

**Supplemental Materials for “Belief System Structure is Predicted by Political Knowledge and Political Engagement and Predicts Attitude Stability Over Time”**

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## **Appendix A: Testing the abandoned pre-registered hypothesis and explaining why we now think our initial logic was fundamentally flawed**

In our introduction, we allude to a pre-registered hypothesis that was abandoned in the completed draft of our manuscript. Here, we detail that hypothesis, explain why we think it was the result of fundamentally flawed reasoning, and provide the results of analyses testing the hypothesis for interested readers.

In our pre-registration for Study 4 we hypothesize that, “People who have symbolic attitudes as central to their belief systems should have more stable attitudes over time.” (H3) We put forth this hypothesis because we surmised that the parties providing cues on the positions citizens *should* take on the issues should lead individuals who organize their belief systems around partisanship (i.e., those who have partisanship as central to their belief systems) to have more stable attitudes over time as they simply adopt these positions as their own.

We initially felt this logic was consistent with the evidence presented by Bouteyline and Vaisey (2017), Converse (1964), and Kinder and Kalmoe (2017). Upon further reflection on the evidence and arguments presented by these authors, we now feel our hypothesis was misguided on at least three fronts. In their analysis of the 2000 American National Election Studies (ANES) data, Boutyline and Vaisey (2017) conduct subgroup analysis in which subgroup average belief systems are constructed and network properties are examined. These authors find that all subgroups they examine (44 in total) have partisanship as central to their belief systems. While groups did vary in the amount of organization present in their belief systems, the authors argue that across groups, partisanship acts as a “perceptual screen” helping citizens integrate political information and develop attitudes towards other elements. Importantly, although partisanship is central on average, and acts as a perceptual screen for those who organize their attitudes around partisanship, this logic does not preclude those who do not have partisanship as central to their belief systems from having organized belief systems or from developing strong political attitudes. Similarly, just because partisanship organizes a belief system and acts as a perceptual screen does not mean that partisanship can’t lead to *unstable* political attitudes as new attitude objects become politically relevant and the parties realign on other issues. As such, we felt our initial interpretation of these findings as evidence that those who have partisanship as central to their belief systems should have more stable attitudes over time resulted in part from a fundamental misinterpretation of Bouteyline and Vaisey’s (2020) work on our part.

Finally, both Converse (1964) and Kinder and Kalmoe (2017) find that only a small minority of citizens have organized belief systems and that unlike others, these individuals tend to 1) have stable political attitudes over time, and 2) have consistent ideological and partisan identities, and substantive political attitudes. However, there is no *direct* evidence that all, or most of these individuals have partisanship as central to their individual belief systems. Such a pattern would be necessary for our hypothesis to be logically sound. This misinterpretation of Converse (1964) and Kinder and Kalmoe’s (2017) work underlies the third fundamental flaw in our hypothesis.

Because the hypothesis that those who have partisanship as central to their belief systems should have more stable attitudes over time resulted from a flawed reading of the literature, we felt it

was irresponsible to present the hypothesis in the main text of our manuscript. However, in the interest of transparency, we felt it best to still present the empirical test of the hypothesis here. Below, we verbally describe the tests we conducted in studies 3 and 4 to test the hypothesis. Finally, we present the results of these tests.

First, we calculated each individual's most central object in their belief system and saved that information in a variable in our datasets. Second, we coded a dummy indicator that took the value of 1 if partisanship was an individual's most central attitude, 0 otherwise.

Because the design of Studies 3 and 4 varies, with Study 3 consisting of two waves, and Study 4 consisting of three, our modeling strategy differs between the waves. In Study 3 we fit a multilevel model in which our outcome is Time 2 attitudes. We then interact Time 1 attitudes with symbolic centrality in predicting Time 2 attitudes. All models include a random intercept for attitude, and a random intercept for respondent. If those with symbolic elements as central to their belief systems have more stable attitudes over time, then we should observe a positive and significant interaction between symbolic centrality and Time 1 attitudes in predicting Time 2 attitudes.

In contrast for Study 4 we fit two models. One is our pre-registered model. In this model, we calculate the MSSD for each attitude for each individual by squaring the differences in attitude position for each individual for each attitude between each successive wave, and then taking the mean of this value. Then, we use this variable as our dependent variable. Thus, a *higher* MSSD indicates *greater instability* in an individual's attitude. The MSSD is then predicted by attitude centrality, political knowledge, political engagement, network density, and our term of interest for this hypothesis, whether a symbolic attitude is central to the individual's belief system.

