Supplemental Information for The Measurement of Partisan Sorting for 180 Million Voters

Jacob R. Brown[1] and Ryan D. Enos[2]
[1] Institute for Quantitative Social Science and Department of Government, Harvard University, Cambridge, Massachusetts, USA (jrbrown@g.harvard.edu)
[2] Institute for Quantitative Social Science and Department of Government, Harvard University, Cambridge, Massachusetts, USA (renos@gov.harvard.edu)

Supplementary Methods

Data Coverage

Supplementary Table 1 shows the percent of each voter in the voterfile with non-missing values for each variable after our additions to the original L2 file. In geographic-based analysis, voters missing the geographic variable are not included in the analysis. Note that 93% of the US population lives in a CBSA and 75% of the US population lives in a Census Place. Gender, race, and age are used in the imputation process described below where we also discuss how we imputed missing values for those variables. Party has 100% coverage in the 30 states and the District of Columbia where party ID is recorded.

Nearest Neighbor Analysis up to 50,000 Neighbors

In our analysis we measure partisan residential context by determining the 1,000 nearest neighbors to each voter. Prior to conducting this analysis, we took a random sample of 10,000 voters and located their 50,000 nearest neighbors, so as to determine the number of nearest neighbors at which adding more neighbors the the analysis is not informative as to a voter's Spatial Exposure and Isolation. For these 10,000 voters, we calculated their Spatial Exposure and Isolation at varying levels of neighbors from 5 up to 50,000. Supplementary Figure 1 plots the distribution percentiles of Spatial Exposure and Isolation for this sample across number of neighbors. We see that the major changes in Spatial Exposure and Isolation that result from adding more neighbors to the analysis levels off after 1,000 neighbors. Above that, more neighbors add little information to our proximity-weighted measures.

Imputation of Partisanship

Our analyses rely on imputations of partisanship for voters not registered to a political party in the voterfile. We impute partisanship for voters who do not have partisanship explicitly recorded through a three-step process. First, we code remaining non-partisans as Democrat or Republican based on the last partisan primary in which they voted: most states that do not record partisanship — and some that do record partisanship — have open primaries, so voters can cast a ballot in either parties' primary, providing an indication of partisan attachment (Supplementary Table 2). Next, we code individuals registered to third parties with clear ideological leans into the Democrat or Republican classification. Supplementary Table 3 shows our classifications of each third party. Lastly, we impute partisanship for the remaining non-partisans through a Bayesian process combining the individual-level probability of different combinations of voter demographics conditional on partisanship based on a nationwide sample of voterfile validated respondents from the Cooperative Congressional Election study (CCES) (1), with a geographic prior based on the 2016 vote share of the precinct in which the voter lives, net the Republican and Democratic counts in that precinct.

Precinct level vote shares were constructed from data provided by the MIT Election Lab and augmented with data collected from individual states. Using a series of spatial and tabular joins, we successfully merge 98.59% of voters with their precinct-level returns. There

is some variation in the success of merging across states, ranging from 0% non-merged in several states to 13.01% in South Dakota, which is a state in which some counties do not have spatially defined precinct, but in which voters can vote in whatever voting precinct they choose. For voters for whom we could not put in a precinct, we instead constructed a geographic prior from county-level returns (Supplementary Table 4).

To construct the individual level probability, we use the voterfile validated sample of CCES respondents (that is voters who, prior to anonymization, are matched to individuals on the voterfile so that aspects of their identity are confirmed against official records) and for four variables (race, age, gender, and turnout in the 2016 election), we calculate the probability of every unique combination, conditional on self-reported partisanship (Democrat, Republican, or independent, where "lean" Democrat or Republican were incorporated into Democrat or Republican). We coarsen age into quantiles (18-34, 35-50, 51-62, > 63) for this analysis, and group CCES respondents into strata based on these four variables.

In the L2 voterfile, 810,364 voters do not have a gender listed. For these voters, we imputed Male or Female gender based on their age and first name, using the `R` package `gender`, which compares name and age to census data on frequency of male and female names across years. With this we successfully impute gender for all but 60,407 of the voters with missingness in the gender variable. Additionally, 3,017,665 voters do not have their age recorded on the voterfile. For these voters, we impute their age by taking the median age of other voters in the file with the same first name and same gender. We do this for all voters with missingness save those in Wisconsin, where, relying on YouGov survey data indicating that voters with no age in the voterfile are overwhelmingly in the 18-34 age demographic, we categorize their age in the youngest stratum (YouGov survey data was collected in 2019 for the *New York Times* and was communicated to us privately by Nate Cohn on December 18, 2019). In this way, we were able to successfully impute age for all but 381,926 of the voters with missingness in the age variable. For the voters still missing values for these variables after these steps, we constructed their prior probabilities from the proportion of Democrats and Republicans with their intersection of available variables.

We then calculate the proportion of the three partisan groups in the CCES sample who fit into each strata. The groups were Democrat, Republican, or Independent, with independents who said they "lean" toward Democrat or Republican assigned to the party to which they lean. We then ascribe, to each unclassified non-partisan in the nationwide file, the probabilities of their demographic makeup conditional on each partisan group.

$$Pr(X_i = x|D_i) = \frac{\sum_{j=1}^{n_D} \mathbb{I}(X_j = x)}{n_D}$$
$$Pr(X_i = x|R_i) = \frac{\sum_{j=1}^{n_R} \mathbb{I}(X_j = x)}{n_R}$$
$$Pr(X_i = x|I_i) = \frac{\sum_{j=1}^{n_R} \mathbb{I}(X_j = x)}{n_I}$$

where X_i is the demographic makeup of voter i in the nationwide voterfile, X_j is the demographic makeup of CCES respondent j, n_D is the number of self-reported Democrats

in the CCES sample, n_R is the number of self-reported Republicans in the CCES sample, and n_I is the number of self-reported independents in the CCES sample.

The geographic prior is constructed by taking the precinct-level (or county for small portion of voters, see above) probability that a non-Republican or non-Democrat cast a vote for the Republican or Democratic candidate in 2016. This is done by taking the number of votes for the Republican candidate in the 2016 general election — Donald Trump — and the Democratic candidate — Hillary Clinton — and subtracting the number of Republicans (registered, third party lean, or by primary voting) from the vote count for the Republican candidate and subtracting the number of Democrats from the vote count for the Democratic candidate. The remaining votes for the Republican (Democrat), after accounting for the registered Republicans (Democrats) over the remaining total votes cast after accounting for the registered Republicans (Democrats) defines the geographic prior of being a Republican (Democrat). The probability of being an independent is 1 minus the probability of being a Democrat or Republican. This is:

$$Pr(\mathrm{R}_p) = \frac{\text{Trump Votes}_p - \text{Republicans}_p}{\text{Total Votes}_p - \text{Republicans}_p - \text{Democrats}_p}$$

$$Pr(\mathrm{D}_p) = \frac{\text{Clinton Votes}_p - \text{Democrats}_p}{\text{Total Votes}_p - \text{Republicans}_p - \text{Democrats}_p}$$

$$Pr(\mathrm{I}_p) = 1 - Pr(\mathrm{D}_p) - Pr(\mathrm{R}_p)$$

With these probabilities, we use Bayes formula to construct the posterior probability of being a Democrat, Republican or Independent:

$$Pr(\mathrm{R}_i|X_i) = \frac{Pr(X_i|\mathrm{R}_i)Pr(\mathrm{R}_c)}{Pr(X_i|\mathrm{R}_i)Pr(\mathrm{R}_c) + Pr(X_i|\mathrm{D}_i)Pr(\mathrm{D}_c) + Pr(X_i|\mathrm{I}_i)Pr(\mathrm{I}_c)}$$

$$Pr(\mathrm{D}_i|X_i) = \frac{Pr(X_i|\mathrm{D}_i)Pr(\mathrm{R}_c)}{Pr(X_i|\mathrm{R}_i)Pr(\mathrm{R}_c) + Pr(X_i|\mathrm{D}_i)Pr(\mathrm{D}_c) + Pr(X_i|\mathrm{I}_i)Pr(\mathrm{I}_c)}$$

$$Pr(\mathrm{I}_i|X_i) = \frac{Pr(X_i|\mathrm{I}_i)Pr(\mathrm{R}_c)}{Pr(X_i|\mathrm{R}_i)Pr(\mathrm{R}_c) + Pr(X_i|\mathrm{D}_i)Pr(\mathrm{D}_c) + Pr(X_i|\mathrm{I}_i)Pr(\mathrm{I}_c)}$$

Supplementary Table 5 shows the percent of the electorate classified as Democrats, Republicans, and Independents at each step of the imputation process prior to the Bayesian imputation, then shows the weighted averages of the posterior probabilities that result from our multi-step imputation.

Supplementary Figure 2 shows the distribution of posterior partisanship probabilities separately for Democratic and Republican partisanship across (a) voters for whom we impute partisanship using the Bayesian imputation, (b) voters who are not registered to the Democratic or Republican party in the L2 files, so for whom we code partisanship through their primary voting, third party affiliation, or Bayesian imputation, and (c) all voters in the L2 file, registered to a major party or otherwise. Voters who are registered to a major party, vote in a partisan primary, or are registered to a party with a clear ideological lean

will have a posterior partisan probability of 1 for the assigned party and 0 for the out-party. This is reflected in the distribution of all voters, where the most common posterior values are overwhelmingly 0's and 1's. In the distribution of voters for whom we were unable to code based on primary voting or third party affiliation, and thus relied on Bayesian imputation, there is more variation in posterior probabilities with many falling between 0 and 1.

Survey Details

In order to assess the accuracy of our imputation, we surveyed 12,221 voters, randomly sampled after stratification by state and whether partisanship was visible on the voterfile with an over-sample of non-partisans. Respondents were contacted by email from email addresses linked to the voterfile by the vendor L2. In the survey we validate L2's linking, finding that, conditional on getting a response, 86.1% of respondents report to being the person to whom the email address was matched in the voter list. We limit our analysis to these voters ($n = 10,519$).

To conduct the survey, we sent emails containing the invitation to participate in our online Qualtrics survey to 1,753,493 unique voters. Of these emails, 47.2% bounced, indicating that the email was invalid or that our email was rejected by a server, perhaps for spam protection. Thus, 925,339 unique voters received an invitation to participate in the survey, and we received 12,221 responses, a response rate of 1.3%, which is similar to the single-digit response rates expected for modern phone or email surveys. In our analysis of the survey, we construct survey weights to account for non-response and report results with and without these weights below.

Survey Weights

In comparing our imputed partisanship to self-reported partisanship, we present unweighted survey results and results that incorporate survey weights created to make the survey population more comparable to the population of voters for whom we imputed partisanship, that is voters not explicitly registered as Democrats or Republicans in the L2 voter lists. These weights incorporate observable information on race, age, gender, vote history, and the type of urban area (major, minor, or outside) and population density in which the respondent lives. We also model response bias within the sample of people emailed surveys along the same observable variables. The survey weights are the combination of these models.

To construct the weights, we first model the likelihood of having an email address attached to voter records for each unaffiliated voter in the nationwide voter list.

$$P(\text{Email}_i|\mathbf{X}_i) = g^{-1}(\beta\mathbf{X}_i)$$

where $g^{-1}(\cdot)$ is the inverse-logit function, $\mathbf{X}_i$ is a vector of covariate values for voter i's state of residence, pre-imputation partisan identification, race, age, gender, whether or not they voted in 2016, the category (High, Medium, Low, Very low) of population density of the tract in which they live, and the type of urban area (Major, Minor, Outside Metro area) in which they live.

Next, we model the likelihood of a voter with an email being contacted for our survey. Potential survey respondents were randomly sampled after stratification by state and whether

partisanship was visible on the voterfile with an over-sample of non-partisans. We then multiply the probability of having an email with the probability of contact to produce a design probability (probability of having an email and receiving a survey invite) for each voter in our survey contact list.

$$P(\text{Contact}_i|\text{State}_i, \text{Partisan Registration}) = g^{-1}(\beta_0 + \beta_1 \text{State}_i + \beta_2 \text{Partisan Registration})$$

$$P(\text{Email}_i \cap \text{Contact}_i|\mathbf{X}_i) = P(\text{Email}_i|\mathbf{X}_i) \times P(\text{Sampled}_i|\text{State}_i, \text{Partisan Registration})$$

After receiving responses, we model the likelihood of receiving a response within our contacted sample. We then multiple response probability with our design probability to get the overall probability of having an email, being contact, and getting a response. We re-scale these weights as is common practice so that their sum reflects the total number of respondents.

$$P(\text{Response}_i|\mathbf{X}_i) = g^{-1}(\beta \mathbf{X}_i)$$

$$\text{Survey Weight}_i = \frac{1/(P(\text{Email}_i \cap \text{Contact}_i \cap \text{Response}_i|\mathbf{X}_i))}{\sum_{i=1}^{n} 1/(P(\text{Email}_i \cap \text{Contact}_i \cap \text{Response}_i|\mathbf{X}_i))} \times n$$

where n is the number of survey respondents.

Supplementary Figure 3 and Supplementary Table 6 detail the distribution of weights across the entire survey sample and the subset that are not registered as Republicans or Democrats. Tables 7 through 11 and Supplementary Figure 4 demonstrate how the survey sample (weighted and unweighted) compares across key observable variables (race, gender, population density, urban area, 2016 turnout, and age) to the entire population of registered voters in the US, the entire population of US voters not registered to a major party, the subset of voters for whom L2 has an email, and the sample of voters whom we sent an invitation to participate in the survey. Across variables, the survey sample is comparable to the populations from which it was drawn, but is older, has higher proportions of men, Whites, people living in lower population densities and outside of major urban areas, and higher levels of 2016 turnout than the comparison populations. Once survey weights are incorporated these levels look very similar across variables.

Supplementary Results

Results with Discrete Assignment of Partisanship

As discussed in the Methods section of the article, rather than weighting neighbors by the probabilities constructed from our imputation process, we can assign all voters to a discrete party affiliation based on the party with the highest probability from the imputation. Through this process, we classify 89% of voters not registered to a major party as leaning toward either Democrats or Republicans. Supplementary Figure 5 shows results with this assignment of partisanship. Note that Extended Data Figure 6 shows results with no imputation of partisanship.

Results with Different Distance Weights

In the main analysis, we calculated partisan exposure with $a = 1$. The distributions of Spatial Exposure and Isolation with $a = 2$ is in Supplementary Figure 6. In this case, closer distances are given significantly more weight than with $a = 1$ so that the nearest neighbor becomes extremely important in shaping the partisan environment and exposure and isolation become even more extreme than when weights are constructed with $a = 1$. The distributions by quantiles are displayed in Supplementary Table 12.

Weights can also be constructed, not by neighbor distance, but by rank of neighbor closeness, so that the first closest neighbor to each voter, regardless of distance, is given the most weight, the second closest, the next most weight, etc. Distributions with this weighting scheme are in Supplementary Figure 7. In this case, distance is given less significance so that the nearest neighbor, no matter how far apart is given the most weight, resulting in exposure and isolation becoming, on average, less extreme. The distributions by quantiles are displayed in Supplementary Table 13.

Comparison of Spatial Exposure to Other Measures of Segregation

We present distributions of exposure when it is measured using other approaches and compare these to Spatial Exposure and Isolation. All of these comparisons are to apsatial measures, either using individual voters or areal units to calculate segregation. In our analyses, our primary measure of partisan exposure and isolation are averages of exposure to neighbors of each party in a voter's $1,000$ nearest neighbors, weighted by the inverse distance the voter lives from each neighbor. An exposure measure that does not weight for distance is making the strong assumption that distance does not affect probability of exposure, so that the spatial distribution of partisans within the $1,000$ nearest neighbors is uninformative as to partisan exposure.

We present comparisons for: 1) Aspatial individual exposure, that is exposure with the $1,000$ nearest neighbors as the unit of analysis but unweighted by distance between individuals. 2) Asptial aggregate exposure, that is exposure with areal units as the unit of analysis. We present these using cities/towns, ZIP codes, and Census Tracts. 3) Aspatial aggregate exposure calculated from 2016 precinct-level election returns, rather than individual partisanship recorded on or imputed from the voterfile.

