender identity was not collected in Studies 1 and 2. There was 1 week between Time 1 and 2 for Study 3. There were 2 weeks between Time 1 and 2 and between Time 2 and 3 in Study 4. The number we report for Study 4 Time 2 and Time 3 are for subjects assigned to the control condition, who we analyze to test our longitudinal predictions. (See main text and preregistration.)

Studies 1 and 2 were opened for 400 people on Prolific with approval ratings of 95 or

higher, who were born in the U.S., had U.S. nationality, and lived in the U.S. at the time of data

collection. Because of the verbal nature of the task, analysis was restricted to those who reported

English as their primary language. For Study 3, the study was opened to 600 participants at Time

1 with approval ratings of 95 or higher, who were born in the U.S., lived in the U.S. at the time

of data collection, and who reported being fluent in English according to Prolific's pre-screening

tool. For Study 4, we opened a task on Prolific to recruit 1200 participants who were in the U.S.,

reported their nationality as U.S. American, and had an approval rating of 95 or higher according

to Prolific's pre-screening tool.

Studies 3 and 4 were both longitudinal studies. Study 3 included a second wave of data collection in which several of subjects' political attitudes were re-measured approximately one week after Time 1 data collection. At Time 1, we used measures of subjects' belief system structure and political attitudes and tested political attitude stability with the measures collected at Time 2. Study 4 consisted of three longitudinal waves in which data collection took place approximately two weeks after the prior wave of data were collected. Specifically, Time 2 data were collected two weeks after Time 1 data were collected, and Time 3 data were collected two weeks after Time 2 data were collected. In both studies, only subjects who reported their ideologies to us as liberal or conservative in the first wave of data collection were invited back and retained for analysis. As detailed in our preregistration for Study 4, Time 2 included two experimental conditions for another project. We exclude those who received an experimental treatment from our longitudinal analysis and instead focus our longitudinal analysis on the participants assigned to the control condition. Details on the logic behind this analytic decision are provided in more detail in our preregistration document. At Time 1, we measured subjects' belief system structure and political attitudes, at Time 2 and Time 3 we re-measured political attitudes. More details on measures at each time point is provided below in the "Measures" section and in Table 2 below.

Table 2
Relevant measures included at each time point

Study	Time-point	Measures
Study 1	1	Conceptual similarity Political engagement
Study 2	1	Conceptual similarity Political engagement
Study 3	1	Conceptual similarity Attitude positions Political engagement

		Political knowledge
	2	Attitude positions
Study 4	1	Conceptual similarity Attitude positions Political engagement Political knowledge
	2	Attitude positions
	3	Attitude positions

*Note*: Table shows which measures are included and relevant at each wave of data collection for each study.

Measures

Belief System: Conceptual Similarity Task

For all studies, participants completed a version of the conceptual similarity task to estimate belief system *structure* (i.e. how elements of the belief system are interconnected). This is a validated measure of individual belief system structure (Brandt, 2022). The measure has strong internal consistency and test-retest reliability, it replicates known findings in the field, and it responds to experimental manipulations as expected (Brandt, 2022; see also Ertan et al., 2022 and Stolier et al., 2020 for related approaches). Study 4's version of the task is visualized in Figure 1. For pairs of attitudes, participants report how likely they are to co-occur. These self-reported links are used to represent the connections between the attitudes in the belief system. Figure 2 shows the results of this process for two participants in the study. Consistent with our contention that belief systems vary in structure across people, these two participants have different belief systems. For example, whereas Respondent 1 has strong links between their attitude about the Democratic party and a number of issues, Respondent 2 has strong links between their attitudes towards equality and a number of issues.
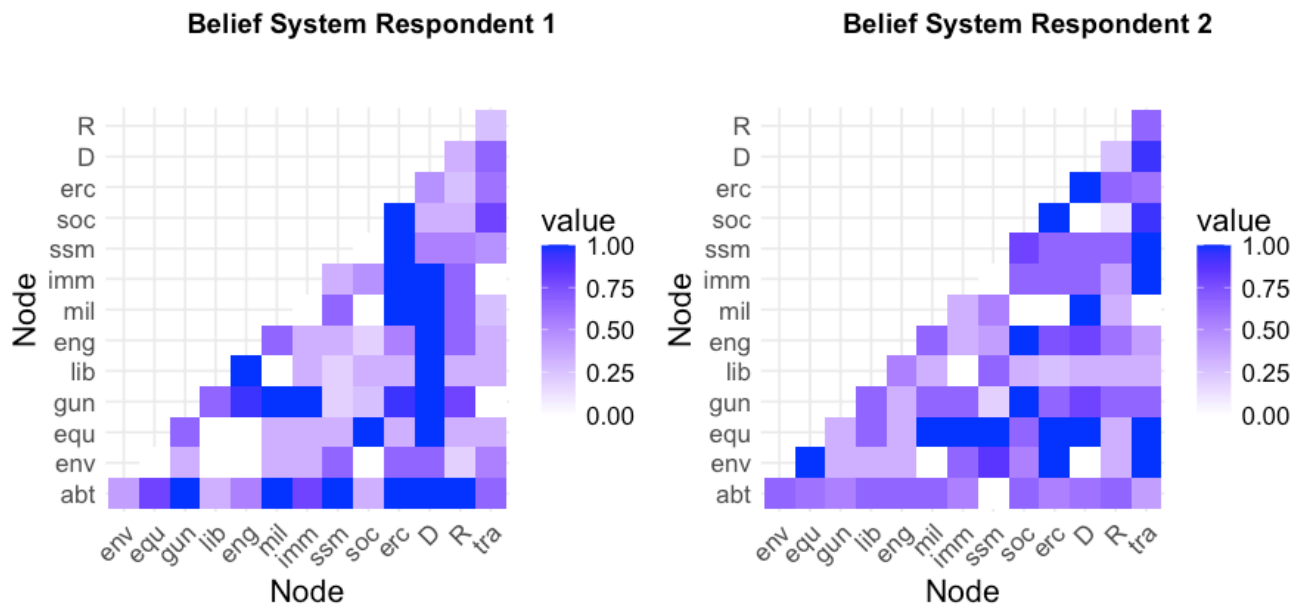
Figure 1

Illustration of the conceptual similarity task for measuring belief systems
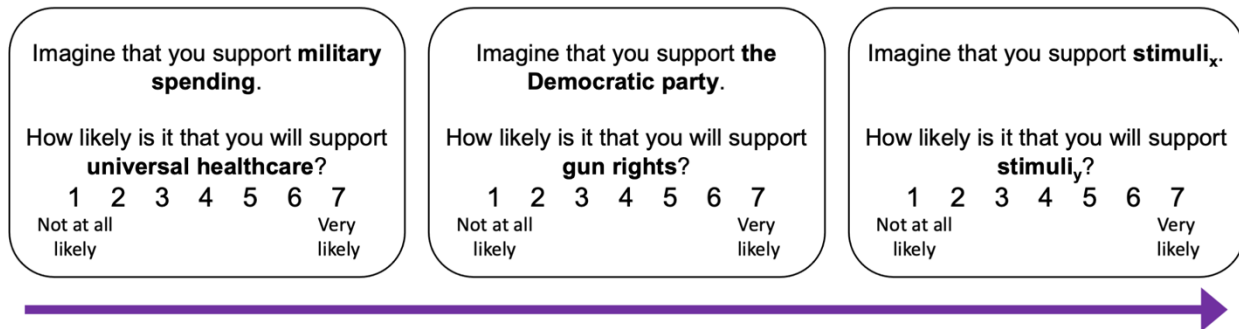
Figure 2

Example individual respondent level belief matrices created from conceptual similarity ratings

Note: Element abbreviations are as follows: env = environmental regulations, equ = equality, gun = gun control, lib = liberty, eng = making English the official language, mil = military spending, imm = restrictions on immigration, ssm = same-sex marriage, soc = social programs, erc = teaching about racism in schools, D = the Democratic Party, R = the Republican Party, abt = abortion rights. Shading represents the strength of the tie (irrespective of direction, i.e., consistent or inconsistent) between two elements.