In Study 3 and Study 4, we find no evidence in support of this hypothesis. In Study 3 the interaction between Time 1 attitude and symbolic centrality in predicting Time 2 attitude is small and non-significant ( $b = -.008$ ,  $SE = .03$ ,  $CI = [-.07, .06]$ ,  $p = .88$ ). In Study 4, the coefficient for symbolic centrality in predicting MSSD is small and non-significant ( $b = -.004$ ,  $SE = .003$ ,  $CI = [-.01, .001]$ ,  $p = .18$ ).

## **Appendix B: Item Wording For Issue Attitudes**

### Restrictions on immigration

Immigrants grow the American economy.

Immigrants take jobs away from Americans.

### Environmental regulations

We need more regulations to make sure that the environment is protected.

Environmental impact is exaggerated by certain people.

### Abortion

The decision of whether or not to receive an abortion should be left entirely to a pregnant person.

The government should ban abortion except for in extreme cases.

### Social programs

Social programs are not effective.

Social programs serve a valuable role in our society.

### Teaching about racism in schools

Schools should offer classes that focus on the history of race and racism in the U.S.

It is unpatriotic for schools to offer classes that focus on the history of race and racism in the U.S.

### Making English the official language

The United States should not have an official language.

I am in favor of making English the official language of the United States.

### Military Spending

Cutting funding to the military would be a mistake.

The military budget needs to be cut.

### Universal Healthcare

Universal health care will help solve many of America's problems.

There is no need for universal health care in America.

### Same-sex Marriage

I would support a Constitutional Amendment to ban same-sex marriage.

Legalizing same-sex marriage was the right decision.

### Gun rights

It should be easier for law abiding citizens to bear arms.

Laws covering the sale of firearms should be made more strict.

### The Republican Party

The Republican party has the right idea about what is good for the country.

The Republican party has the WRONG idea about what is good for the country.

### The Democratic Party

The Democratic party has the right idea about what is good for the country.

The Democratic party has the WRONG idea about what is good for the country.

### Values

Liberty is important when thinking about what is best for America.

Equality is important when thinking about what is best for America.

Respecting tradition is important when thinking about what is best for America.

### Appendix C: Study 4 Pre-Registered Model Longitudinal Results (Fixed-Effects)

**Pre-registration:** “We will regress attitude stability as measured with the MSSD on political knowledge, political engagement, network density (as operationalized by the mean edge weight within in individual’s network), attitude centrality (operationalized as described above), and a dummy indicator for whether a symbolic element is central to an individual’s belief system network. The model will be a multilevel model with random intercepts for participant and attitude object. If hypothesis 1 is supported, the coefficient for centrality should be negative and significant, indicating that those attitudes that are more central are less likely to vary over time. If hypothesis 2 is supported the coefficient for network density should be negative and significant, indicating that those who have denser belief system networks have more stable attitudes over time. If hypothesis 3 is supported people who have symbolic elements as central to their belief system networks should have more stable attitudes over time, thus the coefficient for symbolic centrality should also be negative and significant.

Since following our multiple imputation, we will have 5 multiply imputed datasets, we will run 5 models, 1 on each of the datasets, and pool the results of the analyses (Van Buuren & Groothuis-Oudshoorn, 2011)<sup>1</sup>.”

Term	Estimate	Standard Error	P-Value
Knowledge	-.02	.007	.002
Engagement	-.0002	.006	.96
Density	.01	.007	.15
Centrality	-.04	.008	<.0001
Symbolic Central	-.004	.003	.18

*Note:* Model was changed due to some correlation between terms of interest (e.g., centrality of individual attitudes and density of network, engagement and knowledge being related to density) that could change substantive interpretation of constructs (e.g., Lynam et al., 2006). Other than density changing in direction and significance, results are otherwise unchanged. We do not draw strong conclusions regarding density and attitude stability (see main text) and our primary result of interest (that more central attitudes are more stable over time than peripheral attitudes) remains unchanged. In this model, as pre-registered higher MSSD’s represent greater *instability* in contrast to the coding presented in text.

<sup>1</sup> Note; Numbering of hypotheses differs between pre-registration and manuscript, but this is a rhetorical choice with the exception of our abandoned hypothesis 3 from the pre-registration.