For all comparisons, a consistent pattern emerges of aspatial measures understating the true extent of isolation and exposure on average and distributions exposure and isolation quite different than when accounting for distance. For each alternative approach, we show the nation-wide distributions of exposure and isolation, the percentage-point and percent change (with the extremes trimmed at 100%) for each individual voter with the alternative measure compared to the spatially-weighted measure, and the absolute percentage-point and percent change for each individual voter when using the alternative measure. These comparisons of absolute changes are important because while not accounting for the distance between voters, on average, creates downward bias in measures of segregation, segregation is also significantly overstated for a large proportion of voters, meaning that the absolute bias is large and both over and understates segregation.

Individual Spatial versus Aspatial Measures

In the Extended Data we present comparison statistics of weighted versus unweighted partisan exposure measures based on the $1,000$ nearest neighbors. In Extended Data Fig. 1 we show the spatially weighted and unweighted distributions and in Extended Data Fig. 2 we show the nationwide distribution of the change in exposure for each individual voter when we weight by distance. In Extended Data Fig. 3 we show the absolute differences between spatial and aspatial measures. For many voters, the change is small, likely reflecting homogeneity within their 1,000 nearest neighbors. But for a large portion of voters, we see that not accounting for the spatial relationships between them and their neighbors significantly distorts the measurement of partisan exposure and isolation. For both parties, partisan isolation appears lower, and exposure appears higher, when distance is not incorporated, with fewer Democrats living in extreme isolation (> 0.95). The Republican distributions spreads with the incorporation of distance.

City-based Measures

We present comparison statistics of the weighted individual partisan exposure and isolation to city-based aspatial exposure and isolation, with city defined by Census Places. The nationwide distribution in Supplementary Figure 8 is less smooth with the city-based measure and the extreme exposure and isolation are reduced. The individual differences between the city-based measure and the individual spatially-weighted measure are in Supplementary Figure 9 and the absolute differences are in Supplementary Figure 10. These distributions by quantiles are displayed in Supplementary Table 14.

ZIP code-based Measures

We present comparison statistics of the weighted individual partisan exposure and isolation to ZIP code-based aspatial exposure and isolation. The nationwide distribution in Supplementary Figure 11 also reduces extreme exposure and isolation. The individual differences between the ZIP code-based measure and the individual spatially-weighted measure are in Supplementary Figure 12 and the absolute differences are in Supplementary Figure 13. These distributions by quantiles are displayed in Supplementary Table 15.

Census Tract-based Measures

We present comparison statistics of the weighted individual partisan exposure and isolation to Census Tract-based aspatial exposure and isolation. The nationwide distribution in Supplementary Figure 14 also reduces extreme exposure and isolation. The individual differences between the Census Tract-based measure and the individual spatially-weighted measure are in Supplementary Figure 15 and the absolute differences are in Supplementary Figure 16. These distributions by quantiles are displayed in Supplementary Table 16.

Precinct-based Measures

We present comparison statistics of the weighted individual partisan exposure and isolation to precinct-based aspatial exposure and isolation. In this case precincts are based on vote returns, rather than partisanship constructed from the voterfile. We calculate these using aggregate data from election returns because this is the lowest level of aggregate data most commonly available to researchers and presents the most direct aggregate analogy to individual-level measures. The nationwide distribution in Supplementary Figure 17 shows similarities to the individual-based spatially-weighted distribution but the the individual differences between the precinct-based measure and the individual spatially-weighted measure in Supplementary Figure 18 and the absolute differences in Supplementary Figure 19 show the downward bias on segregation found with other aspatial measures. These distributions by quantiles are displayed in Supplementary Table 17.

Imputation Accuracy

Validation of Partisanship

Using these data, we assess validity and accuracy of our imputation in two ways: first by comparing our imputed partisanship to self-reported partisanship (again including "lean" partisans in the parties) and also by comparing the ideology of imputed and non-imputed voters.

Extended Data Fig. 5 plots the imputed posterior partisanship probabilities for our survey respondents who are not registered as Democrats or Republicans against their rates of self-reported partisanship. A perfect correlation would follow the 45 degree lines in these figures. We see that our partisan predictions are strongly correlated with self-reported partisanship, and approach the levels of accuracy that we might expect given the levels of partisan instability in survey response (see main text). We are most accurate when our imputation is most confident, where much of the support of our imputation lies and at the high ends, we approach the levels of accuracy possible with the proportions of partisans in our sample.

To more systematically test the accuracy of the imputation, we compute Brier Scores detailing the mean squared error, or the average squared deviation of each survey respondent's posterior partisan probability from their actual partisanship. A Brier score is designed to assess the magnitude of deviations for a probabilistic forecast, and produces a statistic on a 0 to 1 scale, with 0 being zero deviations, or perfect accuracy, and 1 being complete

deviations, or zero accuracy. This is:

$$\text{Brier Score}_p = \frac{1}{n}\sum_{i=1}^{n}[P(p)_i - \mathbb{I}(p_i = p)]^2$$

where the Brier score for predicting p partisanship is the summation of the squared deviations of $P(p)_i$ (the posterior partisan probability of p partisanship for respondent i) from $\mathbb{I}(p_i = p)$ (an indicator variable equaling 1 if the survey respondent reports as being p partisanship). Brier Scores can be inverted (1-score) and interpreted similar to the rate of accuracy of the forecast. Thus, when we observe a Brier score of 0.23 (0.24 unweighted by survey weights) for Democratic partisanship and 0.23 (.25 unweighted) for Republican partisanship, this indicates our forecast is accurately predicting partisanship at rates of approximately 77% for both parties. Supplementary Figure 20 further illustrates the accuracy of the forecast, plotting the histogram of Brier Scores for survey respondents, as well as the average and median scores. Supplementary Figures 21 and 22 demonstrate the consistency of these patterns for survey respondents living in different states, different types of urban areas, and different densities.

Comparison of Ideology

We can also validate the premise and accuracy of our imputation by examining the political ideology of imputed to non-imputed voters. If the voters we impute have, on average, very different political ideology than those not imputed, then imputing for the purposes of measuring partisan exposure could be misleading because it would artificially inflate the levels of exposure to ideologically (dis)similar voters. On the other hand, if imputed and non-imputed voters have similar ideologies, it demonstrates that not imputing would be a mistake because it would cause us to understate levels of exposure to these ideologies.

Across a number of tests, we find strong consistency between imputed and non-imputed voters in our survey data. In Supplementary Figure 23, we compare responses on a 7-point scale of ideology from "Extremely Liberal" to "Extremely Conservative." This ideology scale is standard on large-scale political science surveys, such as the American National Election Study. Comparing imputed and non-imputed voters yields similar distributions within party, as defined by self-reported responses to a three item question about their partisanship. For Democrats ($n = 2,914$) a Kolmogorov-Smirnov test for a difference in distributions between imputed and non-imputed voters yields $D = 0.022, p = 0.893$ (two-tailed test), not allowing us to reject the null hypothesis of no difference in distributions at $p < .05$. Kolmogorov-Smirnov for Republicans ($n = 3,069$) also shows similar ideology across imputed and non-imputed voters ($D = 0.029, p = 0.564$, two-tailed test). In Supplementary Figure 24 we also compare ideology across imputed and non-imputed partisans within party but further subset the data by states in which party registration is possible (see Supplementary Table 2). Within party, the ideology across imputed and non-imputed individuals and different types of states is very similar.

We can also use ideology to validate that our imputations reflect ideological variation so that the probability of partisanship is correlated with ideology, that is those we impute as

more likely to be Republican are more conservative than those we impute as more likely to be Democrats. We do this in Supplementary Figure 25 where we show that our posterior probability of being a Democrat ($Pr(D)$) is correlated with two measures of ideology and that the variation is consistent across imputed and non-imputed voters and across states with and without party registration. The first is on the self-reported scale of ideology, where 1 means "Extremely Liberal" and 7 means "Extremely Conservative". In the top figure, as $Pr(D)$ (divided into five quantiles on the x-axis) increases, the average self-reported ideology also becomes more liberal. In the lower figure, we scale ideology using survey respondents' statement of being "for" or "against" eight issues before Congress. These were (issues were presented in random order):

1. Repeal Affordable Care Act: Would repeal the Affordable Care Act of 2009 (also known as Obamacare).

2. American Health Care: Would repeal the tax penalties on individuals for not maintaining health coverage and on employers for not offering coverage. Would end subsidies to help people purchase insurance and would end funding for states that expanded Medicaid.

3. Financial CHOICE Act: Allows banks to not be subject to the heightened regulatory requirements of Dodd-Frank by maintaining enough reserve funds to withstand a financial downturn. Grants the president the power to fire the head of the Consumer Financial Protection Bureau and the Federal Housing Finance Agency at any time and without cause. Repeals a rule which prevents commercial banks from making speculative investments for their own profits.

4. Kate's Law: Increases criminal penalties for individuals in the country illegally who are convicted of certain crimes, deported, and then re-enter the U.S. illegally.

5. Countering America's Adversaries Through Sanctions Act: Places sanctions on Iran, North Korea, and Russia. Sets into law sanctions imposed by the Obama administration for Russia's interference in Ukraine, Syria, and the 2016 presidential election. Requires the president to get congressional approval before easing or lifting sanctions on Russia.

6. No Sanctuary for Criminals: Withholds federal funds from states and localities that do not follow federal immigration laws.

7. Assault Weapons Ban of 2019: Makes it a crime to knowingly import, sell, manufacture, transfer, or possess a semiautomatic assault weapon or large capacity ammunition feeding device.

8. Impeaching Donald Trump, President of the United States, for high crimes and misdemeanors.

9. Federal Civilian Workforce Pay Raise Fairness Act of 2019: increases by 2.6% the rates of basic pay for federal civilian employees for 2019.

We then scale their responses to extract a measure of latent ideology for each voter using the method developed by (2). This is the same method that has been used to scale the ideology of Members of Congress and voters in previous research (3). The scale is arbitrary, with a mean of 0, max of 2.23, and min -1.96. More negative scores mean more liberal. The median Democrat in our data has a score of -1.07, the median Republican 0.87, and the median Independent -0.08. We examine the correlation between this measure and $Pr(D)$ and, once again, find that as $Pr(D)$ increases, their issue-scaled ideology also becomes more liberal, as indicated by lower scores on this latent dimension.

Comparison to the Normal Vote

In the main text, we reference comparison of our imputation and weighted exposure measures to classical measures of the normal vote. The political science concept of the "normal vote" refers to the portion of the electorate in a given geography that prefers to vote for Democratic (Republican) candidates, independent of candidate-specific or election-specific effects (4). A common measure of the normal vote is to take presidential vote returns across time, typically 3 election cycles, and to calculate the average of the portions for each party across the time period (5). To compare our imputations to the normal vote, we download county-level presidential election returns from the MIT Election Lab, and calculate the average presidential Democratic and Republican vote by county across the 2008, 2012 and 2016 presidential elections. We then aggregate our imputation measures by county, calculating the average of our Democratic and Republican imputations for each county, as well as the average of individual-level weighted exposure to each party by county. In Supplementary Table 18, we present the county-level correlations between Democratic normal vote and average imputed Democratic partisanship, and Republican normal vote and average imputed Republican partisanship. We also present the correlation between county-level Democratic normal vote and average spatial exposure to Democrats, and between county-level Republican normal vote and average spatial exposure to Republicans. For all correlations, we weight by number of registered voters in the county, to best represent the experience of the average individual. Our measures of partisanship are highly correlated ($r = .92$) with these standard measures of the normal vote, as are our measures of spatial exposure.

Tests for Difference of Mean Relative Differences from Zero

In the Methods section of the main text, we state that "at each level of geography, for both Democrats and Republicans a population-weighted T-test for a mean different than zero yields $p < 0.001$ (two-tailed test). See Supplementary Information for further details." Full results for these tests are displayed in Supplementary Table 19.

Relative Exposure Robustness to Dropping Same-household Neighbors

Here, we present the robustness of our Relative Exposure results to calculating Spatial Exposure and Isolation without including neighbors who live in the same household as the voter, leaving a measure of partisan exposure to other voters with which a voter does not live. In day to day life, a good deal of exposure to politics likely comes from people living in the same household, so including household members makes sense. However, for Relative Exposure statistics, the comparison between Democrats and Republicans living in the same geography, we want to know if they are robust to dropping same-household neighbors to demonstrate that the differences between Democrats and Republicans who live in the same town and neighborhood are not attributable only to different patterns in cohabitants, but to actual choices of where to live in relation to one's neighbors.

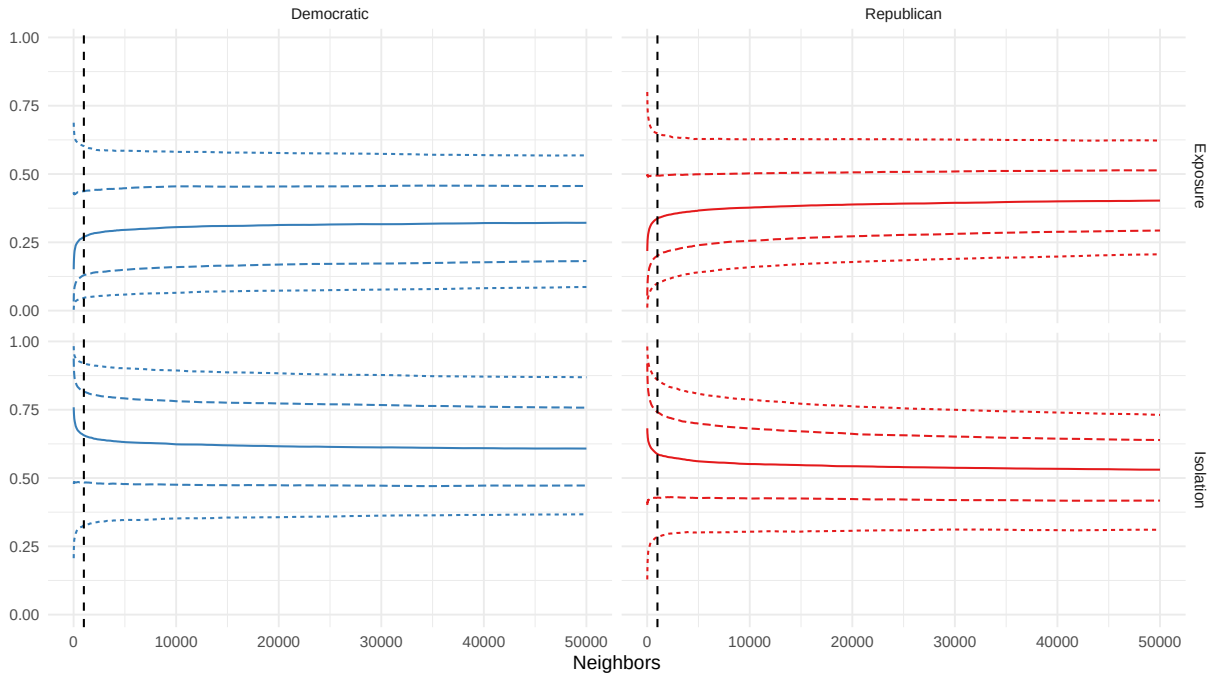
We identify cohabitants by finding voters registered at the exact same address. Supplementary Figure 26 presents the distribution of how many neighbors (from the original 1,000) are left across voters after we drop their same-household neighbors. We see that many voters live with 0, 1 or 2 cohabitants and very few live with more than 3 registered cohabitants. To appear as neighbors in our analysis, these cohabitants must be registered to vote. This precludes children and other cohabitants who are unregistered by choice or for other reasons.

After dropping same-household neighbors, we do see reductions in the differences between the partisan environments of Democrats and Republicans living in the same geographies. However, even down to the neighborhood (Census Tract) level, we still see meaningful differences between Democrats and Republicans. Supplementary Figure 27 presents the distribution of Relative Exposure across different baseline geographies. We further test whether these differences are statistically significant, by estimating t-tests, weighting by the population of each unit, on the within-geography difference between Democratic and Republican partisan environments. Supplementary Table 20 presents results of this analysis for where we drop same-household neighbors. We see that results are consistent in direction and significance across baseline geographies for the main results (see Supplementary Table 19) and the results without same-household neighbors.