Participants complete the measure for pairs of attitudes in a random order. In Study 1, participants completed the measure for all pairs of attitudes. In Studies 2 and 3, participants were randomly assigned to 90 of the 156 possible pairs. In Studies 1-3 participants completed the measure for both orderings of the attitude pair. In Study 4, we did not include both pair orders because these were highly correlated in Studies 1-3 (see Brandt, 2022). Participants in Study 4 were randomly assigned to 75 of the 105 possible attitude pair combinations. The missing data in Studies 2-4 are missing completely at random (MCAR) by design, and so we estimated missing data using Bayesian multiple imputation (Enders, 2017; Little et al., 2014; Van Buuren & Groothuis-Oudshoorn, 2011) with data that included people's attitude positions, non-missing conceptual similarity responses, and demographic and psychological covariate information. Multiple imputation was conducted in R version 4.3.0 using the R package mice (Van Buuren & Groothuis-Oudshoorn, 2011). Trace plots and R-hat values reveal acceptable convergence.

All the attitudes examined in our studies are in Table 3. We included different sets of issues across the studies. This was originally done in Studies 1-3 to ensure that the conceptual similarity task was validated across a variety attitudes (Brandt, 2022). It was done in Study 4 to ensure that the findings we report here are not attitude dependent. Study 1 aimed to include relatively polarizing attitudes. Study 2 aimed to include some attitudes that were polarizing, as well as some that were not, as defined as having smaller partisan *differences* in positions (e.g., social security). Study 3 aimed to include a range attitudes that were included in the Roper iPoll database the year prior to data collection (which was 2020; Clifford & Kennedy, 2021). Study 4 included polarizing attitudes relevant to the embedded experimental study, in addition to three politically relevant values (i.e. equality, liberty, and tradition). In all studies, we also include symbolic attitudes (in this case, attitudes towards the parties) in the conceptual similarity task.

Table 3

Issue positions, identities, and values used to estimate belief system structure in all studies.

Study 1	Study 2	Study 3	Study 4
Operational / Policy Attitudes			
abortion rights	ban smoking in public places	a wealth tax on wealth above $25 million dollars	Abortion
environmental protection	**environmental protection**	allowing vote by mail in all elections	**environmental protection**
gay rights	free trade with China	background checks on all gun sales	**gun rights**
government aid for Black people	**gay rights**	banning police from using chokeholds	making English the official language
government run healthcare	**gun ownership**	deporting immigrants working in the United States illegally	**military spending**
gun ownership	increased education funding	establishing an independent Palestinian state	**restrictions on immigration**
military spending	legalized marijuana	federal investments in infrastructure	same-sex marriage
regulations on big businesses	limits on medical malpractice suits	funding more research into renewable energy sources	social programs
restrictions on immigration	mandatory vaccines	going to war with Iran	teaching about racism in schools
severe criminal sentences	**regulations on big businesses**	increasing the number of Supreme Court justices	universal healthcare
taxes on the rich	social security	requiring all students to receive the COVID19 vaccination	—
Symbolic / Identity Attitudes			
the Democratic party	**the Democratic party**	**the Democratic party**	**the Democratic party**
the Republican party	**the Republican party**	**the Republican party**	**the Republican party**
Values			
—	—	—	equality
—	—	—	liberty
—	—	—	tradition

Note: Attitudes are listed in alphabetical order. Attitudes included in more than one study are in bold.

The task had two additional minor differences across studies. First, in Studies 1-3 participants were randomly assigned to a version of the task about their own belief system, or the belief system of an unspecified other person. This was done to explore if these different targets made any differences in the validity of the measure. They did not (see Brandt, 2022). Therefore, we collapse across this distinction for Studies 1-3. For Study 4, we specifically ask about people's own belief system. Second, we slightly modified the wording for the task in Study 4, so

that it was clearer. Instead of asking, "Imagine that you support one attitude, how likely is it that you will support the other?" and then listing the pair of attitudes (Studies 1-3 own belief system wording), we asked "Imagine that you support [attitude_x]. How likely is it that you will support [attitude_y]?". Across all studies, participants responded to the question on a scale ranging from 1 = not at all likely to 7 = very likely.

Attitude Positions

In addition to measuring the *structure* of people's belief systems with the conceptual similarity task, in Studies 3 and 4, we also used measures of people's *positions* on the political issues we studied in the conceptual similarity task (i.e. whether they support or oppose the issue). These measures were used to assess stability.[5] For Study 3 we used the same exact wording from Table 2 and asked people the extent they supported or opposed the issue (1 = Strongly oppose, 7 = Strongly support). For Study 4, we include two items to measure each attitude (r's range [.75, .91], see supplemental materials for all items), except for the values. These we measured with single items: "Equality is important when thinking about what is best for America", "Liberty is important when thinking about what is best for America", and "Respecting tradition is important when thinking about what is best for America." All attitude positions were measured on a scale from 1 = Strongly disagree to 7 = Strongly agree. We rescaled attitude positions to range from 0-1 such that 1 represents the most conservative position in the dataset, and 0 represents the most liberal position.

Political Knowledge and Engagement

In all the studies we measured political engagement. Studies 1, 2 and 3 used the two items, "How interested are you in politics?" (1 = very uninterested, 7 = very interested), and

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[5] Issue positions were also measured in Studies 1 and 2. We did not use them for these studies as our research questions do not pertain to cross-sectional attitude positions.

"How important are politics to you?" (1 = very unimportant, 7 = very important). Study 4

included a slightly different two-item measure, "How much attention do you pay to news about

politics on TV, radio, printed newspapers, the internet and social media?" (1 = none at all, 5 = a

great deal), and "How important are politics to you?" (1 = very unimportant, 7 = very important).

In all studies, the items were moderately to highly correlated (Study 1 r = .86, Study 2 r = .86,

Study 3 r = .90, Study 4 r = .59). We recoded the scored scale in each study to range from 0-1

such that 0 represented the minimum value on the scale in the dataset, and 1 represented the

maximum (M Study 1 = .66, M Study 2 = .65, M Study 3 = .61, M Study 4 = .65).

Studies 3 and 4 included a 10-item, multiple choice measure of political knowledge (α

Study 3 = .40, α Study 4 = .48). Participants were asked factual questions about government

employees (e.g., how many Supreme Court justices are women?), political leadership (e.g.,

current Speaker of the US House of Representatives), and current events (e.g., current rate of

unemployment). Most questions had four response options except for a question asking about

which political party controls the US House of Representatives. Responses were coded 1 if they

were correct and 0 otherwise (Study 3 M = .52; Study 4 M = .54). We implemented Clifford and

Jerit's (2016) cheating reduction procedure. Prior to the questions we asked participants, "It is

important to us that you do NOT use outside sources like the Internet to search for the correct

answer. Will you answer the following questions without help from outside sources?" Following

Clifford and Jerit, we analyzed responses for people who both said yes and no to this question

(Study 3: yes n = 583, no n = 14, missing n = 1; Study 4: yes n = 1111, no n = 32, missing n =

13).