**Appendix D: Logistic Regression With Binary MSSD Dependent Variable for Study 4,  
Testing Attitude Centrality and Network Density's Relationship With Stability**

**Log MSSD (1- No Change, 0- Change)**

Term	Estimate	Standard Error	P-Value
Centrality	2.7	.45	<.001

**Log MSSD (1- No Change, 0- Change)**

Term	Estimate	Standard Error	P-Value
Density	2.35	.38	<.001

### Appendix E: Study 4 Pre-Registered Models Knowledge and Engagement Will Predict Density

**Pre-registration:** “Hypothesis 5<sup>2</sup> will be tested by fitting an OLS regression. In this model, network density (operationalized as mean of the absolute value of all ties in an individual’s network at time 1) will be regressed on political engagement (model 3) and political knowledge (model 4). If political knowledge and political engagement significantly predict network density, then hypothesis 5 is supported.”

#### Density

Term	Estimate	Standard Error	P-Value
Knowledge	.05	.007	<.001

#### Density

Term	Estimate	Standard Error	P-Value
Engagement	.15	.007	<.002

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<sup>2</sup> Note; Numbering of hypotheses differs between pre-registration and manuscript, but this is purely a rhetoric choice with the exception of our abandoned hypothesis 3 from the pre-registration



## Appendix F: Study 4 Pre-Registered Models Knowledge and Engagement Will Predict Symbolic Centrality

**Pre-registration:** “Hypotheses 4 and 5<sup>3</sup> will also be tested with linear regression models. To test Hypothesis 4, that political knowledge and political engagement will predict having a symbolic element as central to one’s belief system network, we will fit logistic regressions in which symbolic centrality at time 1 (1=yes, 0=no) is regressed on political knowledge (model 1), and political engagement (model 2). If political knowledge and political engagement significantly predict having a symbolic element as central to one’s belief system network then hypothesis 4 is supported.”

### Symbolic Central? (0- No; 1- Yes)

Term	Estimate	Standard Error	P-Value
Knowledge	.61	.29	.02

### Symbolic Central? (0- No; 1- Yes)

Term	Estimate	Standard Error	P-Value
Engagement	.12	.26	.68

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<sup>3</sup> Note; Numbering of hypotheses differs between pre-registration and manuscript, but this is purely a rhetoric choice with the exception of our abandoned hypothesis 3 from the pre-registration

### Appendix G: Simulation Based Power Analyses

Study	Model Syntax	Hypothesis	Hypothesized Effect Size	Estimated Power
Study 1	lmer(centrality ~ symbolic + (symbolic   ResponseId) + (1   name))	symbolic >0	.15	1
	lmer(centrality ~ symbolic*engage + (symbolic   ResponseId) + (1 name))	symbolic*engage>0	.10	1
	lm(density ~ engage)	engage>0	.15	.99
Study 2	lmer(centrality ~ symbolic + (symbolic   ResponseId) + (1   name))	symbolic > 0	.15	.80
	lmer(centrality ~ engage*symbolic + (symbolic   ResponseId) + (1 name))	engage*symbolic> 0	.10	.99
	lm(density ~ engage)	engage > 0	.15	.99
Study 3	lmer(centrality ~ symbolic + (1   ResponseId) + (1   name))	symbolic > 0	.15	.81
	lmer(centrality ~ pk*symbolic + (1   ResponseId) + (1 name))	pk*type > 0	.10	1
	lmer(centrality ~ engage*symbolic + (1   ResponseId) + (1 name))	symbolic*type > 0	.10	1
	lm(density ~ pk)	pk >0	.15	1
	lm(density ~ engage)	engage > 0	.15	1
	lmer(position_t2 ~ position_t1_c*centrality + (1 name) + (1 ResponseId))	position_t1_c*centrality > 0	.50	.89
	lmer(position_t2 ~ position_t1_c*density + (1 ResponseId))	position_t1_c*density >0	.30	.93
Study 4	lmer(centrality ~ symbolic + (1   ResponseId) + (1   name))	symbolic >0	.15	1

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lmer(centrality ~ symbolic*pk + (1 ResponseId) + (1 attitude))	symbolic*pk	.10	1
lmer(centrality ~ symbolic*engage+ (1   ResponseId) + (1   name))	symbolic*engage	.10	1
lm(density ~ pk)	pk>0	.15	1
lm(density ~ engagement)	engagement > 0	.15	1
lmer(dict_mssd ~ centrality + (1 name) + (centrality ResponseId)	centrality>0	.5	1
lmer(dict_mssd ~ density + centrality + (1  attitude) + (1 ResponseId))	density > 0	.3	1

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*Note:* Variables names for variables representing the same concept were changed to match each other for ease of substantive interpretation. In actuality, in the replication files, variable names for the same construct variable across different datasets.