Within-Race Partisan Segregation

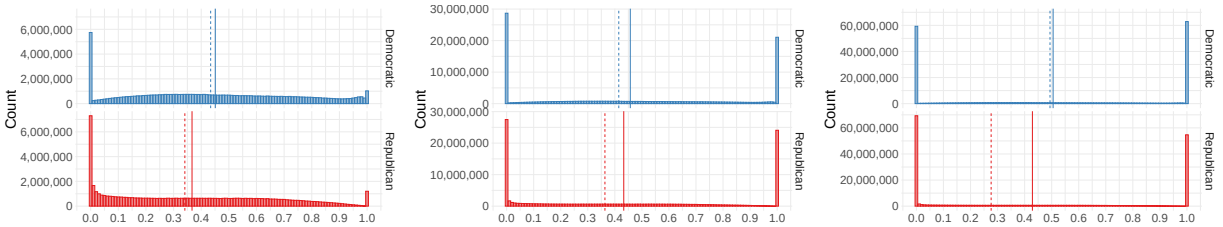
To test the extent to which partisan segregation is distinct from racial/ethnic segregation, we compare our measures of partisan segregation to the same measures but with exposure and isolation only calculated among voters of the same race. Among non-Hispanic white voters, the distribution of the difference between Spatial Exposure and Isolation calculated among all voters and only among their non-Hispanic white neighbors are narrowly centered around 0, indicating that, on average, partisan isolation within race for whites mirrors general partisan segregation (Extended Data Fig. 6) and that high levels of partisan isolation remain, even when accounting for racial/ethnic isolation. Supplementary Figure 28 shows the same for voters from other racial/ethnic groups, where there is more change from baseline results when looking only within group.

Supplementary Figures



Supplementary Figure 1: Change in Spatial Exposures by Number of Neighbors

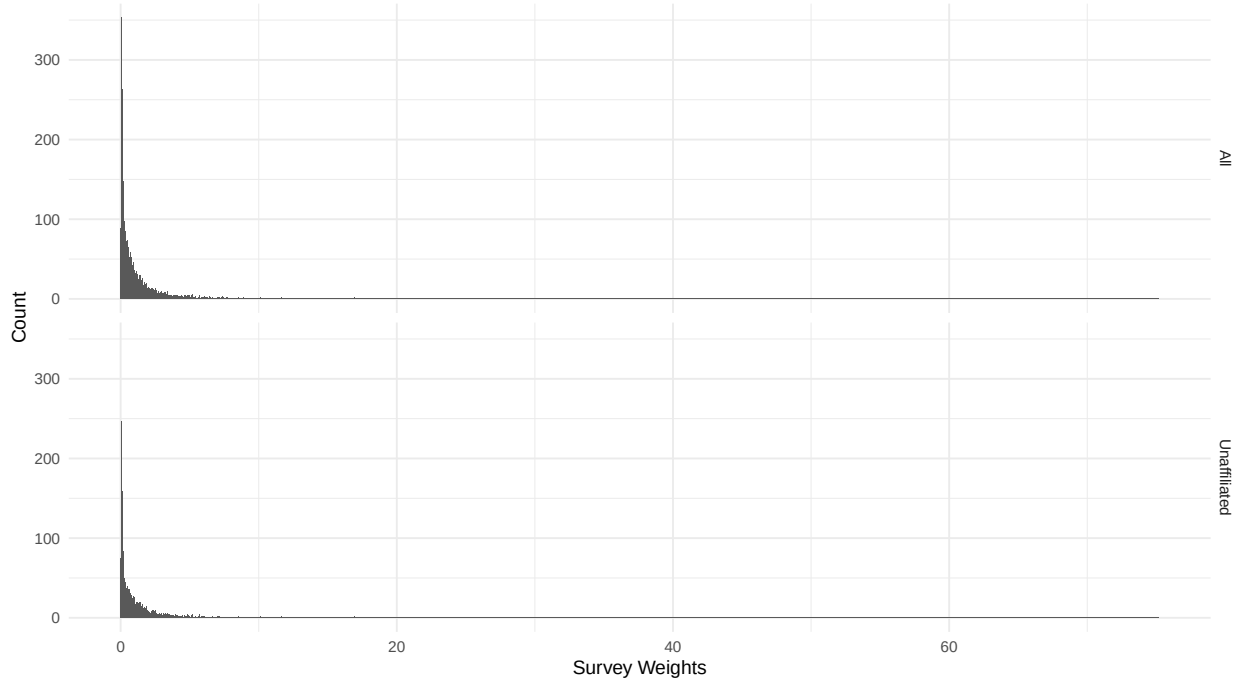
Lines display the percentiles of of Democratic and Republican Spatial Exposure/Isolation at different levels of neighbors for the sample of 10,000 voters where we identified their 50,000 nearest neighbors. The solid lines represent the median or 50th percentile, the dashed line represent the 25th and 7th percentiles, and the dotted lines the 10th and 90th percentiles. The horizontal dashed black line represents the 1,000 neighbor mark. We see that the major changes in Spatial Exposure and Isolation that result from adding more neighbors to the analysis levels off after 1,000 neighbors. Above that, more neighbors add little information to our proximity-weighted measures.



(a) Bayesian Imputation (b) Unaffiliated Voters (c) All Voters

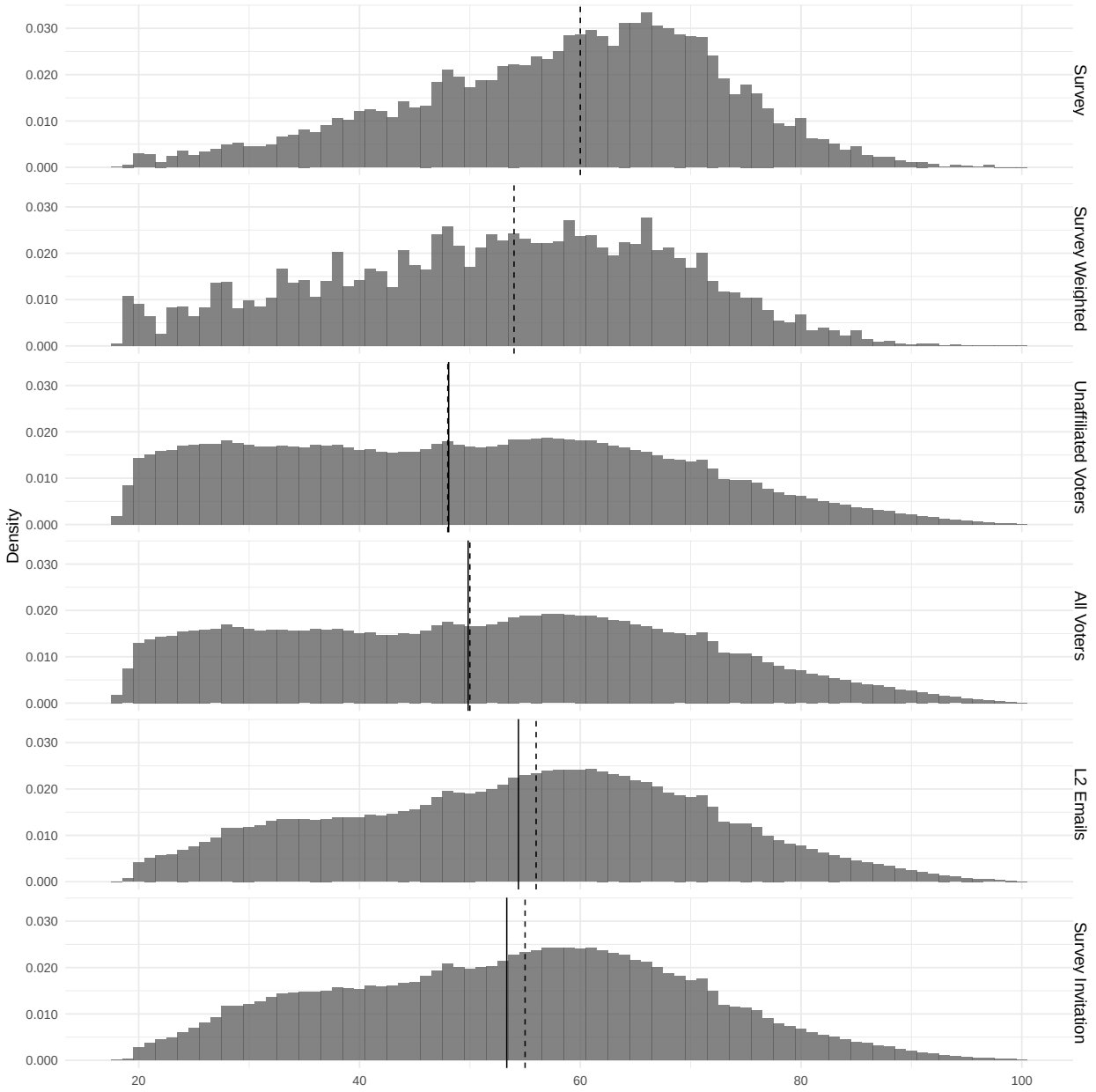
Supplementary Figure 2: Posterior Partisanship

Histograms show the distribution of posterior partisanship probabilities separately for Democratic and Republican partisanship across (a) all voters where we impute partisanship using the Bayesian imputation, (b) all voters who are not registered to the Democratic or Republican party in the L2 files, so for whom we code partisanship through their primary voting, third party affiliation, or Bayesian imputation, and (c) all voters in the L2 file, registered to a major party or otherwise. Note that voters who are registered to a major party, vote in a partisan primary, or are registered to a party with a clear ideological lean will have a posterior partisan probability of 1 for the appropriate party and 0 for the out-party. Solid vertical lines plot the mean and dashed vertical lines plot the median of each distribution.



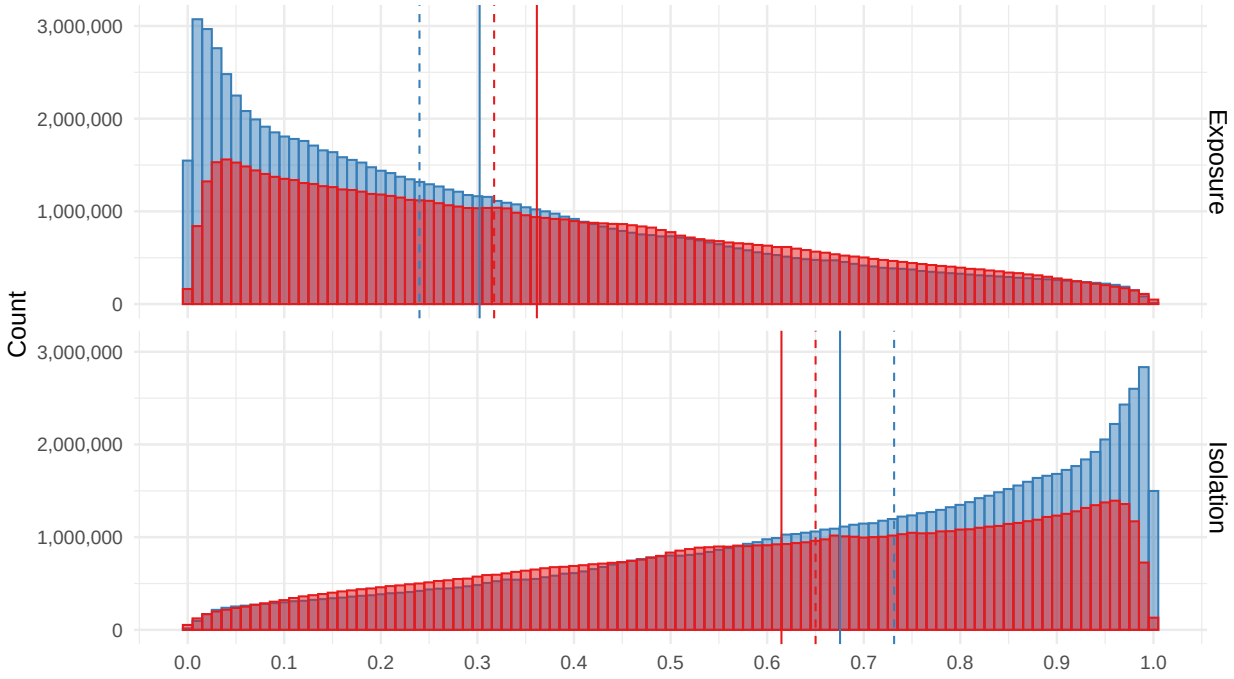
Supplementary Figure 3: Survey Weights Histogram

Distribution of survey weights across the entire survey sample ($n = 10,519$) in the top panel and the subset of the survey sample comprised of voters not registered to major political party ($n = 7,087$) in the bottom panel. Weights are scaled so that the sum equals the total number of respondents in the sample.



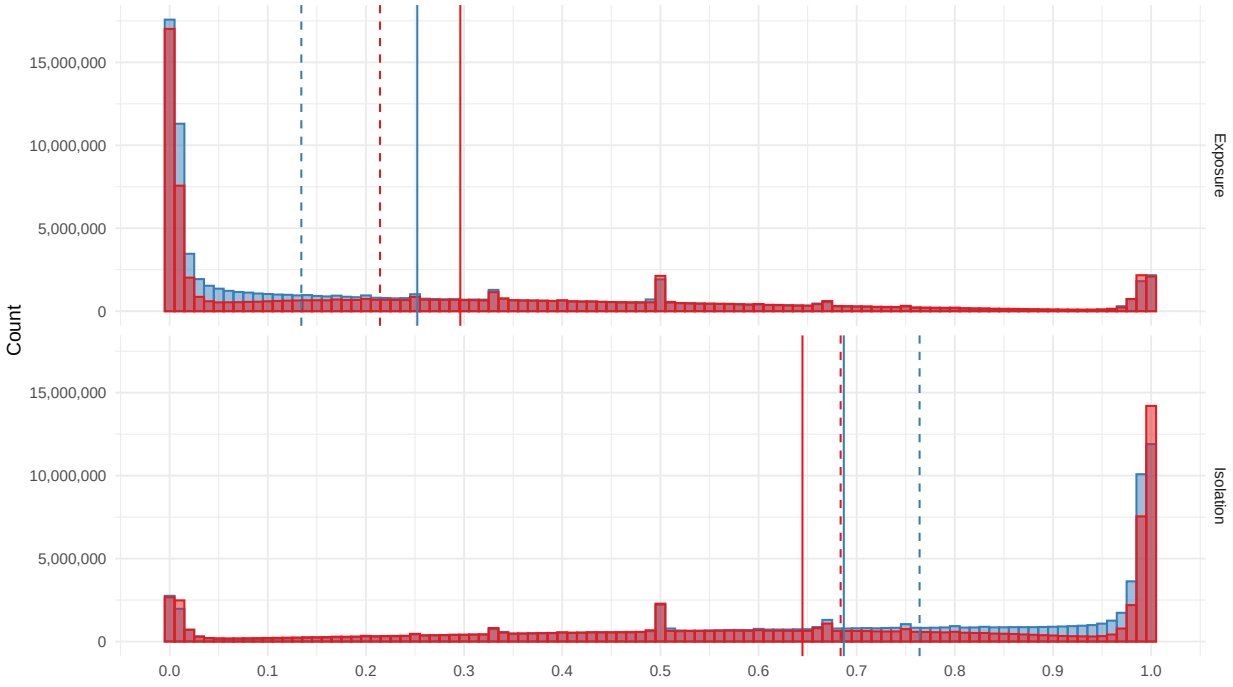
Supplementary Figure 4: Age Survey Comparison

Distribution of age for the survey sample, the weighted survey sample, the entire population of registered voters in the US, the entire population of US voters not registered to a major party, the subset of voters for whom L2 has an email, and the sample of voters whom we sent an invitation to participate in the survey. Vertical solid lines plot the mean and vertical dashed lines plot the median of the distributions.