Results

General Analysis Strategy

We tested all predictions using regression models. The precise models we fitted varied across studies and predictions depending on study data structure and the nature of variables of interest. We detail the precise models for each prediction before presenting the results relevant in testing the prediction. Because data from Studies 2-4 randomly assigned subjects to complete a subset of conceptual similarity items, data from these studies are missing completely at random (MCAR) by design. Therefore, for Studies 2-4, we conducted multiple imputation using the MICE package (Van Buuren & Groothuis-Oudshoorn, 2011) in R version 4.3.0 and present pooled results for those studies.

Cross-Sectional Results

Symbolic element centrality: Modeling strategy

To test whether symbolic elements are more central to belief systems than operational elements we fitted multi-level models using the lmer function from lme4 package (Bates, 2010) or the lmerModList function in the merTools package (for multiple imputation, Knowles et al., 2016). All models were fitted in R version 4.3.0. We used the lmer function in fitting the Study 1 model, as these data are not imputed. We used the lmerModList function to fit the Study 2-4 models on each multiply imputed dataset and the pool function to pool results. All variables in the models were rescaled to range from 0-1 prior to analysis so that regression coefficients can be interpreted as indicating the predicted proportion change in the dependent variable upon moving from the minimum to the maximum value of the independent variable in the dataset.

To test whether symbolic elements are central to individual level belief systems we regressed element centrality (defined as an element's mean connection to all other elements in the belief system) on attitude type (1= symbolic, 0 = operational/ values see Table 2). Attitudes were nested within participants, and we included random intercepts for both attitudes and for

participants in a cross-classified model. In addition, we included random slopes for the attitude type predictor for participants in Studies 1 and 2. However, the random slope for participants was removed in Studies 3 and 4 because the model fit was singular due to lack of variation in the attitude type predictor across participants. If symbolic elements are more central to belief systems than operational attitudes, the coefficient for attitude type should be positive and significant.

We also report exploratory results from Study 4. The conceptual similarity task in Study 4 also contained political values. As such, we fitted a similar model to those described above in which we also included a dummy indicator for political values (1- political value, 0- other). In this model, centrality is regressed on *two* dummy indicators, one indicating whether an element is a political value, and the other indicating whether the element is symbolic. This model is otherwise identical to that described above for Study 4.

Finally, we present descriptive plots of the frequency with which each element contained in the conceptual similarity task emerged as subjects' *most* central belief system element. We do this in part because some have argued that the most central element in a belief system helps organize other attitudes (e.g., Converse, 1964), and partially to succinctly visualize variation around general centrality trends.

Symbolic element centrality: Results

Across all studies, symbolic attitudes were more central than other attitudes. However, in Study 3, the relationship was not statistically significant, although the size of the effect was similar to that uncovered in other studies (Study 1 $b = .09$, SE $= .02$, CI $= [.05, .14]$, $p = .001$; Study 2 $b = .11$, SE $= .05$, CI $= [.012, .21]$, $p = .02$; Study 3 $b = .09$, SE. $= .05$, CI $= [-.008, .19]$, $p = .07$; Study 4 $b = .07$, SE $= .03$, CI $= [.03, .11]$, $p =.002$). An internal meta-analysis pooling

results across studies revealed that overall, symbolic attitudes are more central than other types of attitudes (estimate symbolic b = .09, SE = .02, CI = [.06, .12], p < .001). This is consistent with the hypothesis that symbolic elements are the most central elements to individual level belief systems, in line with theory and results from studies on sample average belief systems. These results are presented in Figure 3.

Figure 3

Attitude centrality and attitude type across studies
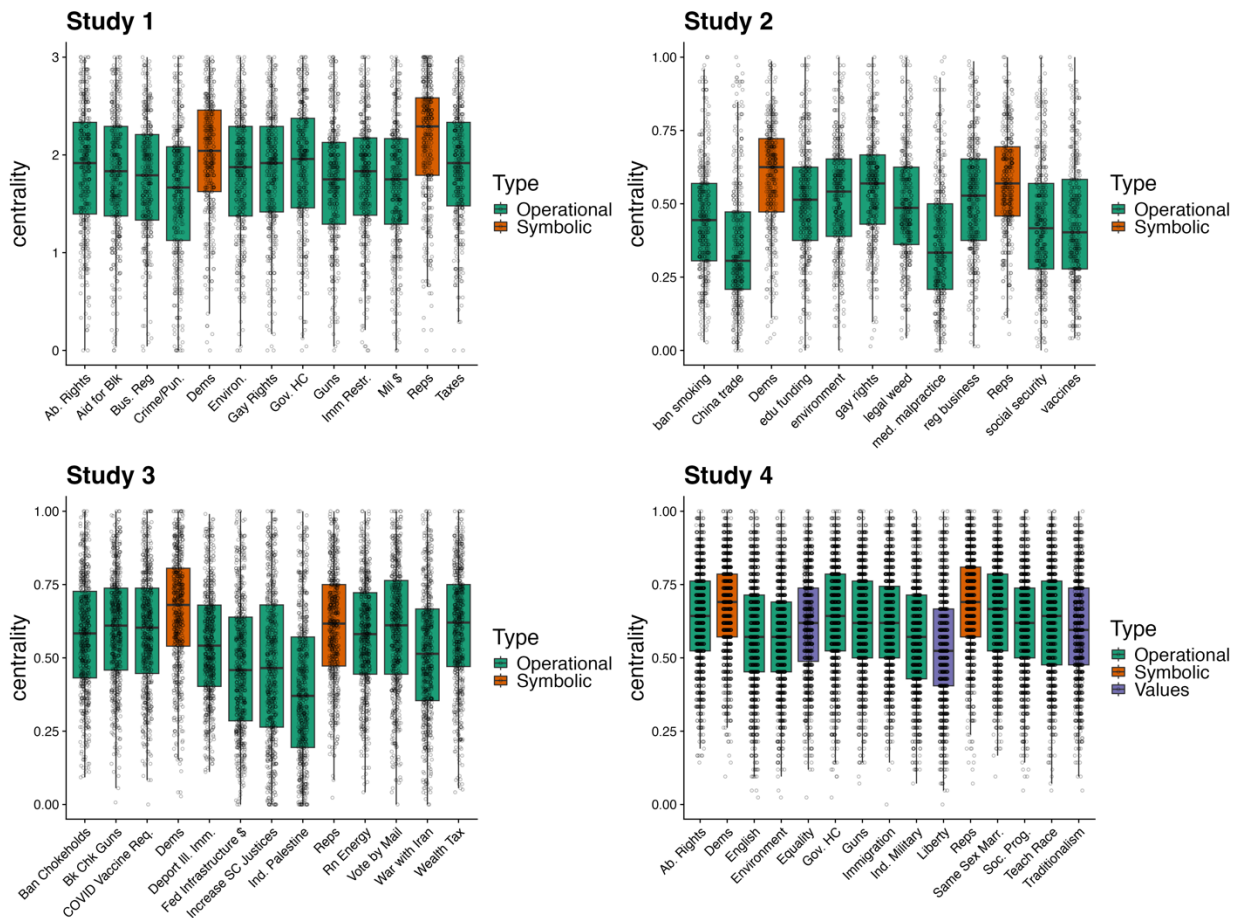
Note: Figure shows average centrality of symbolic, operational, and value belief system elements across all 4 studies.

Exploratory analyses with Study 4 data in which the centrality of political values are compared to that of symbolic and operational elements revealed that values are no more or less central than operational elements (the baseline category in the model), but the finding that symbolic elements are more central than other elements is robust to this alternative specification (b symbolic = .07, SE = .02, CI = [.03, .11], p = .003; b values = -.03, SE = .03, CI = [-.07, .009], p = .11). Notably, politically relevant values are not more central than political issues. These results support the hypothesis that symbolic elements are more central to political belief systems.

Because we examine individual-level belief systems, we can also identify the participants who have symbolic elements as the *most central* elements in their belief systems. That is, although symbolic elements are the most central elements on average, they are not the most central elements for every person. A sizable minority of participants have other elements (operational elements or values) as central to their belief systems (see Figure 4). About a third of subjects have elements *other* than symbolic elements as central to their belief systems. Among those who had operational elements as central to their belief systems, there was variability in which *specific* operational element was central with no attitude emerging as *the* central operational element. This is depicted in Figure 4 which graphs the frequency of most central belief system element for participants across studies.

Figure 4

Most central element in participant's belief systems
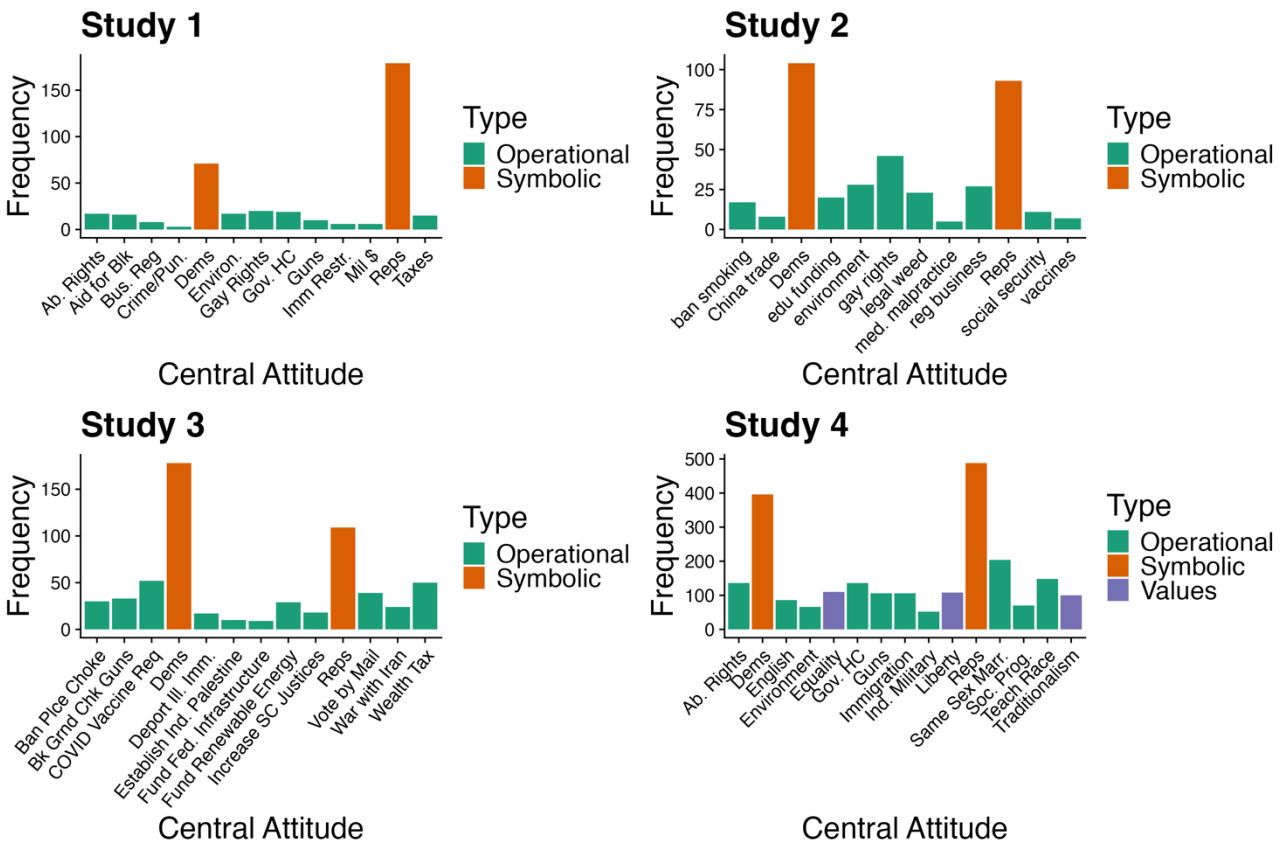
Note: Figure 4 plots the frequency of each participants' most central belief system element

Political knowledge, political engagement, and symbolic centrality: Modeling strategy

　　　　To test whether symbolic elements are more central to the belief systems of those who are

high in political knowledge and political engagement, we fitted multilevel models. We again

regressed attitude centrality on attitude type (1 = symbolic, 0 = other), but this time we also

included grand mean centered political engagement (Studies 1-4) or political knowledge (Studies

3 and 4) and their interaction with attitude type in the model. If symbolic elements are more

central to belief systems for those who are high in political knowledge or political engagement, a

positive and significant interaction between political knowledge or engagement and symbolic attitude type should emerge, indicating that symbolic elements are higher in centrality for individuals higher in these constructs. Again, all variables were recoded to range from 0-1 such that 0 represented the minimum value on the variable in the dataset, and 1 represent the maximum. Thus, the coefficients can be interpreted as the expected proportion change in the dependent variable upon moving from the lowest value to the highest value of the respective independent variable in the dataset.