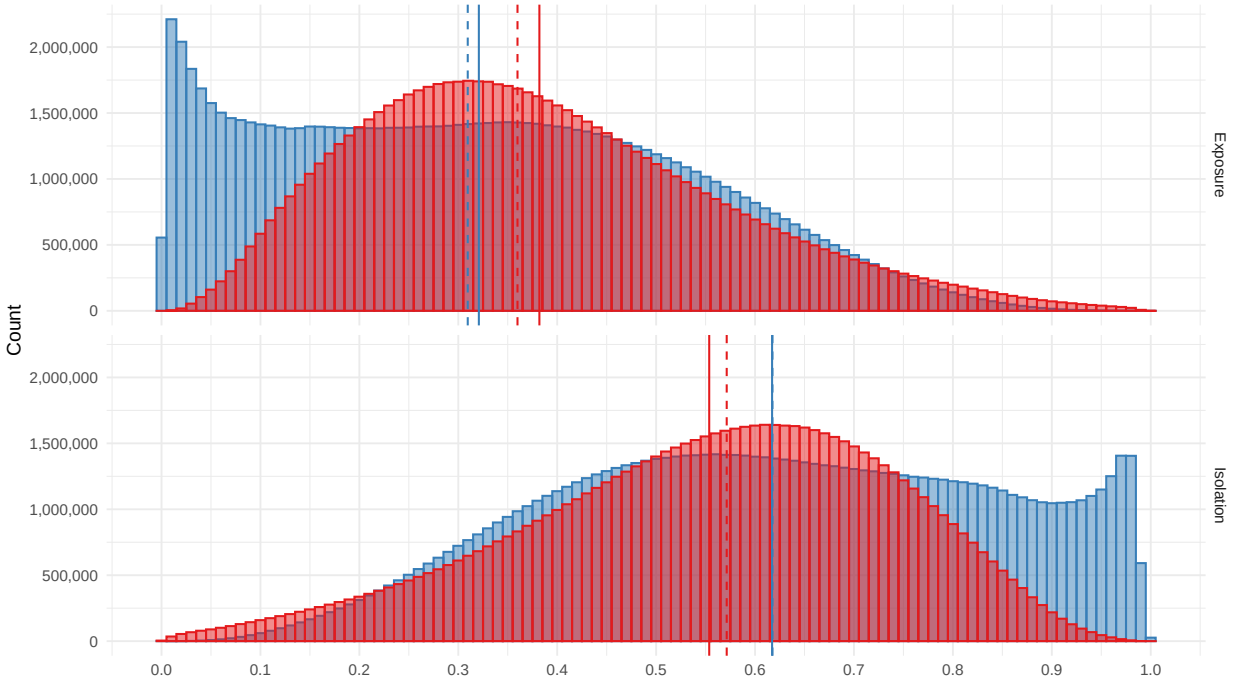
Supplementary Figure 5: Exposure and Isolation with discrete neighbors' partisanship

Nationwide distribution of partisan Spatial Isolation and Exposure separately for Democrats (blue) and Republicans (red) with exposure calculated with discretized partisanship, with voters coded as Democrats or Republicans based on which posterior probabiliy of partisanship is highest. Solid vertical lines represent mean values and dashed lines represent median values. Colored cells present spatially weighted proportion of out-party (Exposure) or in-party (Isolation) neighbors across percentiles. The distributions are weighted by the posterior partisan probabilities.



Supplementary Figure 6: Exposure and Isolation with $a = 2$

Nationwide distribution of partisan Spatial Isolation and Exposure separately for Democrats (blue) and Republicans (red) with $a = 2$, with distances squared when constructing inverse distance weights. Solid vertical lines represent mean values and dashed lines represent median values. Colored cells present spatially weighted proportion of out-party (Exposure) or in-party (Isolation) neighbors across percentiles. The distributions are weighted by the posterior partisan probabilities.

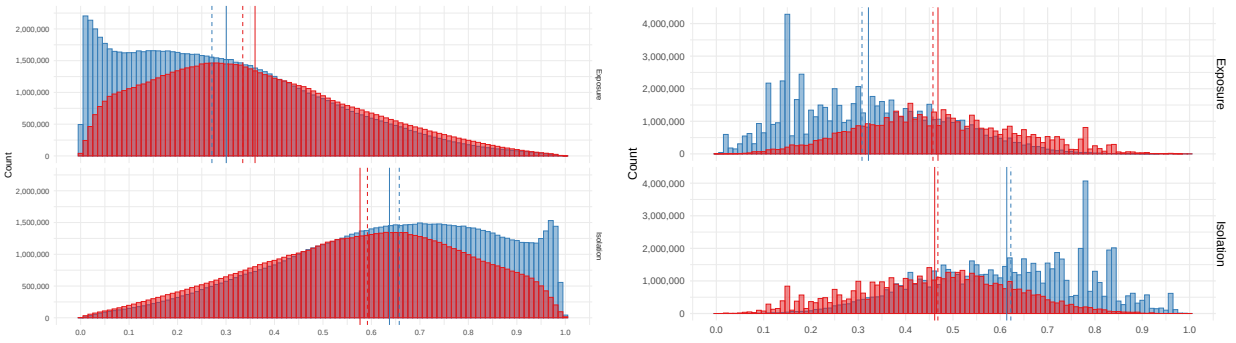


Supplementary Figure 7: Exposure and Isolation weighted by neighbor closeness rank

Nationwide distribution of partisan Spatial Isolation and Exposure separately for Democrats (blue) and Republicans (red) with weighting my neighbor closeness rank. Solid vertical lines represent mean values and dashed lines represent median values. Colored cells present spatially weighted proportion of out-party (Exposure) or in-party (Isolation) neighbors across percentiles. The distributions are weighted by the posterior partisan probabilities.

(a) Individual Spatial

(b) City-based Aspatial

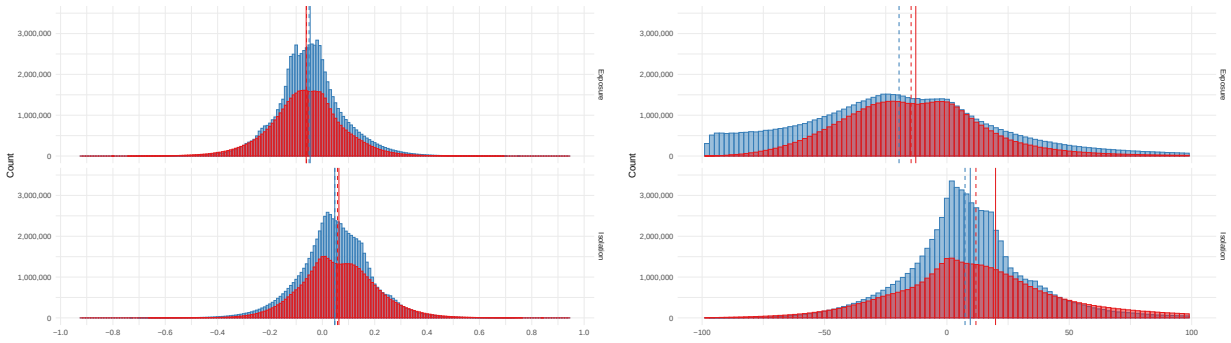


Supplementary Figure 8: Individual Spatial Versus City-based Aspatial Exposure/Isolation

Nationwide distribution of spatial (left) and aspatial city-based (right) partisan isolation and exposure separately for Democrats (blue) and Republicans (red). Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Percentage Point Change

(b) Percent Change

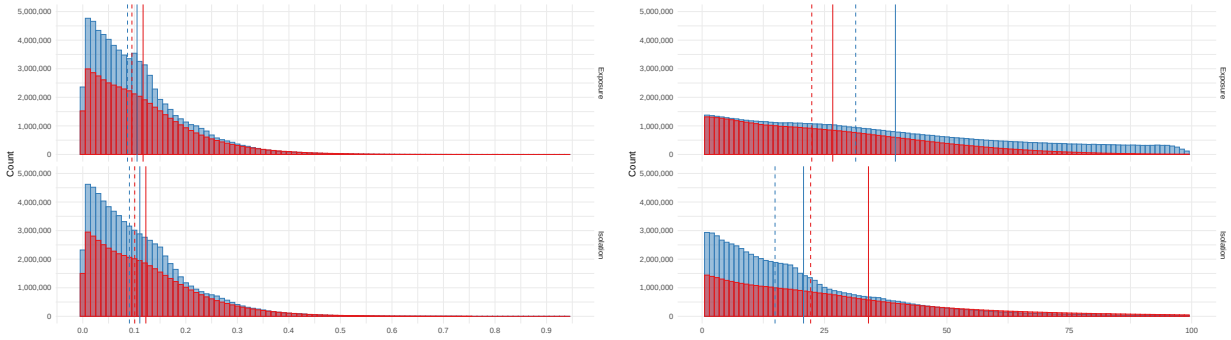


Supplementary Figure 9: Individual Differences in Spatial versus City-based Aspatial Exposure/Isolation

Nationwide distribution of individual-level changes in partisan Exposure and Isolation separately for Democrats (blue) and Republicans (red). The histograms on the left show the percentage point difference in spatial and city-based aspatial exposure, while the histograms on the right show the percent change. Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Absolute Percentage Point Change

(b) Absolute Percent Change

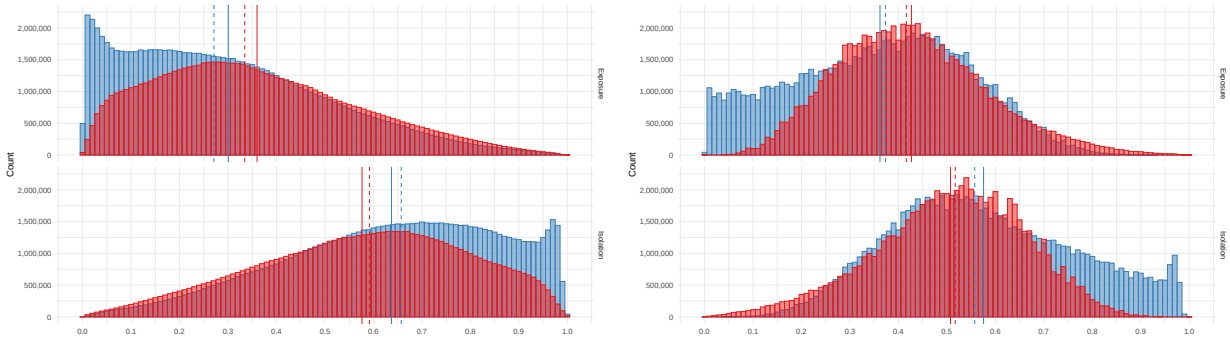


Supplementary Figure 10: Individual Absolute Differences in Spatial versus City-based Aspatial Exposure/Isolation

Nationwide distribution of individual-level absolute changes in partisan Exposure and Isolation separately for Democrats (blue) and Republicans (red). The histograms on the left show the percentage point absolute difference in spatial and aspatial exposure, while the histograms on the right show the absolute percent change. Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Individual Spatial

(b) ZIP code-based Aspatial

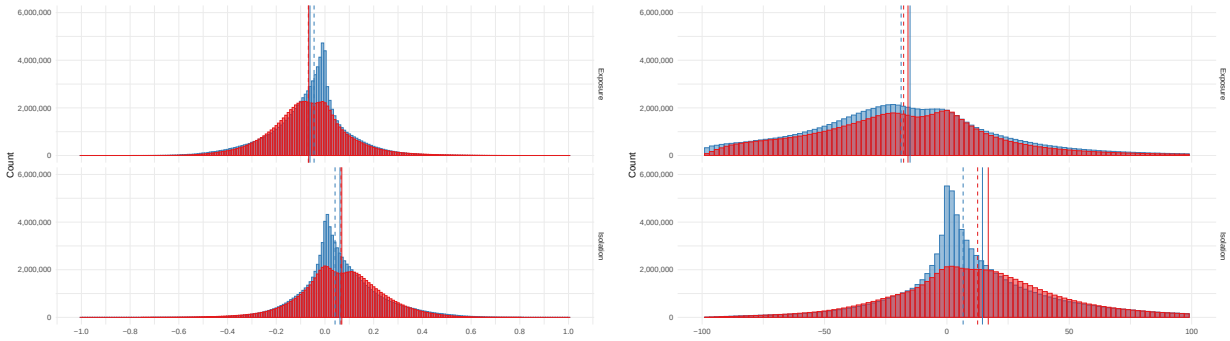


Supplementary Figure 11: Individual Spatial Versus ZIP code-based Aspatial Exposure/Isolation

Nationwide distribution of spatial (left) and aspatial ZIP code-based (right) partisan isolation and exposure separately for Democrats (blue) and Republicans (red). Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Percentage Point Change

(b) Percent Change

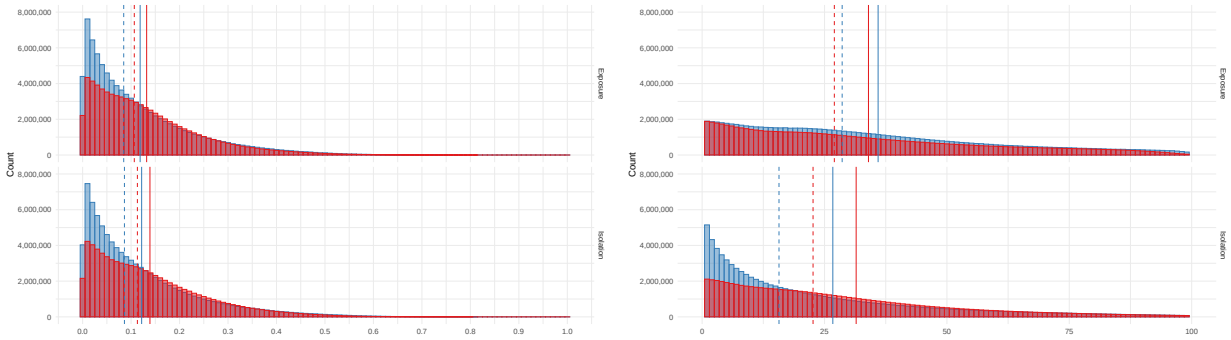


Supplementary Figure 12: Individual Differences in Spatial versus ZIP code-based Aspatial Exposure/Isolation

Nationwide distribution of individual-level changes in partisan Exposure and Isolation separately for Democrats (blue) and Republicans (red). The histograms on the left show the percentage point difference in spatial and ZIP code-based aspatial exposure, while the histograms on the right show the percent change. Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Absolute Percentage Point Change

(b) Absolute Percent Change

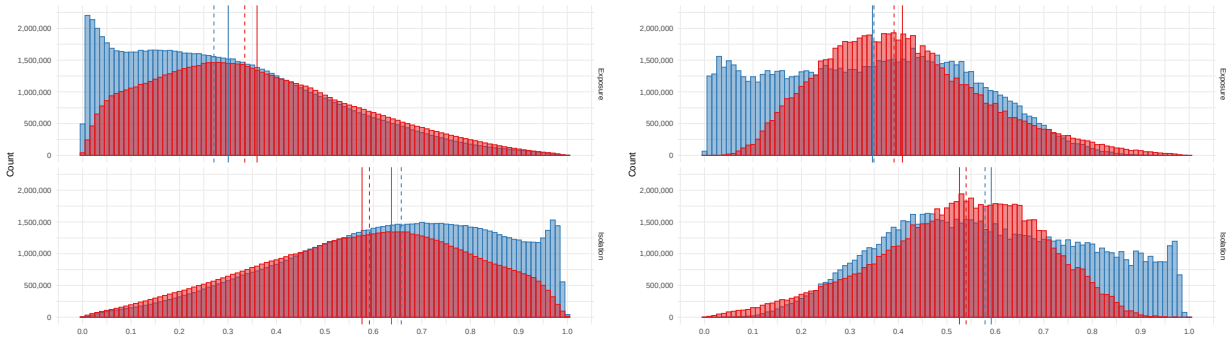


Supplementary Figure 13: Individual Absolute Differences in Spatial versus Zip code-based Aspatial Exposure/Isolation