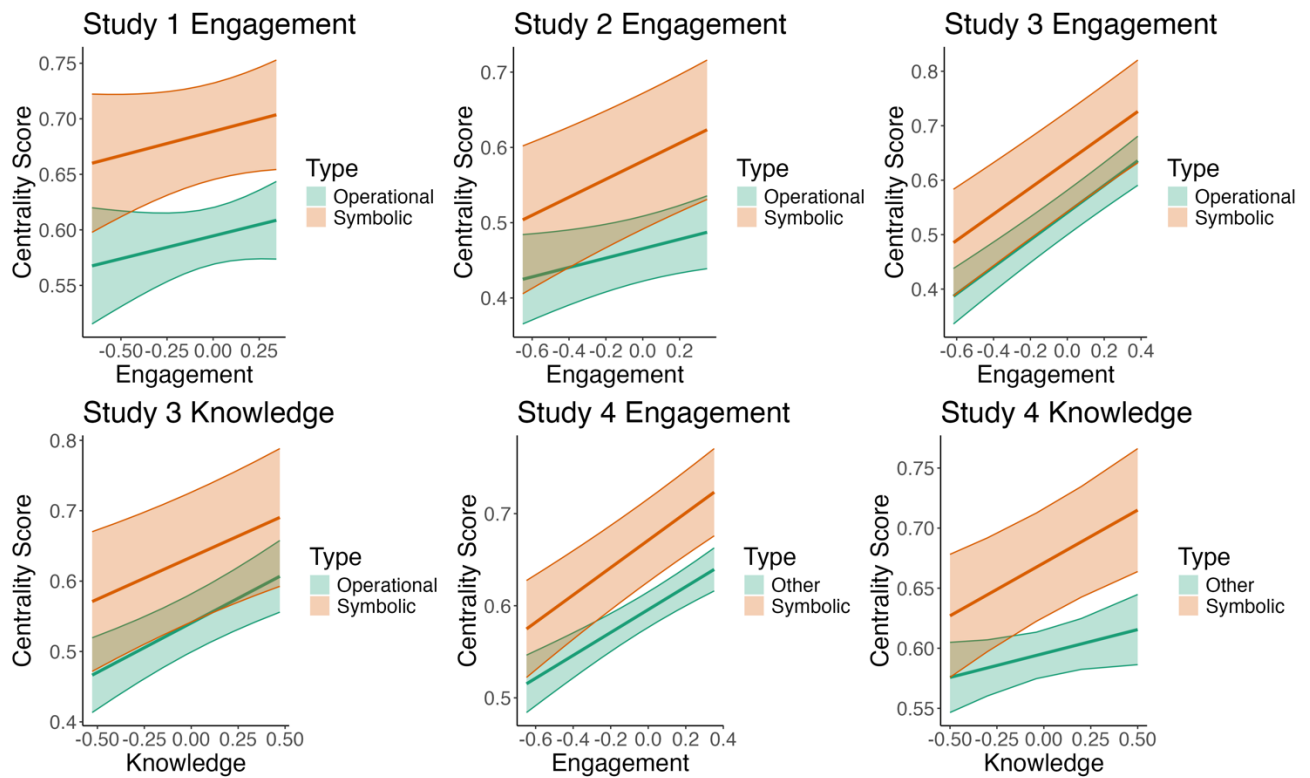***Political knowledge, political engagement, and symbolic centrality: Results***

Studies 1-4 contained a measure of political engagement. In Studies 1 and 3, political engagement did not significantly interact with attitude type in predicting centrality (Study 1 symbolic × engagement $b = .003$, SE $= .02$, CI $= [-.03, .04]$, $p = .89$; Study 3 symbolic × engagement $= -.007$, SE $= .02$, CI $= [-.06, .02]$, $p = .63$). In Study 2, engagement did significantly interact with attitude type in the direction suggested by theory (b symbolic × engagement Study 2 $= .05$, SE $= .02$, CI $= [.01, .09]$, $p = .01$), but the size of the effect was small. In Study 4, engagement was a marginally significant predictor of increased symbolic centrality (b symbolic × engagement $= .02$, SE $= .012$, CI $= [-.003, .46]$, $p = .06$), but the size of the effect was small. The results of an internal meta-analysis suggest that engagement is a marginally significant predictor of increased symbolic centrality ($b = .017$, SE $= .01$, CI $= [-.03, .04]$, $p = .10$), but the meta-analytic effect size is very small. As such, we do not draw strong conclusions regarding the relationship between political engagement and symbolic element centrality based on the evidence we present here.

Studies 3 and 4 contained a measure of political knowledge. In Study 3, political knowledge did not significantly interact with attitude type when predicting centrality. The

coefficient was also in the opposite direction from that theory would predict (*b* symbolic ×

knowledge Study 3 = - .02, SE = .02. CI = [-.06, .02], *p* = .29). In Study 4, political knowledge

did significantly interact with attitude type when predicting symbolic centrality, and effects were

in the predicted direction (*b* symbolic × knowledge Study 4 = .05, SE = .01, CI = [.03, .07], *p* =

.001). Results of an internal meta-analysis reveal a very small non-significant positive

association between political knowledge and symbolic centrality (*b* = .017, SE = .035, CI = [-.05,

.09], *p* = .62). As above, we do not draw any strong conclusions with respect to whether

symbolic elements are more central for those who are high in political knowledge. Results are

not supportive of the hypotheses and are presented in Figure 5.

Figure 5

Element type inconsistently interacts with political knowledge and engagement in predicting

symbolic element centrality

Note: Figure 5 plots the interaction between political knowledge or political engagement and symbolic element belief system centrality.

Political knowledge, political engagement, and belief system density: Modeling strategy

To test whether those who are high in political knowledge and political engagement have greater belief system density than those who are lower in political knowledge and political engagement, we fitted linear regression models. We fitted linear regression models rather than multi-level linear regression models because our outcome variable, belief network density, and our predictors, political knowledge and political engagement are person-level rather than within-person attitude-level variables. We operationalize belief network density by taking the average level of the absolute value of connection in each individual's belief system network. We then regress belief network density on political knowledge (Studies 3 and 4) or political engagement (Studies 1-4). We recoded all variables to range from 0-1 so that coefficients represent the expected proportion change in the dependent variable upon moving from the minimum to the maximum value of the dependent variable in the dataset. Again, political knowledge and political engagement are grand mean centered. If those with greater political knowledge or political engagement have greater belief network density in line with the hypothesis, then the coefficients for political knowledge and political engagement should be positive and significant.

Political knowledge, political engagement, and belief system density: Results

In all four studies, political engagement was positively associated with network density, although it was non-significant in Study 1 (Study 1 $b = .04$, SE = .03, CI = [-.03, .11], $p = .23$; Study 2 $b = .08$, SE = .03, CI = [.02, .14], $p = .02$; Study 3 $b = .27$, SE = .02, CI = [.21, .33], $p < .001$; Study 4 $b = .15$, SE = .02, CI = [.11, .19], $p < .001$). An internal meta-analysis shows a significant positive effect of engagement on belief system network density ($b = .14$, SE = .05, CI

= [.04, .24], p < .001). Similarly, in both Studies 3 and 4 political knowledge is a significant

predictor of belief system density (Study 3 b = .15, SE = .04, CI = [.07, .23], p < .001; Study 4 b

= .05, SE = .02, CI = [.01, .09], p = .04). These results are consistent with the hypothesis and are

visualized in Figure 6.

Figure 6

Relationship between political knowledge, political engagement, and belief system network
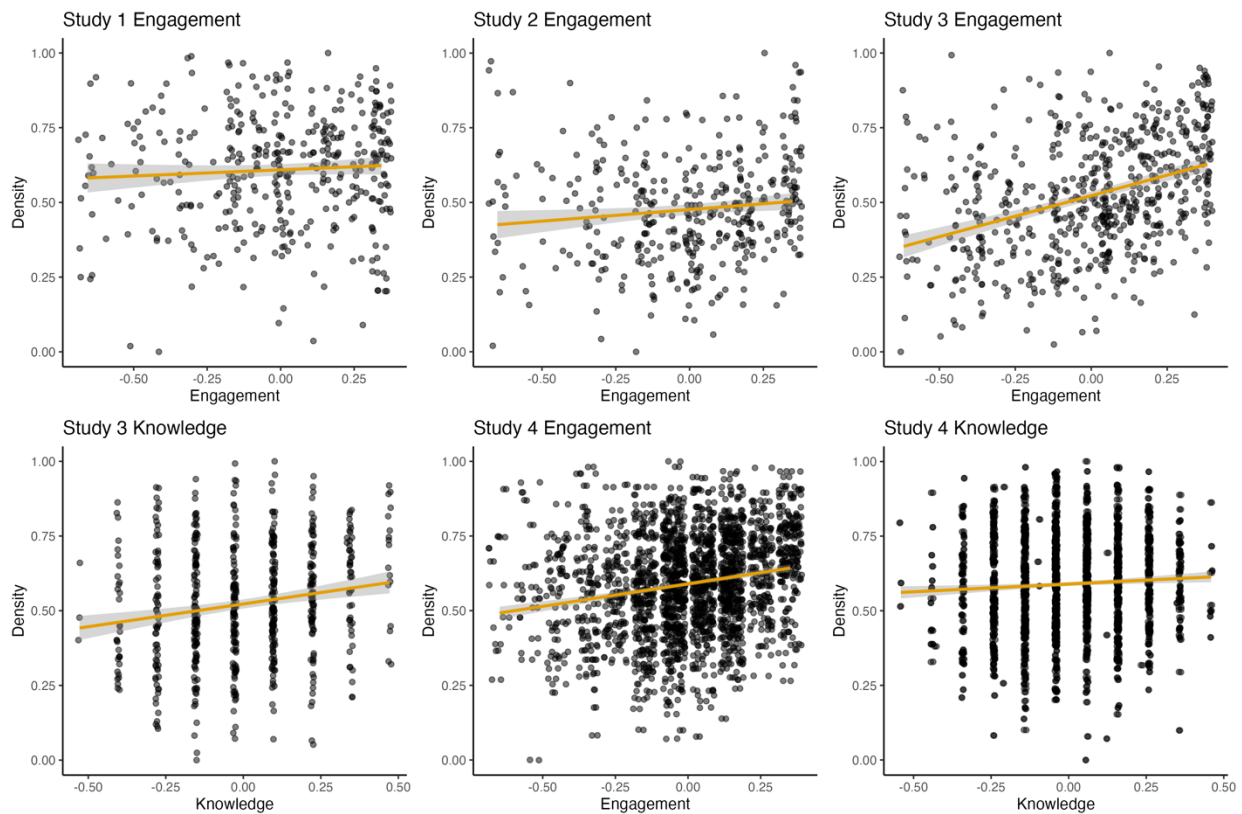
density

Note: Figure plots the results of regression models showing a small but significant positive

relationship between political knowledge, political engagement, and belief system network

density across Studies 1-4. Jittering is added to the figure for aesthetic purposes.

More central attitudes are more stable over time: Modeling strategy

Because our longitudinal Studies 3 and 4 consisted of slightly different designs, with different numbers of waves, our analysis strategy varies between the two studies. We detail our analysis strategy and results for each of the two longitudinal predictions separately.

In Study 3 we measured belief system structure at Time 1, and political attitudes about three issues (war with Iran, funding renewable energy, and increasing the number of Supreme Court justices) at Time 1 and Time 2. To test whether more central attitudes are more stable over time, we used multilevel models to regress Time 2 attitude positions on Time 1 attitude positions, attitude centrality score, and the interaction between Time 1 attitude positions and attitude centrality. All variables were recoded to range from 0-1, such that 0 represented the minimum value on the variable in the dataset, and 1 represented the maximum value. Both centrality and position were then centered within persons. In all models, we include a random intercept for centrality and for target attitude.

With the Study 4 data, we fitted a similar model, with a few key departures to account for the study's slightly different data structure. First, following our preregistration, because the study had three waves rather than two, we calculated the Mean Square Successive Difference (MSSD; Jahng et al., 2008) to operationalize attitude stability across time points. The MSSD captures instability by squaring the difference between an attitude measured across two successive time points, and doing this for all time points under study. Then, these squared values are added for each attitude, and the mean of squared difference for an attitude across time points is calculated.

We initially intended to use raw MSSD scores as our dependent variable (see our preregistration). However, preliminary analyses revealed that MSSD was heavily skewed right, with most attitudes having an MSSD value of 0 (indicating no change throughout the course of the study), but a minority exhibiting some change. As such, we binarized our MSSD variable

such that a value of 1 indicated that an individual's attitude had remained stable throughout the course of the study (i.e., had a raw MSSD value of 0) and 1 if the attitude had moved (i.e., had a raw MSSD value greater than 0).

We used this categorical indicator of stability as our dependent variable. In testing the prediction that more central attitudes would be more stable over time, we fitted a multilevel regression model where this binarized MSSD variable was regressed on attitude centrality. The model also included random intercepts for attitude and for respondent. Centrality was centered within persons, and all variables were rescaled to range from 0-1 (prior to centering for the independent variables). If more central attitudes are more stable over time, then the coefficient for centrality in predicting stability should be positive and significant.[6]

More central attitudes are more stable over time: Results

In both studies, we uncover strong evidence that more central attitudes are indeed much more stable over time, as predicted by prominent theories of belief systems and inter-attitude structure. In Study 3, the interaction between Time 1 positions and attitude centrality in predicting Time 2 attitudes is positive and significant ($b = .65$, SE $= .16$, CI $= [.34, .96]$, $p < .001$), indicating that Time 1 attitudes are more predictive of Time 2 attitudes when attitudes are higher in centrality (pooled Simple Slope when Centrality is $+ 1$ SD $= .76$, SE $= .03$, CI $= [.70, .82]$) than lower in centrality (pooled Simple Slope when Centrality is $- 1$ SD $= .59$, SE $= .03$, CI $= [.53, .65]$). That is, we find that attitudes are more stable when they are more central to subject's belief systems.

Results from Study 4 lend themselves to the same substantive interpretation: the positive and significant coefficient for centrality in predicting stability indicates greater stability for more

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[6] We report our preregistered analyses with the raw MSSD variable in the Supplemental Materials. We also report the results of a multilevel logistic regression model.

central attitudes, and less for peripheral attitudes ($b = .51$, SE $= .07$, CI $= [.37, .65]$, $p < .001$).

Not only do these results show that central attitudes are more stable than peripheral attitudes; the effect size for centrality is large, with the most central attitudes showing more than half a scale range more stability than the most peripheral attitudes. For instance, if one's attitude towards gay marriage is central to their belief system, but one's attitude towards abortion is peripheral, we would expect the attitude towards gay marriage to be much more likely to remain stable than the attitude towards abortion. These results are displayed in Figure 7.