Nationwide distribution of individual-level absolute changes in partisan Exposure and Isolation separately for Democrats (blue) and Republicans (red). The histograms on the left show the percentage point absolute difference in spatial and aspatial exposure, while the histograms on the right show the absolute percent change. Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Individual Spatial

(b) Census Tract-based Aspatial

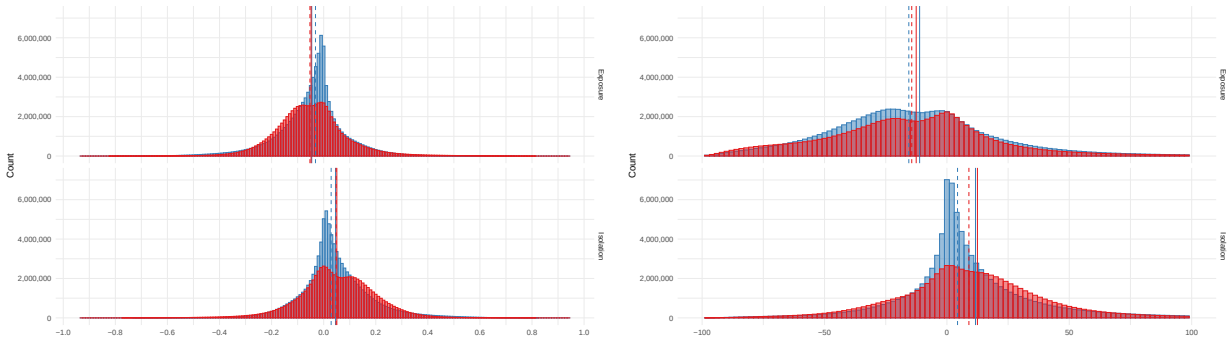


Supplementary Figure 14: Individual Spatial Versus Census Tract-based Aspatial Exposure/Isolation

Nationwide distribution of spatial (left) and aspatial Census Tract-based (right) partisan isolation and exposure separately for Democrats (blue) and Republicans (red). Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Percentage Point Change

(b) Percent Change

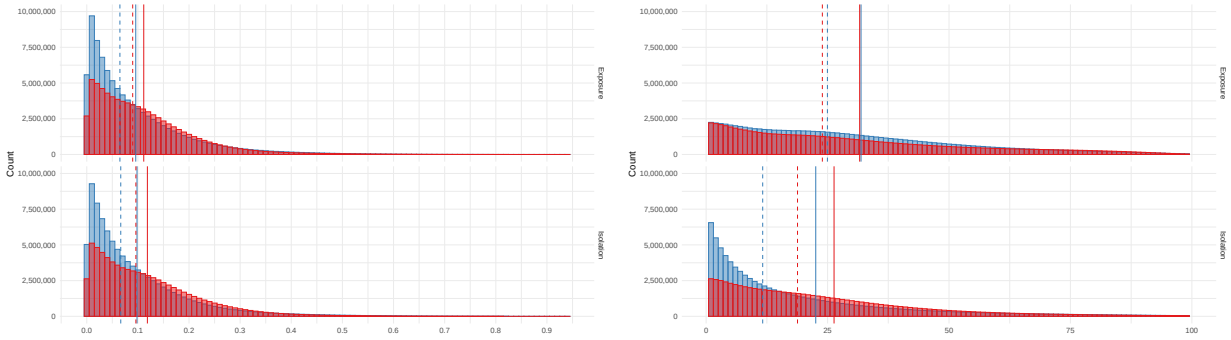


Supplementary Figure 15: Individual Differences in Spatial versus Census Tract-based Aspatial Exposure/Isolation

Nationwide distribution of individual-level changes in partisan Exposure and Isolation separately for Democrats (blue) and Republicans (red). The histograms on the left show the percentage point difference in spatial and Census Tract-based aspatial exposure, while the histograms on the right show the percent change. Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Absolute Percentage Point Change

(b) Absolute Percent Change



Supplementary Figure 16: Individual Absolute Differences in Spatial versus Census Tract-based Aspatial Exposure/Isolation

Nationwide distribution of individual-level absolute changes in partisan Exposure and Isolation separately for Democrats (blue) and Republicans (red). The histograms on the left show the percentage point absolute difference in spatial and aspatial exposure, while the histograms on the right show the absolute percent change. Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Individual Spatial

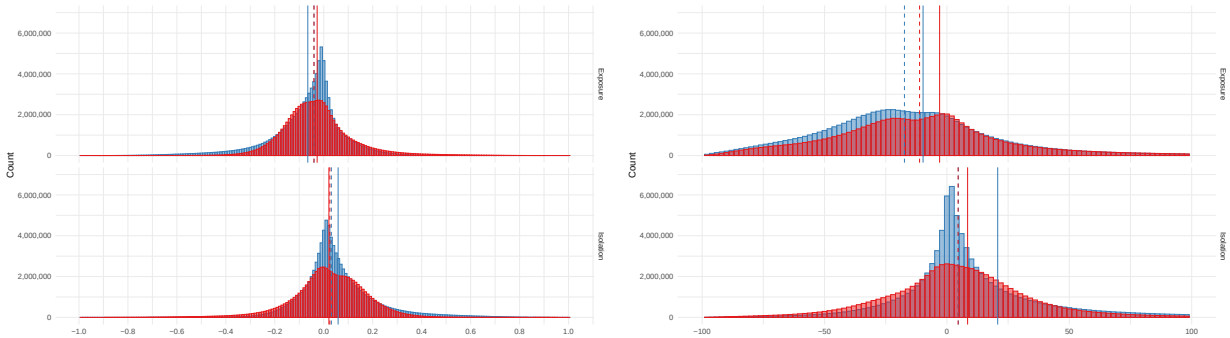
(b) Precinct-based Aspatial

Supplementary Figure 17: Individual Spatial Versus Precinct-based Aspatial Exposure/Isolation

Nationwide distribution of spatial (left) and aspatial Precinct-based (right) partisan isolation and exposure separately for Democrats (blue) and Republicans (red). Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Percentage Point Change

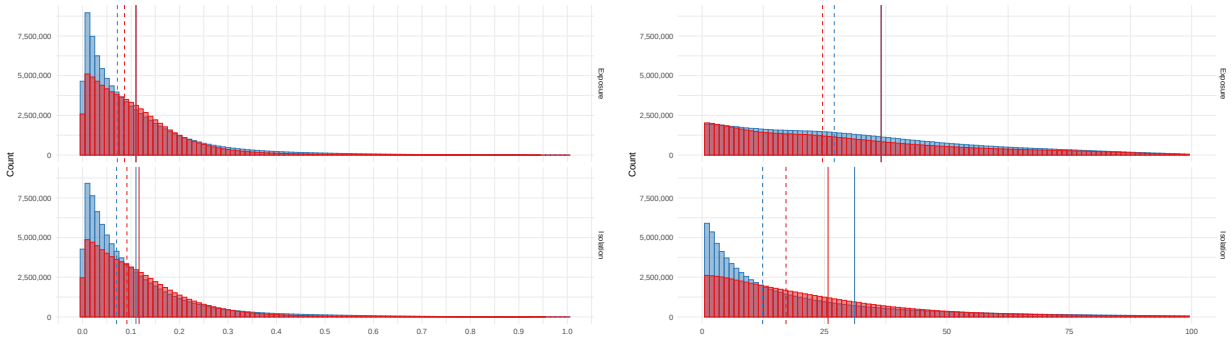
(b) Percent Change



Supplementary Figure 18: Individual Differences in Spatial versus Precinct-based Aspatial Exposure/Isolation

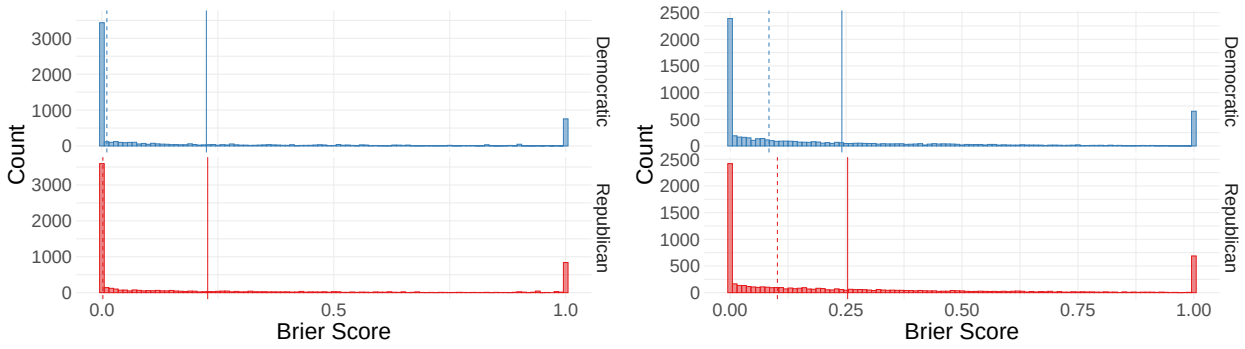
Nationwide distribution of individual-level changes in partisan Exposure and Isolation separately for Democrats (blue) and Republicans (red). The histograms on the left show the percentage point difference in spatial and Precinct-based aspatial exposure, while the histograms on the right show the percent change. Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.

(a) Absolute Percentage Point Change (b) Absolute Percent Change



Supplementary Figure 19: Individual Absolute Differences in Spatial versus Precinct-based Aspatial Exposure/Isolation

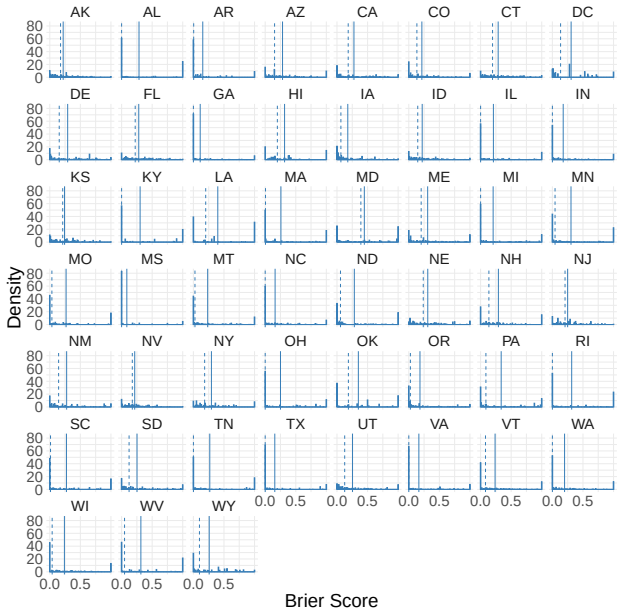
Nationwide distribution of individual-level absolute changes in partisan Exposure and Isolation separately for Democrats (blue) and Republicans (red). The histograms on the left show the percentage point absolute difference in spatial and aspatial exposure, while the histograms on the right show the absolute percent change. Solid vertical lines represent mean values and dashed lines represent median values. The distributions are weighted by the posterior partisan probabilities.



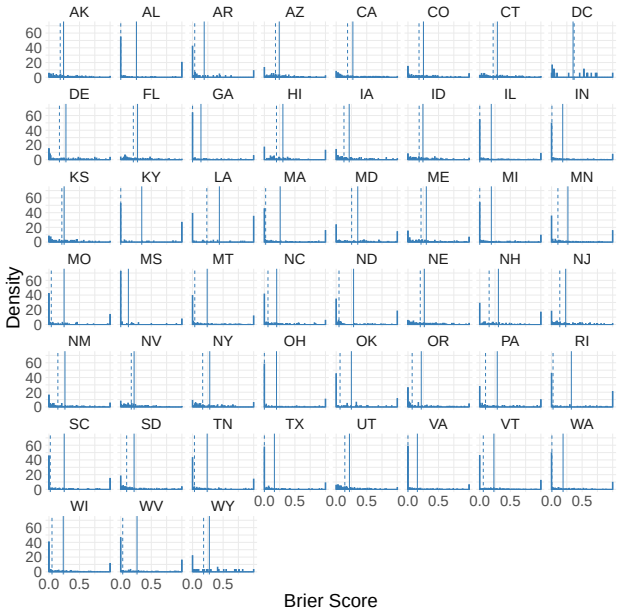
(a) Survey Weights (b) Unweighted

Supplementary Figure 20: Brier Score Distributions

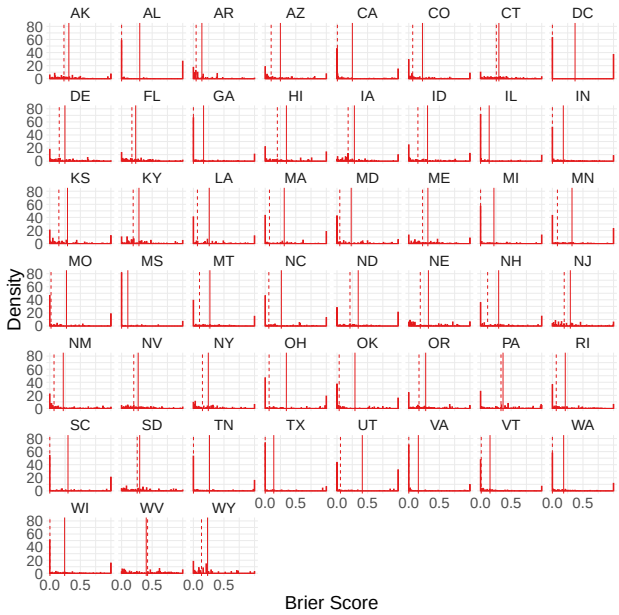
Brier score distribution for survey respondents not registered to the Democratic or Republican party ($n = 7,087$). The left panel shows the distribution weighted by survey weights, and the right panel shows unweighted distribution. Dashed vertical lines show the median and solid vertical lines show the mean for the distribution.



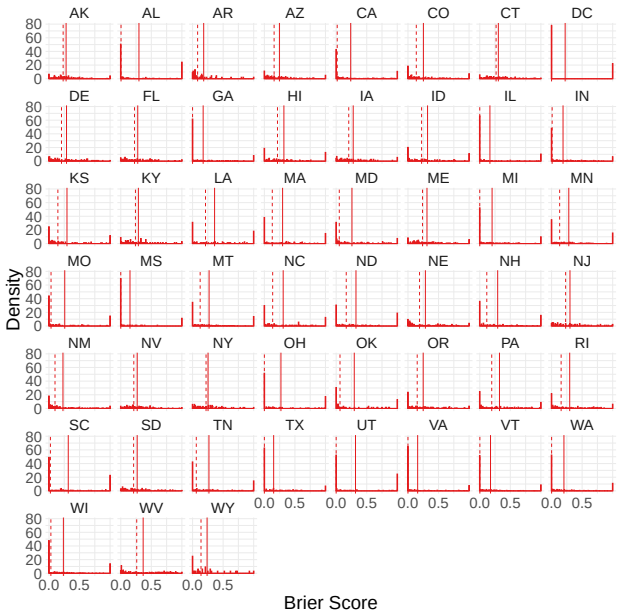
(a) Democratic: Survey Weights



(b) Democratic: Unweighted



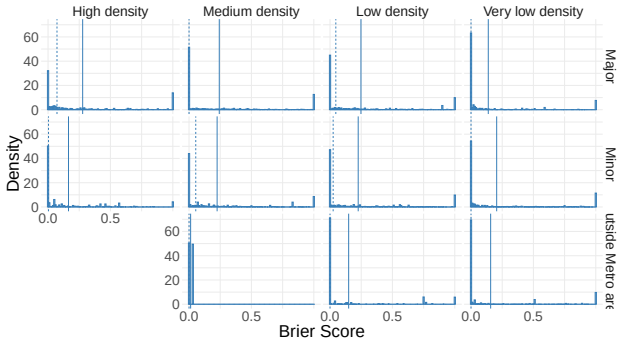
(c) Republican: Survey Weights



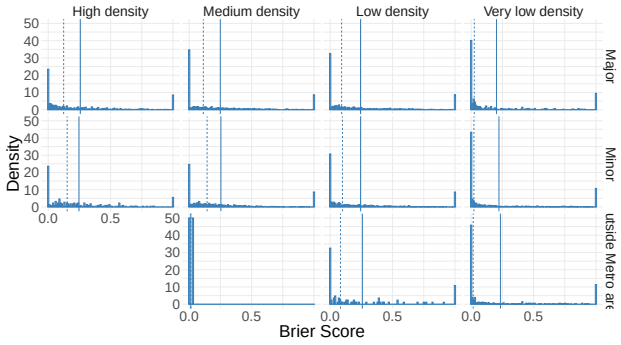
(d) Republican: Unweighted

Supplementary Figure 21: Brier Score Distributions by State

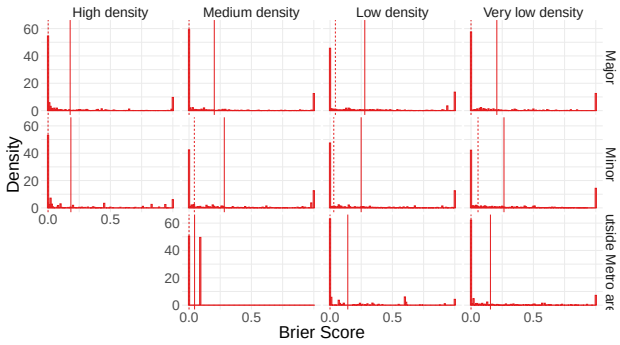
Brier score distribution for survey respondents not registered to the Democratic or Republican party, subset by each state. The left panel shows the distribution weighted by survey weights, and the right panel shows unweighted distribution. Dashed vertical lines show the median and solid vertical lines show the mean for the distribution.