Figure 7

More central attitudes are more stable over time
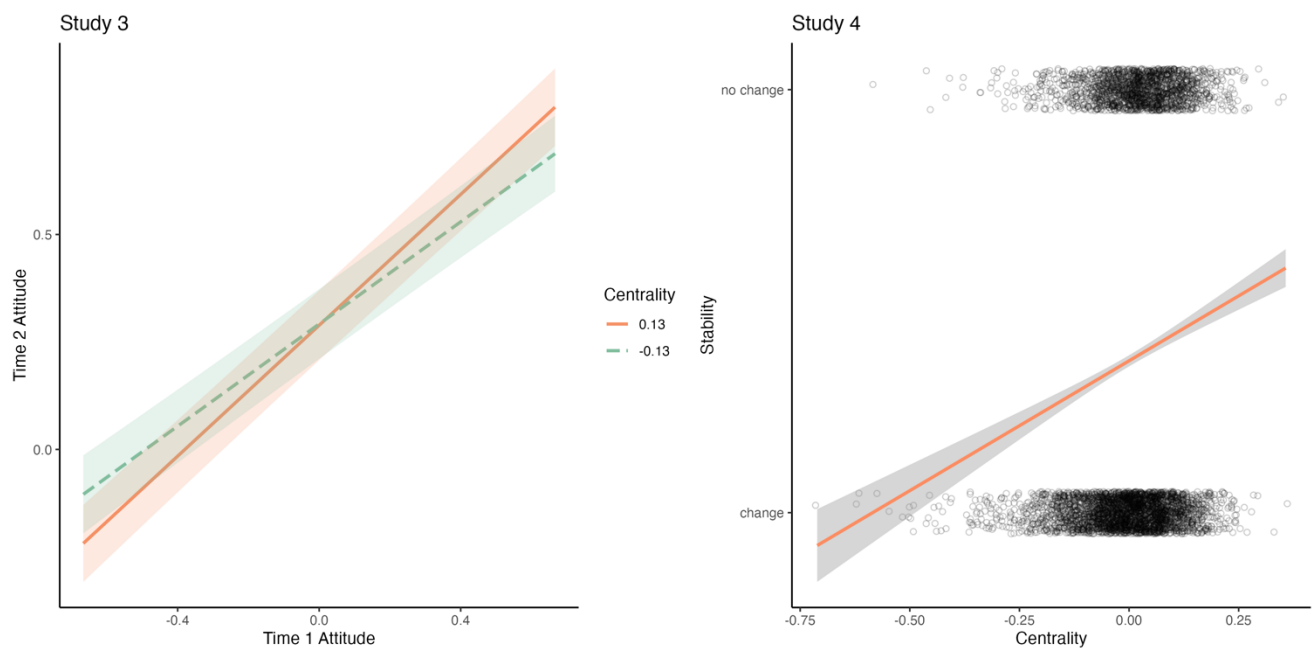
Note: Figure 7 shows results from studies 3 and 4 testing whether more central attitudes are more stable over time than peripheral attitudes. Both studies show a strong relationship between centrality and stability. For Study 3, we plotted values at the mean +/- 1 SD.

Belief system density predicts greater attitude stability over time: Modeling strategy

The final prediction we test is that those with dense belief systems should have more stable attitudes over time than those who have less dense belief systems. We operationalize belief system network density as the mean level of connection between attitudes in the belief system network. As above, our slightly different data structure between Study 3 and Study 4 necessitates slightly different modeling strategies between the two studies.

To test whether belief system density predicts increased attitude stability in Study 3, we fitted a multilevel model where attitude position at Time 2 was regressed on attitude position at Time 1, belief network density, and their interaction. The model included random intercepts for attitude and for subject. Variables were recoded to range from 0-1 such that the minimum value in the dataset takes the value of 0, and the maximum takes the value of 1. Time 1 attitude was then centered within-persons, and density was centered between-persons. If belief network density predicts increased attitude stability, a positive and significant interaction between Time 1 attitude and belief system network density should emerge such that those with dense networks have Time 1 attitudes that are more predictive of their Time 2 attitudes than those with lower belief system network density. In other words, this pattern of results would indicate increased attitude stability for those who have denser, compared to less dense belief system networks.

To test the prediction in Study 4, we again use the MSSD to operationalize our dependent variable. We also again binarize the variable, in the same manner as above (0- attitude change, 1- attitude stability) and use this binarized stability indicator as our dependent variable in analyses.[7] We fitted a multilevel model in which we regressed the binarized MSSD variable on between-person centered belief system network density. We included random intercepts for attitude and for subject in the model, and rescaled variables to range from 0-1. If those with denser networks

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[7] Again, we report our preregistered analyses using the raw MSSD variable and a logistic regression model using the binary MSSD variable in the Supplemental Materials.

have more stable attitudes over time, we would expect a positive and significant coefficient for density.

Belief system density predicts greater attitude stability over time: Results

In Study 3, greater belief system network density did *not predict* increased attitude stability. The interaction between density and Time 1 attitude in predicting Time 2 attitude was substantively small and statistically non-significant (*b* density*Time1 attitude = .03, SE = .09, CI = [-.15, .21], *p* = .74). In contrast, in Study 4, belief network density did significantly predict increased attitude stability (*b* = .52, SE = .07, CI = [.38, .66], *p* < .001). These results offer inconclusive support for the hypothesis and are presented in Figure 8.

Figure 8

Belief system network density and attitude stability
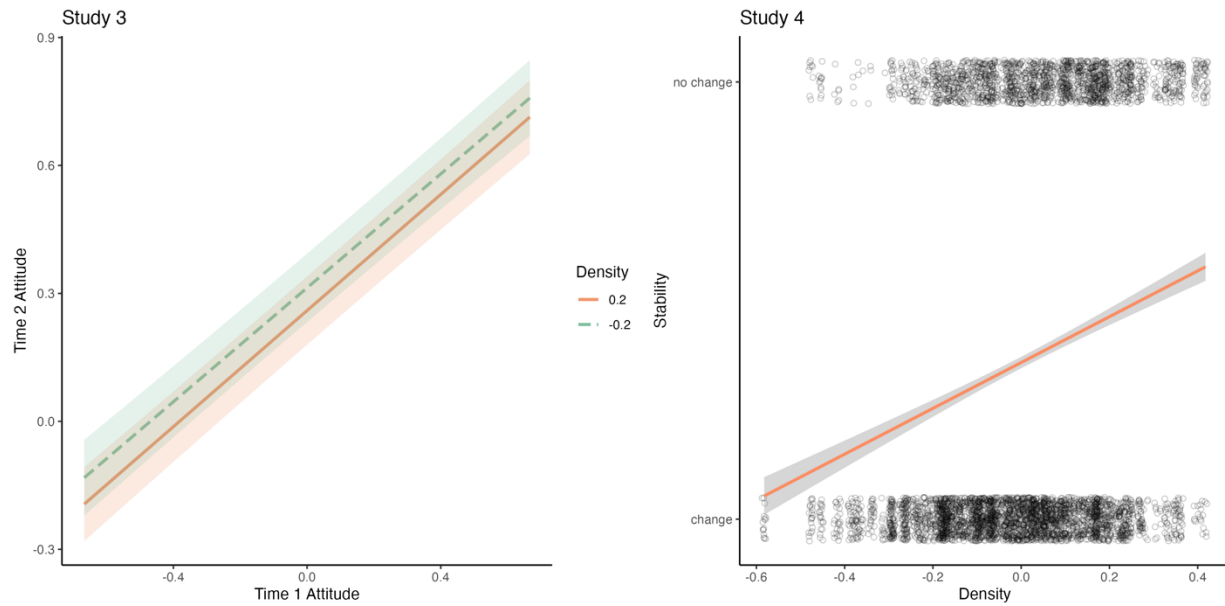
Note: Figure plots the relationship between belief system network density and attitude stability in studies 3 and 4. Results are inconsistent with Study 4 showing a positive and significant relationship between density and attitude stability, and Study 3 showing no relationship. For Study 3, we plotted values at the mean +/- 1 SD.

General Discussion

Belief system structure, and its implications for people's political beliefs and behaviors is a core topic in the social sciences (e.g., Ansolabehere et al., 2008; Boutyline & Vaisey, 2017; Brandt & Sleegers, 2021; Campbell et al., 1960; Converse, 1964; Conover & Feldman, 1981; Eagly & Chaiken, 1993; Fishman & Davis, 2022; Goldberg & Stein, 2018; Goren et al., 2009; Mondak, 1993; Zaller, 1992). These topics are important because belief systems shape how people perceive and engage with the political world (Bakker et al., 2020; Brandt, 2022; Converse, 1964; Van Zomeren, 2013; Zaller, 1992), as well as have implications for attitude

stability and change (Brandt & Sleegers, 2021; Coppock & Green, 2022; Goldberg & Stein, 2018; Kam, 2005).