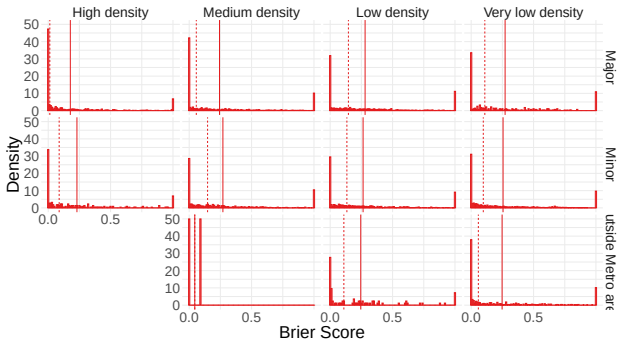
(a) Democratic: Survey Weights



(b) Democratic: Unweighted



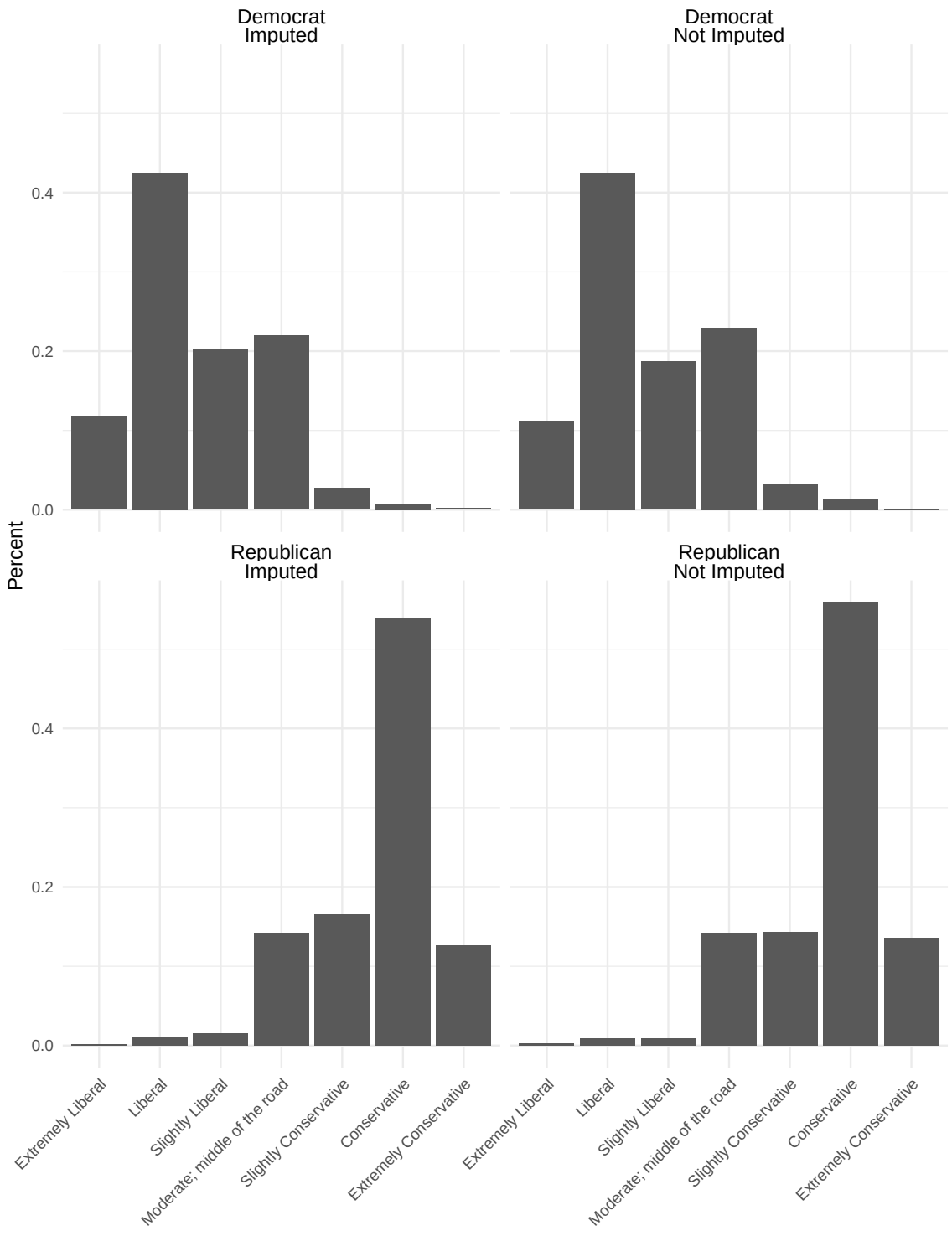
(c) Republican: Survey Weights



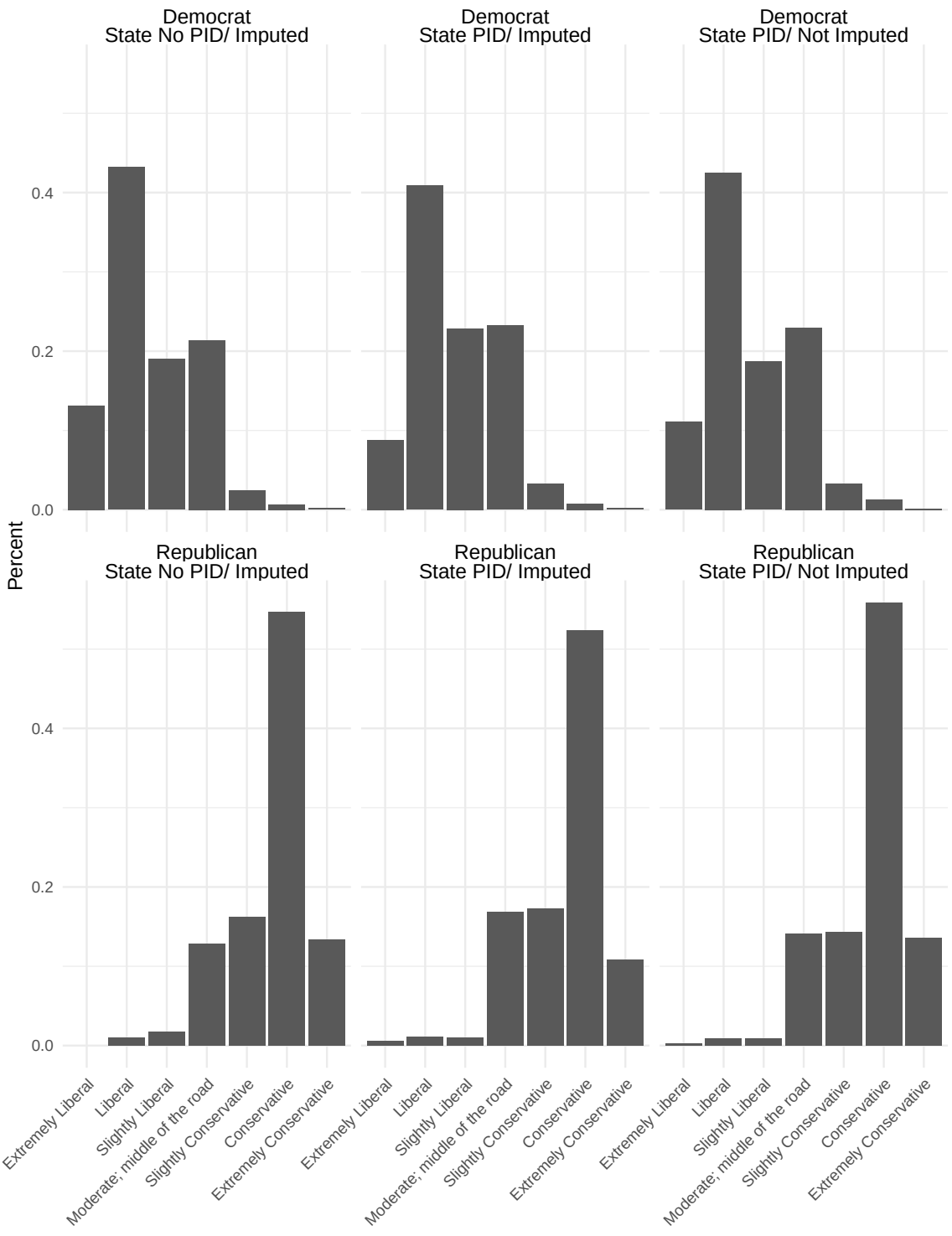
(d) Republican: Unweighted

Supplementary Figure 22: Brier Score Distributions by Urban Area and Density

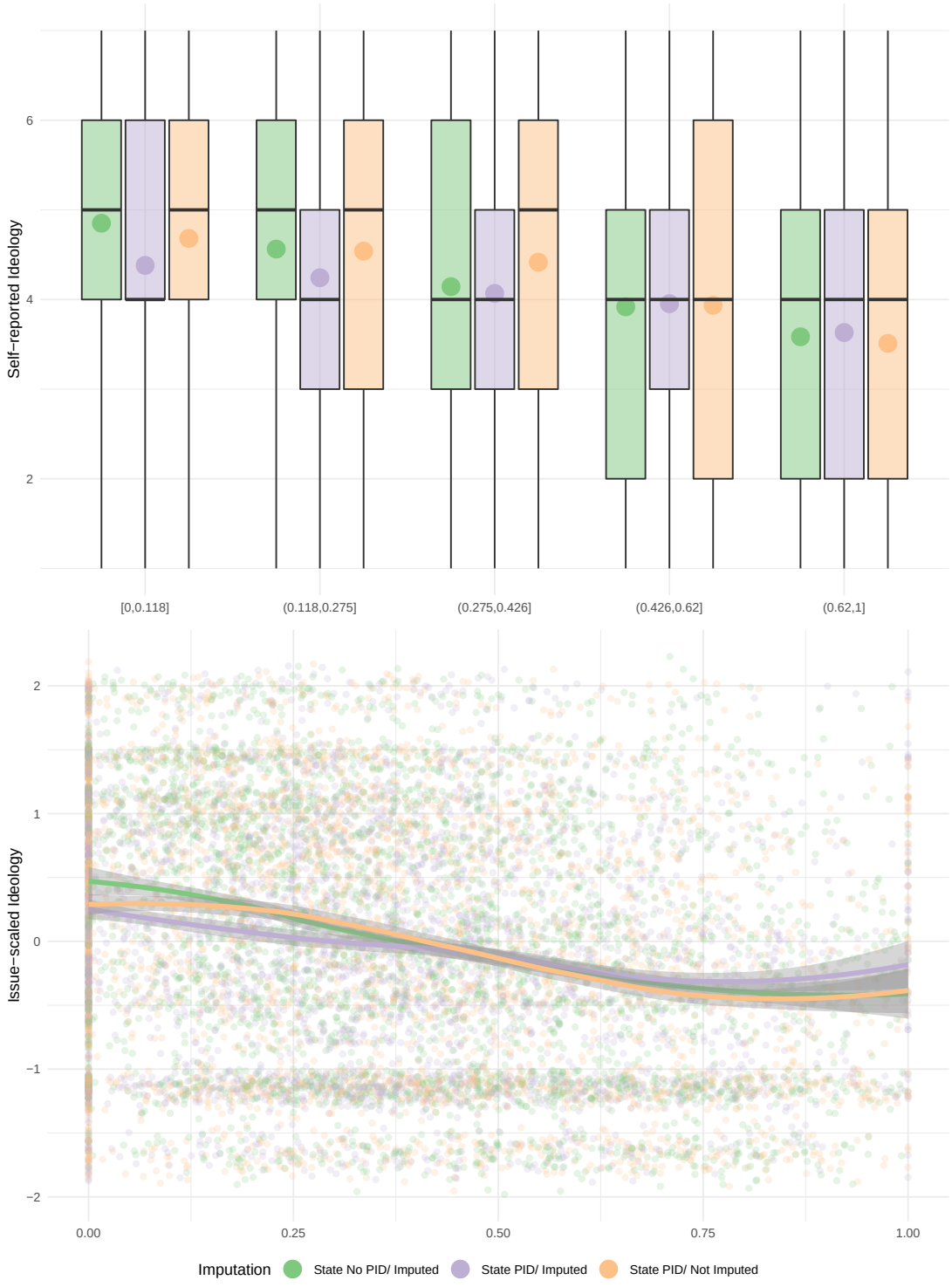
Brier score distribution for survey respondents not registered to the Democratic or Republican party, subset by urban area type and density. The left panel shows the distribution weighted by survey weights, and the right panel shows unweighted distribution. Dashed vertical lines show the median and solid vertical lines show the mean for the distribution.



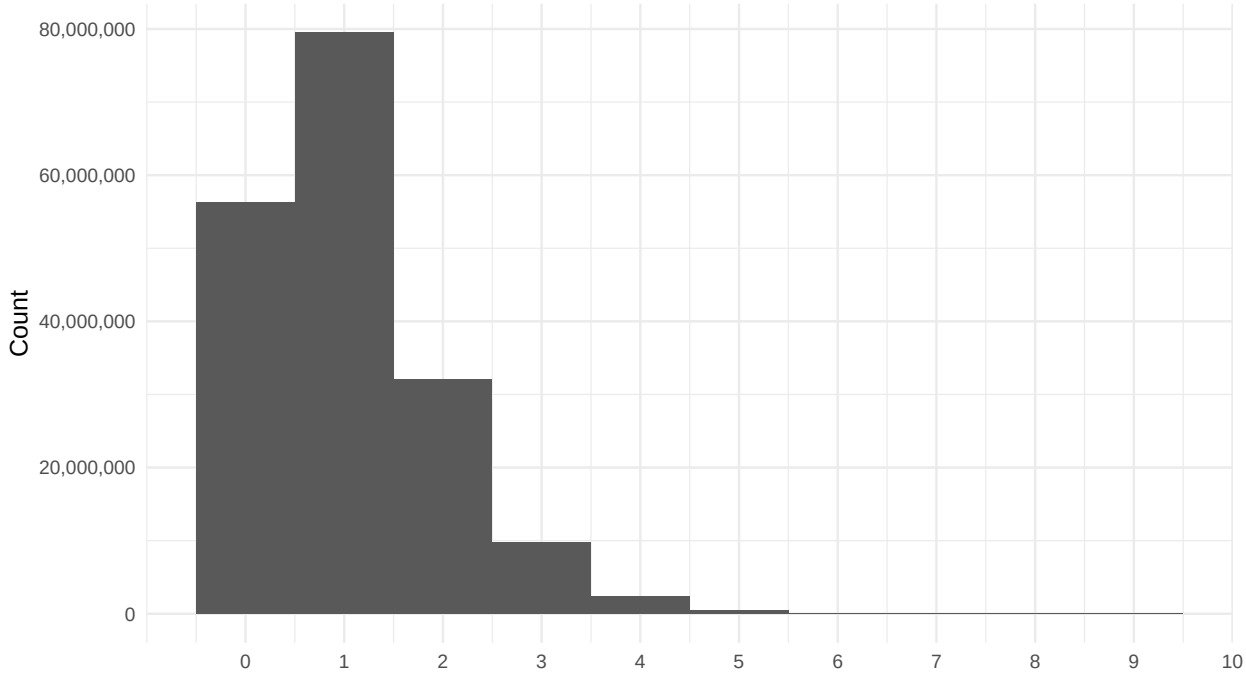
Supplementary Figure 23: Distribution of self-reported ideology for self-described Republicans ($n = 3,069$) and Democrats ($n = 2,914$) among voters for whom partisanship was or was not imputed.



Supplementary Figure 24: Distribution of self-reported ideology for self-described Republicans ($n = 3,069$) and Democrats ($n = 2,914$) among survey respondents for whom partisanship was or was not imputed and by whether state records party identification.

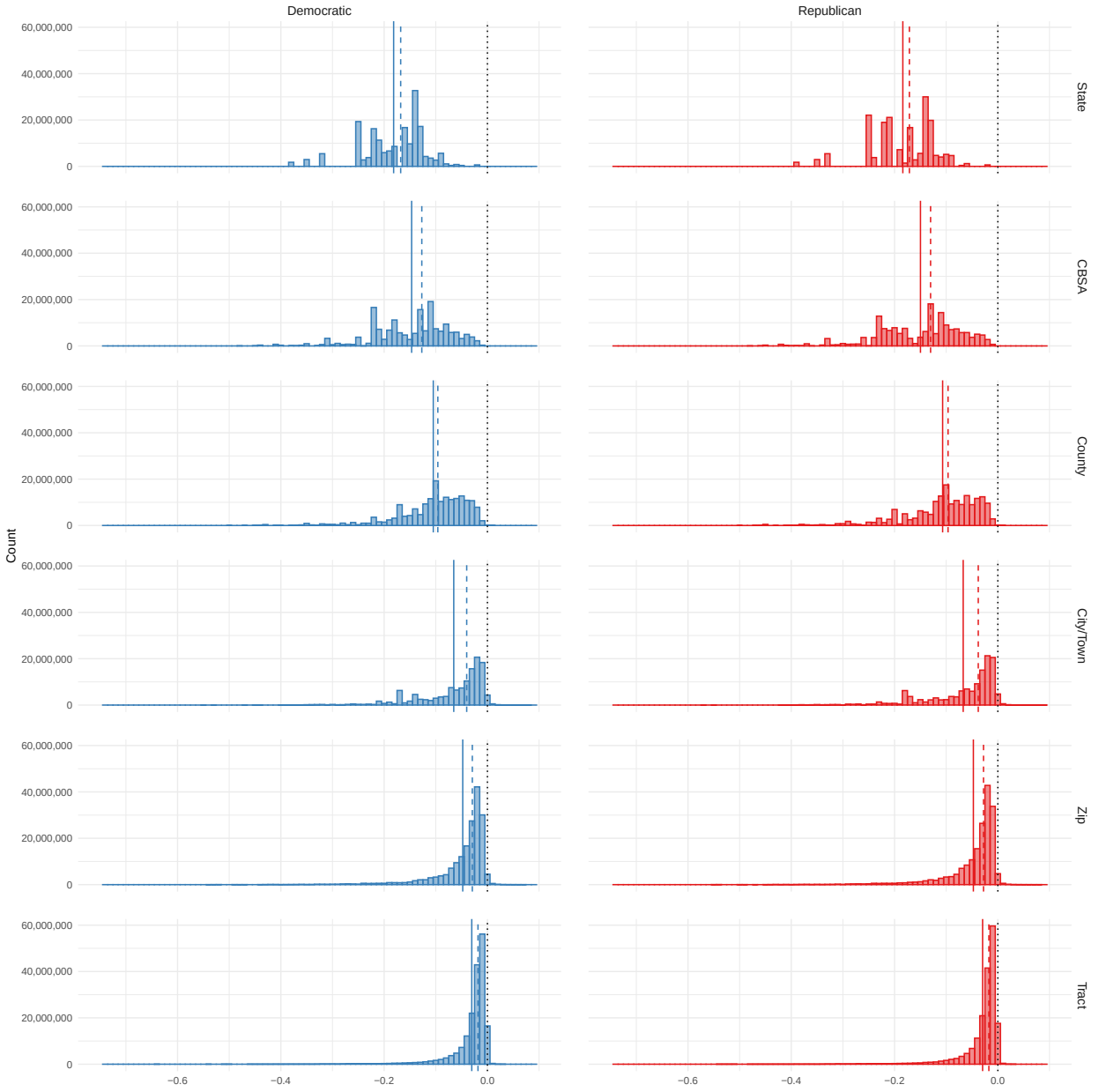


Supplementary Figure 25: Relationship between $Pr(D)$ on x-axes and self-reported ideology (top) and with ideology as scaled from issue support (bottom) on y-axes among survey respondents ($n = 10,124$).



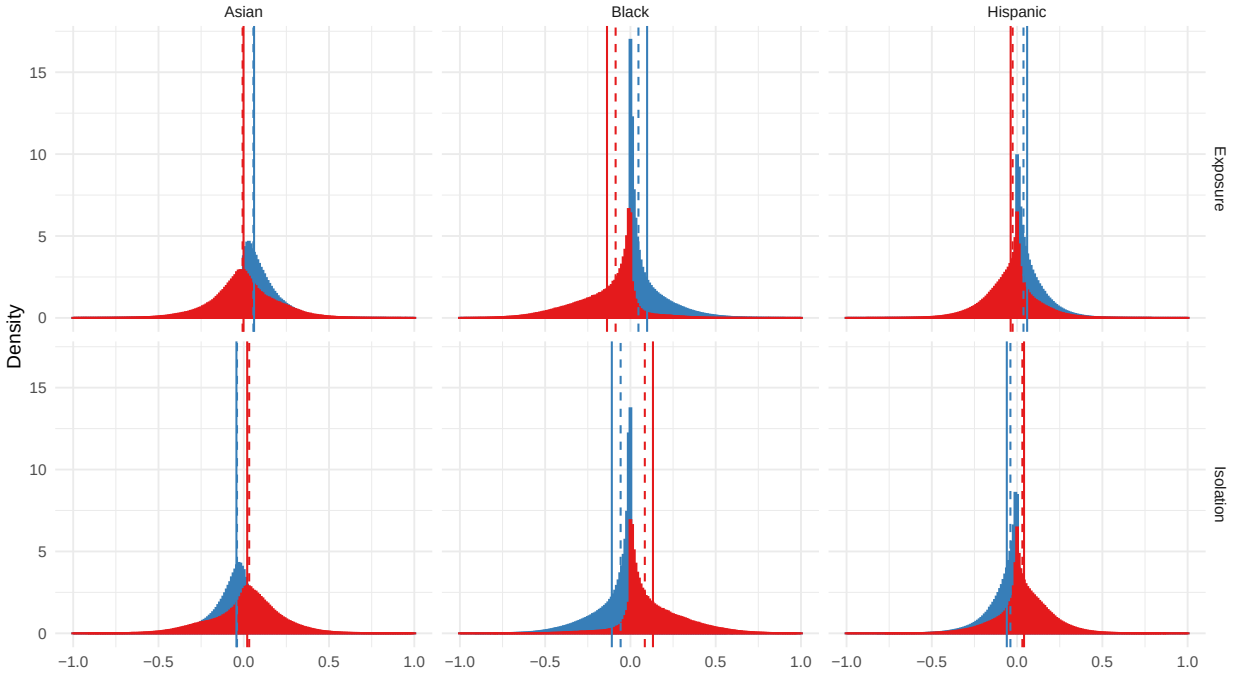
Supplementary Figure 26: Same-Household Neighbors

Nationwide distribution of the number of same-household neighbors in our analysis.



Supplementary Figure 27: Relative Exposure Without Same-household Neighbors by Geography

Weighted nationwide distribution of relative exposure without same-household neighbors across geographic units for Democrats (blue) and Republicans (red). Distributions are weighted by population and the y-axis represents the number of individual voters. Solid vertical lines represent mean values and dashed lines represent median values. Geographies are ordered from bottom to top in decreasing size.



Supplementary Figure 28: Partisan Segregation vs. Within-race Partisan Segregation

Distributions for Black, Hispanic and Asian voters of the differences between partisan segregation calculated from all 1,000 nearest neighbors and partisan segregation calculated only from neighbors of the same race. Positive Isolation values means that a voter appears less isolated by partisanship when we look only at their same-race neighbors. Positive Exposure values means that a voter appears to have less cross-party exposure when we only look at their within-race neighbors. Distributions are plotted separately for Democrats (blue) and Republicans (red). Solid lines represent mean values and dashed lines represent median values. Distributions are weighted by posterior partisan probabilities.

Supplementary Tables

Supplementary Table 1: Coverage of Variables in Voterfile

Variable	Coverage
State	100%
CBSA	93.89%
County	100%
Census Place	71.99%
Zip	99.44%
Tract	100%
Precinct	98.59%
Density	99.97%
Urban Area Classification	100%
Gender	99.55%
Race	91.18%
Age	98.33%
Party	56.51%

Percent of voters on national voterfile not missing each variable before imputation techniques.

Supplementary Table 2: State Registration Rules and Primary Types

State	State Recorded PID	Democratic primary type	Republican primary type
Alabama	No	Open	Open
Alaska	Yes	Open	Closed
Arizona	Yes	Semi-closed	Semi-closed
Arkansas	No	Open	Open
California	Yes	Top-two	Top-two
Colorado	Yes	Semi-closed	Semi-closed
Connecticut	Yes	Closed	Closed
Delaware	Yes	Closed	Closed
District of Columbia	Yes	Closed	Closed
Florida	Yes	Closed	Closed
Georgia	No	Open	Open
Hawaii	No	Open	Open
Idaho	Yes	Semi-closed	Semi-closed
Illinois	No	Open	Open
Indiana	No	Open	Open
Iowa	Yes	Open	Open
Kansas	Yes	Semi-closed	Semi-closed
Kentucky	Yes	Closed	Closed
Louisiana	Yes	Non-partisan	Non-partisan
Maine	Yes	Closed	Closed
Maryland	Yes	Closed	Closed
Massachusetts	Yes	Semi-closed	Semi-closed
Michigan	No	Open	Open
Minnesota	No	Open	Open
Mississippi	No	Open	Open
Missouri	No	Open	Open
Montana	No	Open	Open
Nebraska	Yes	Semi-closed	Semi-closed
Nevada	Yes	Closed	Closed
New Hampshire	Yes	Semi-closed	Semi-closed
New Jersey	Yes	Semi-closed	Semi-closed
New Mexico	Yes	Closed	Closed
New York	Yes	Closed	Closed
North Carolina	Yes	Semi-closed	Semi-closed
North Dakota	No	Open	Open
Ohio	No	Open	Open
Oklahoma	Yes	Semi-closed	Closed
Oregon	Yes	Closed	Closed
Pennsylvania	Yes	Closed	Closed
Rhode Island	Yes	Semi-closed	Semi-closed
South Carolina	No	Open	Open
South Dakota	Yes	Semi-closed	Semi-closed
Tennessee	No	Open	Open
Texas	No	Open	Open
Utah	Yes	Semi-closed	Semi-closed
Vermont	No	Open	Open
Virginia	No	Open	Open
Washington	No	Non-partisan	Non-partisan
West Virginia	Yes	Semi-closed	Semi-closed
Wisconsin	No	Open	Open
Wyoming	Yes	Open	Open

Party registration (column 2) is allowed in some states but not others. The major parties in each state set their own registration rules in conjunction with state law (columns 3 and 4) allowing for either 1) closed primary where only members belonging to the party can vote in the primary; 2) open where any registered voter can vote; 3) semi-closed where previously unaffiliated voters can vote; or 4) top-two or non-partisan where all candidates are listed on the same ballot, regardless of party.

Supplementary Table 3: Parties Coded as Lean Democrat/Lean Republican

Party	Code
Democratic	Lean Democrat
Republican	Lean Republican
Non-Partisan	Unknown
Registered Independent	Unknown
American Independent	Lean Republican
Other	Unknown
Libertarian	Lean Republican
Independence	Unknown
Unknown	Unknown
Green	Lean Democrat
Declined to State	Unknown
Conservative	Lean Republican
Peace and Freedom	Lean Democrat
Working Family Party	Lean Democrat
Constitution	Lean Republican
Reform	Unknown
Constitutional	Lean Republican
Natural Law	Unknown
Women's Equality Party	Lean Democrat
Moderate	Unknown
Progressive	Lean Democrat
American	Unknown
Mountain	Unknown
Liberal	Lean Democrat
Green Libertarian	Lean Democrat
Socialist	Lean Democrat
Independent Democrat	Lean Democrat
Patriot	Unknown
Independent Republican	Lean Republican
Socialist Labor	Lean Democrat
Christian	Unknown
Harold Washington Democrat	Lean Democrat
Communist	Lean Democrat
Taxpayers	Unknown
Social Democrat	Lean Democrat
Consumer	Unknown
Right to Life	Lean Republican
Citizens	Unknown
Whig	Unknown
Rainbow	Lean Democrat
Freedom	Unknown
Anarchist	Unknown
Bull Moose	Unknown
Populist	Unknown
Tea	Lean Republican
Prohibition	Unknown
Free Choice	Unknown
Federalist	Unknown
Worker's Party	Lean Democrat
Labor	Lean Democrat
Harold Washington Republican	Lean Republican
Harold Washington	Lean Democrat
Individualist	Unknown
Alliance	Unknown
Citizens Republican	Lean Republican
Natural Party	Unknown
Grass Roots	Unknown
Tax	Unknown
Solidarity	Unknown
Peoples	Unknown

Voters registered with a political party were assigned to one of the major parties if the party had a clear ideological lean aligning it with Republicans or Democrats. If there is no clear ideology, the party was coded as "uknown" and not used for imputation.

Supplementary Table 4: State-level voter to precinct matches

State	Precinct Matches	County Matches	Total Voters	Percent Precinct	Percent County
Alabama	2725805	216864	2942669	92.63%	7.37%
Alaska	440960	5891	446851	98.68%	1.32%
Arizona	3355012	70571	3425583	97.94%	2.06%
Arkansas	1349036	65582	1414618	95.36%	4.64%
California	18196337	3859	18200196	99.98%	0.02%
Colorado	3015783	123998	3139781	96.05%	3.95%
Connecticut	2119260	3380	2122640	99.84%	0.16%
District of Columbia	396394	48	396442	99.99%	0.01%
Delaware	619808	311	620119	99.95%	0.05%
Florida	12338852	6432	12345284	99.95%	0.05%
Georgia	5465155	3775	5468930	99.93%	0.07%
Hawaii	636251	134	636385	99.98%	0.02%
Idaho	681658	19089	700747	97.28%	2.72%
Illinois	7705542	36662	7742204	99.53%	0.47%
Indiana	3716361	40913	3757274	98.91%	1.09%
Iowa	1885254	2172	1887426	99.88%	0.12%
Kansas	1456847	94437	1551284	93.91%	6.09%
Kentucky	2856862	40351	2897213	98.61%	1.39%
Louisiana	2763402	10876	2774278	99.61%	0.39%
Maine	849285	54260	903545	93.99%	6.01%
Maryland	3798705	311	3799016	99.99%	0.01%
Massachusetts	4020865	36088	4056953	99.11%	0.89%
Michigan	6643980	244	6644224	100.00%	0.00%
Minnesota	3144404	515	3144919	99.98%	0.02%
Mississippi	1704121	70162	1774283	96.05%	3.95%
Missouri	3307305	267974	3575279	92.50%	7.50%
Montana	556203	17874	574077	96.89%	3.11%
Nebraska	975054	75018	1050072	92.86%	7.14%
Nevada	1401254	41825	1443079	97.10%	2.90%
New Hampshire	808929	88	809017	99.99%	0.01%
New Jersey	5330146	13094	5343240	99.75%	0.25%
New Mexico	1077260	89	1077349	99.99%	0.01%
New York	10820724	447366	11268090	96.03%	3.97%
North Carolina	5897797	17601	5915398	99.70%	0.30%
North Dakota	327978	6117	334095	98.17%	1.83%
Ohio	7189406	4410	7193816	99.94%	0.06%
Oklahoma	1551914	128206	1680120	92.37%	7.63%
Oregon	2593732	204739	2798471	92.68%	7.32%
Pennsylvania	7643777	501	7644278	99.99%	0.01%
Rhode Island	690427	803	691230	99.88%	0.12%
South Carolina	2811852	43177	2855029	98.49%	1.51%
South Dakota	416486	62290	478776	86.99%	13.01%
Tennessee	3245682	0	3245682	100.000%	0.00%
Texas	13223300	5243	13228543	99.96%	0.04%
Utah	1332678	44331	1377009	96.78%	3.22%
Vermont	408720	37	408757	99.99%	0.01%
Virginia	4922433	55586	4978019	98.88%	1.12%
Washington	4136953	86870	4223823	97.94%	2.06%
West Virginia	1070862	4154	1075016	99.61%	0.39%
Wisconsin	4445976	659	4446635	99.99%	0.01%
Wyoming	231091	1298	232389	99.44%	0.56%
Total	178303878	2431767	180735645	98.655%	1.35%

Number and percent of voters in each state successfully matched with the precinct in which they live or, if precinct could not be matched, successfully matched to county.