Until recently, scholars lacked the tools to empirically examine belief systems as individual-level systems, leaving the predictions of major theories of belief system structure and dynamics untested at the appropriate level of analysis. We address this gap by using the newly validated conceptual similarity task (Brandt, 2022) that enables the study of belief systems at the individual level. Across four studies, we test five key predictions: whether symbolic elements are more central to belief systems than operational ones, the variability around these trends, if political knowledge and engagement are linked to greater symbolic element centrality and belief system density, whether central attitudes are more stable over time, and whether those with dense belief systems have more stable attitudes over time.

First, we find that symbolic elements are more central to belief systems than operational elements, aligning with both classic research on belief systems (e.g., Campbell, 1960, Converse, 1964) and more recent research using network analysis methods on sample average belief systems (Boutyline & Vaisey, 2017; Brandt et al., 2019). Notably, significant variation exists around this trend, with about a third of individuals in each study having operational elements as central to their belief systems. This shows that past tests focusing on sample averages obscures individual-level variability in belief system structure. Future research should explore the implications of this variability. For example, past work has shown that central, symbolic elements more strongly predict political behaviors than other elements (e.g., Brandt et al., 2019), but it's unclear if this is also true for operational elements or values when they are central to an individual's belief system.

Second, we examine whether political knowledge and engagement predict whether symbolic elements are central to belief systems. Previous research suggests that politically knowledgeable and engaged individuals align their partisan and ideological identities and policy positions more coherently than the less knowledgeable and engaged (Converse, 1964; Kinder & Kalmoe, 2017). Similarly, a recent review (Malka & Federico, 2023) indicates that the politically engaged are more likely to adopt strong issue stances from in-party elites, implying their belief systems may center around symbolic elements. However, our mixed results do not provide unequivocal support for the idea that the knowledgeable and engaged are more likely to center their belief systems around symbolic elements, signaling the need for future research to understand these empirical-theoretical discrepancies.

Third, we find consistent evidence that the politically knowledgeable and engaged have denser belief systems than the less knowledgeable and engaged. This finding is consistent with the notion that there exists in society a group of knowledgeable and engaged "ideologues" (Converse, 1964; Federico & Malka, 2023; Kinder & Kalmoe, 2017) who have coherent, strong connections between their ideological and partisan identities on the one hand, and substantive issue positions on the other. The link between these constructs and belief network density likely emerges because one important way people form belief system ties is by learning "what goes with what" through engaging with politics and learning about political systems and symbols (Converse, 1964; Federico & Malka, 2023).

Fourth, we find that more central belief system elements are *much* more stable over time than peripheral ones. This finding is consistent with major theories of inter-attitude structure, suggesting that more central attitudes are held in place by strong connections to other attitudes (Eagly & Chaiken, 1993; Rokeach, 1968; Scott, 1959). It is also consistent with cognitive

consistency theories (Festinger, 1957; Heider, 1946; Gawronski & Strack, 2004; Gawronski, 2012; Newby-Clark et al., 2002), which suggest that inconsistency between connected attitudes is psychologically uncomfortable. Consequently, changing a central attitude is difficult, as it requires corresponding changes in other attitudes, whereas changing peripheral attitudes is easier as they are less connected to the rest of the belief system.

This finding also relates to our first hypothesis: if central attitudes are more stable, whether symbolic or operational elements are central to belief systems should influence political beliefs and behaviors amid shifting socio-political conditions. For example, those with central symbolic elements may be more likely to adjust their policy positions to align with the party's stance. In contrast, those with operational elements as central may adjust their partisanship to fit pre-existing central operational elements. Along these lines, party-reframing experiments may be less effective for those without symbolic elements as central, as they face less pressure to update policy beliefs to align with their party identity.

Finally, we test whether individuals with dense belief systems, as suggested by simulation studies (Brandt & Sleegers, 2021), have more stable attitudes over time. Our findings are mixed. In Study 3, belief system density had no effect on attitude stability, while in Study 4, a strong positive effect was found. Study 3's shorter time frame (1 week) and fewer attitudes (3) compared to Study 4 (2-week time lags, 13 attitudes) may explain these differences. Political attitudes are, however, very stable over time periods as short as we study here (Brandt & Morgan, 2022), making time lag an unlikely explanation. The more salient attitudes under study in Study 4 may better explain the variation in results. If so it would suggest that having denser belief systems is more predictive of increased stability of salient attitudes compared to less salient attitudes. Future research should directly test these possibilities.

Limitations

Like all research, our studies have limitations. We outline the most pressing ones and detail them in Table 4. First, our samples consist of U.S. Americans, so future research should assess how these findings generalize to other socio-political contexts. It's possible that the U.S.'s unique two-party system may contribute to the observed belief system structure in our studies, especially the dominance of symbolic centrality (though see Brandt et al., 2019 for similar results in New Zealand when examining a sample average belief system). We also did not examine whether findings generalize across identity groups in the U.S. Our predominantly white samples lacked the statistical power necessary for estimating heterogeneity across these subsamples. Investigating heterogeneity especially among marginalized groups deserves dedicated research (see Jefferson, 2023). Finally, while we build on a theory of belief system dynamics (Brandt & Sleegers, 2021), we do not directly test all of its assumptions here. These limitations should be kept in mind when considering our results and they should be directly addressed by future empirical research.

Table 4

Summary of limitations

Limitation	Constraint on reproducibility and generalizability
All studies consist of U.S. Americans	The U.S. has a particular socio-political context, we cannot be sure findings will generalize to other socio-political contexts.
Our samples are predominantly White, and we do not test for heterogeneity across groups within the U.S.	Members of minoritized groups may have different belief system structures and dynamics than Whites due to their unique experiences with the U.S. socio-political system.
We build on a theory of belief system dynamics that we do not directly test	We rely on past tests of the theory of belief system dynamics we use as a starting point in our theorizing (e.g., Brandt & Sleegers, 2021), without directly testing the assumptions of the theory

ourselves. If previous work is misguided, then our work could be invalidated because of the axioms it rests on.

Conclusion

Using a novel method, we estimated individual-level belief systems to test five prominent predictions from theories of political belief systems and inter-attitude structure. We show that belief systems can be studied as *systems* at the theoretically appropriate level of analysis (the individual level) and these individual level belief system networks can help us learn about belief system structure and attitude dynamics. These tests are just the start. The methods and ideas we've developed in this project can be further leveraged to conduct stringent tests of existing belief system theories, as well as test new ideas about belief systems and their dynamics. Some of our findings provide a jumping off point for tests. For example, our finding that symbolic elements are particularly central for many, but not all people suggests that political identities may have similar dynamics for most people. However, for some people, political identities may be much less important for how they think about politics and interact with the political landscape. Similarly, our findings that central attitudes are particularly stable highlights the importance of thinking about attitudes within the context of the other attitudes that they are connected with. That is, attitudes are not atomistic, but rather are connected and influenced by (at least for some people) other attitudes. In this way, our work continues and builds on older social psychological traditions, such as cognitive dissonance and balance theories that emphasize the importance of attitudes and their connections with each other.

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