Supplementary Table 5: Partisan Breakdowns at Each Imputation Stage

Party	L2	After: Primary Coding	Third Party Coding	Full Imputation
Democrat	23.16%	34.70%	34.88%	50.54%
Independent	59.89%	36.38%	35.60%	6.58%
Republican	16.95%	28.92%	29.52%	42.88%

Percent of voters from the nationwide voterfile assigned to each partisan group during each step of the imputation process. Initial proportions in column 1, after being assigned based on voting in a partisan primary election in column 2, after assigning based on third-party affiliations in column 3, and after the Bayesian imputation in column 4, which represents the weighted distribution.

Supplementary Table 6: Survey Weights Percentiles

Sample	1%	10%	25%	50%	75%	90%	99%
All	0.03	0.06	0.12	0.40	1.13	2.31	8.22
Unaffiliated	0.02	0.05	0.11	0.41	1.20	2.39	8.46

Percentiles of survey weights across the entire survey sample ($n = 10,519$) in the top row and the subset of the survey sample comprised of voters not registered to major political party ($n = 7,087$) in the bottom row. Weights are scaled so that the sum equals the total number of respondents in the sample.

Supplementary Table 7: Race Survey Comparison

Sample	non-Hispanic White	Black	Hispanic	Asian	Other
Survey	80.24%	3.28%	3.93%	1.78%	10.76%
Survey Weighted	66.06%	11.15%	9.35%	3.24%	10.19%
Unaffiliated Voters	65.30%	10.33%	10.12%	3.10%	11.15%
All Voters	64.06%	10.65%	11.20%	2.99%	11.10%
L2 Emails	65.32%	10.17%	10.36%	2.90%	11.25%
Survey Invitation	70.98%	8.72%	6.57%	2.55%	11.18%

Percent of voters in each racial category in each sample from which the survey sample was constructed.

Supplementary Table 8: Gender Survey Comparison

Sample	Male	Female
Survey	50.75%	48.85%
Survey Weighted	46.06%	53.74%
Unaffiliated Voters	47.61%	51.93%
All Voters	46.66%	52.90%
L2 Emails	46.03%	53.61%
Survey Invitation	46.86%	52.68%

Percent of voters in each gender category in each sample from which the survey sample was constructed.

Supplementary Table 9: Population Density Survey Comparison

Sample	High density	Medium density	Low density	Very low density
Survey	11.37%	27.77%	33.06%	27.80%
Survey Weighted	17.72%	29.20%	29.46%	23.62%
Unaffiliated Voters	14.89%	29.41%	30.91%	24.77%
All Voters	18.98%	28.91%	29.15%	22.93%
L2 Emails	19.50%	30.30%	29.32%	20.86%
Survey Invitation	12.96%	27.47%	30.77%	28.78%

Percent of voters in each Census Tract density category in each sample from which the survey sample was constructed. Density classifications are listed in Table 1 in the main article.

Supplementary Table 10: Urban Area Survey Comparison

Sample	Major	Minor	Outside Metro area
Survey	38.80%	53.21%	7.99%
Survey Weighted	55.11%	38.03%	6.86%
Unaffiliated Voters	54.36%	38.88%	6.76%
All Voters	55.70%	38.17%	6.12%
L2 Emails	58.66%	36.39%	4.96%
Survey Invitation	40.76%	50.21%	9.02%

Percent of voters in each urban area category in each sample from which the survey sample was constructed. Major are CBSAs with over one-million residents, minor are CBSAs with under one-million residents, and outside metro area are areas non in CBSAs.

Supplementary Table 11: 2016 Turnout Survey Comparison

Sample	Vote 2016
Survey	89.89%
Survey Weighted	70.41%
Unaffiliated Voters	66.23%
All Voters	70.02%
L2 Emails	79.19%
Survey Invitation	74.49%

Percent of voters voting in 2016 Presidential election in each sample from which the survey sample was constructed.

Supplementary Table 12: Spatial Exposure/Isolation with $a = 2$ Quantiles

Type	Party	1%	10%	25%	50%	75%	90%	99%
Exposure	Democratic	0.00	0.00	0.01	0.13	0.43	0.70	1.00
Exposure	Republican	0.00	0.00	0.01	0.21	0.50	0.78	1.00
Isolation	Democratic	0.00	0.20	0.49	0.76	0.98	1.00	1.00
Isolation	Republican	0.00	0.11	0.41	0.68	0.99	1.00	1.00

Quantiles of exposure/isolation for segregation measures constructed with squared distance weights.

Supplementary Table 13: Spatial Exposure/Isolation with Neighbor Rank Weights Quantiles

Type	Party	1%	10%	25%	50%	75%	90%	99%
Exposure	Democratic	0.01	0.05	0.15	0.31	0.47	0.61	0.79
Exposure	Republican	0.07	0.16	0.25	0.36	0.49	0.63	0.86
Isolation	Democratic	0.16	0.33	0.45	0.62	0.79	0.91	0.98
Isolation	Republican	0.09	0.30	0.43	0.57	0.69	0.78	0.90

Quantiles of exposure/isolation for segregation measures constructed with neighbor rank weights.

Supplementary Table 14: City-Based Aspatial Exposure/Isolation Quantiles

Measure	Type	Party	1%	10%	25%	50%	75%	90%	99%
City	Exposure	Democratic	0.03	0.12	0.18	0.31	0.44	0.55	0.71
	Exposure	Republican	0.12	0.26	0.35	0.46	0.58	0.70	0.84
	Isolation	Democratic	0.22	0.38	0.48	0.62	0.76	0.83	0.96
	Isolation	Republican	0.11	0.23	0.35	0.47	0.58	0.67	0.82
Difference	Exposure	Democratic	-0.36	-0.20	-0.12	-0.05	0.02	0.11	0.31
	Exposure	Republican	-0.42	-0.23	-0.14	-0.06	0.02	0.11	0.28
	Isolation	Democratic	-0.31	-0.12	-0.03	0.05	0.13	0.21	0.38
	solation	Republican	-0.27	-0.11	-0.03	0.06	0.15	0.24	0.44
Percent Change	Exposure	Democratic	-95.58	-73.23	-46.22	-19.55	6.63	39.03	162.37
	Exposure	Republican	-75.39	-49.80	-33.63	-14.62	4.39	23.22	84.73
	Isolation	Democratic	-53.03	-21.45	-5.09	7.41	21.05	40.45	101.95
	Isolation	Republican	-65.48	-27.42	-6.60	11.86	34.86	69.69	217.71
Absolute Difference	Exposure	Democratic	0.00	0.02	0.04	0.09	0.15	0.22	0.39
	Exposure	Republican	0.00	0.02	0.04	0.10	0.16	0.25	0.43
	Isolation	Democratic	0.00	0.02	0.04	0.09	0.16	0.24	0.40
	Isolation	Republican	0.00	0.02	0.04	0.10	0.17	0.26	0.44
Absolute Percent Change	Exposure	Democratic	0.52	5.35	14.40	31.37	56.25	82.26	162.46
	Exposure	Republican	0.37	3.78	10.00	22.40	38.25	54.28	88.62
	Isolation	Democratic	0.24	2.46	6.52	14.89	27.64	45.06	101.95
	Isolation	Republican	0.34	3.50	9.64	22.17	41.70	72.37	217.72

Quantiles of exposure/isolation for aspatial segregation measures constructed based on city-level proportion Democrat/Republican. The top row presents the nationwide quantiles for exposure and isolation under this definition. The second row presents the individual differences between the main exposure/isolation measures and the city-based measure. The third row presents the individual percentage difference between the main exposure/isolation measures and the city-based measure. The fourth row presents the individual absolute differences between the main exposure/isolation measures and the city-based measure. The fifth row presents the individual absolute percentage difference between the main exposure/isolation measures and the city-based measure.

Supplementary Table 15: Zip Code-Based Aspatial Exposure/Isolation Quantiles

Measure	Type	Party	1%	10%	25%	50%	75%	90%	99%
Zip	Exposure	Democratic	0.01	0.10	0.22	0.37	0.50	0.60	0.74
	Exposure	Republican	0.13	0.24	0.32	0.42	0.52	0.63	0.83
	Isolation	Democratic	0.20	0.34	0.43	0.56	0.71	0.85	0.97
	Isolation	Republican	0.12	0.30	0.41	0.52	0.62	0.70	0.82
Difference	Exposure	Democratic	0.48	-0.26	-0.14	-0.04	0.01	0.11	0.32
	Exposure	Republican	-0.45	-0.26	-0.16	-0.07	0.02	0.12	0.38
	Isolation	Democratic	-0.32	-0.11	-0.02	0.04	0.14	0.27	0.51
	Isolation	Republican	-0.36	-0.13	-0.03	0.07	0.17	0.28	0.47
Percent Change	Exposure	Democratic	-94.54	-67.09	-42.34	-18.71	4.87	32.98	131.75
	Exposure	Republican	-91.35	-66.86	-42.14	-17.68	4.57	28.89	121.47
	Isolation	Democratic	-68.86	-22.71	-3.76	6.63	27.29	58.95	160.58
	Isolation	Republican	-70.04	-27.97	-6.58	12.56	34.71	62.94	155.99
Absolute Difference	Exposure	Democratic	0.00	0.01	0.03	0.08	0.17	0.28	0.49
	Exposure	Republican	0.00	0.02	0.05	0.11	0.19	0.28	0.48
	Isolation	Democratic	0.00	0.01	0.03	0.09	0.17	0.29	0.51
	Isolation	Republican	0.00	0.02	0.05	0.11	0.20	0.30	0.49
Absolute Percent Change	Exposure	Democratic	0.48	4.90	13.19	28.61	50.26	74.99	131.88
	Exposure	Republican	0.41	4.21	11.77	27.01	49.33	73.16	121.62
	Isolation	Democratic	0.16	1.74	5.47	15.70	35.54	64.09	160.60
	Isolation	Republican	0.36	3.71	10.02	22.66	41.52	67.22	156.02

Quantiles of exposure/isolation for aspatial segregation measures constructed based on zip code-level proportion Democrat/Republican. The top row presents the nationwide quantiles for exposure and isolation under this definition. The second row presents the individual differences between the main exposure/isolation measures and the zip code-based measure. The third row presents the individual percentage difference between the main exposure/isolation measures and the zip code-based measure. The fourth row presents the individual absolute differences between the main exposure/isolation measures and the zip code-based measure. The fifth row presents the individual absolute percentage difference between the main exposure/isolation measures and the zip code-based measure.

Supplementary Table 16: Census Tract-Based Aspatial Exposure/Isolation Quantiles

Measure	Type	Party	1%	10%	25%	50%	75%	90%	99%
Tract	Exposure	Democratic	0.01	0.07	0.18	0.35	0.50	0.61	0.77
	Exposure	Republican	0.11	0.21	0.29	0.39	0.51	0.64	0.85
	Isolation	Democratic	0.18	0.32	0.43	0.58	0.76	0.89	0.97
	Isolation	Republican	0.10	0.29	0.42	0.54	0.65	0.73	0.84
Difference	Exposure	Democratic	-0.44	-0.20	-0.10	-0.03	0.01	0.09	0.28
	Exposure	Republican	-0.38	-0.21	-0.13	-0.05	0.02	0.11	0.38
	Isolation	Democratic	-0.27	-0.10	-0.02	0.03	0.11	0.21	0.47
	Isolation	Republican	-0.36	-0.12	-0.03	0.05	0.14	0.23	0.40
Percent Change	Exposure	Democratic	-85.71	-55.53	-35.94	-15.56	5.14	30.56	136.99
	Exposure	Republican	-88.33	-60.92	-36.69	-14.37	5.22	28.01	137.64
	Isolation	Democratic	-64.27	-19.59	-3.57	4.34	19.65	46.73	167.28
	Isolation	Republican	-65.46	-26.20	-6.91	8.99	27.38	49.07	137.87
Absolute Difference	Exposure	Democratic	0.00	0.01	0.02	0.06	0.13	0.22	0.45
	Exposure	Republican	0.00	0.01	0.04	0.09	0.16	0.23	0.45
	Isolation	Democratic	0.00	0.01	0.03	0.07	0.14	0.23	0.48
	Isolation	Republican	0.00	0.01	0.04	0.10	0.17	0.25	0.45
Absolute Percent Change	Exposure	Democratic	0.41	4.15	11.26	24.97	43.09	64.12	137.05
	Exposure	Republican	0.34	0.58	10.05	23.93	44.39	68.95	137.64
	Isolation	Democratic	0.12	1.33	4.05	11.65	27.75	53.58	167.28
	Isolation	Republican	0.29	2.98	8.09	18.81	34.28	54.81	137.87

Quantiles of exposure/isolation for aspatial segregation measures constructed based on tract-level proportion Democrat/Republican. The top row presents the nationwide quantiles for exposure and isolation under this definition. The second row presents the individual differences between the main exposure/isolation measures and the tract-based measure. The third row presents the individual percentage difference between the main exposure/isolation measures and the tract-based measure. The fourth row presents the individual absolute differences between the main exposure/isolation measures and the tract-based measure. The fifth row presents the individual absolute percentage difference between the main exposure/isolation measures and the tract-based measure.

Supplementary Table 17: Precinct-Based Aspatial Exposure/Isolation Quantiles

Measure	Type	Party	1%	10%	25%	50%	75%	90%	99%
Precinct	Exposure	Democratic	0.01	0.06	0.18	0.36	0.53	0.66	0.83
	Exposure	Republican	0.08	0.17	0.26	0.37	0.50	0.63	0.85
	Isolation	Democratic	0.13	0.28	0.41	0.57	0.76	0.89	0.97
	Isolation	Republican	0.09	0.30	0.44	0.57	0.69	0.78	0.89
Difference	Exposure	Democratic	-0.57	-0.24	-0.12	-0.04	0.01	0.08	0.26
	Exposure	Republican	-0.33	-0.18	-0.11	-0.04	0.04	0.14	0.48
	Isolation	Democratic	-0.25	-0.10	-0.02	0.03	0.12	0.24	0.60
	Isolation	Republican	-0.46	-0.16	-0.06	0.02	0.12	0.20	0.36
Percent Change	Exposure	Democratic	-87.62	-59.36	-38.56	-17.33	4.66	33.61	202.01
	Exposure	Republican	-85.39	-55.88	-33.19	-11.17	9.61	43.94	251.06
	Isolation	Democratic	-59.16	-18.65	-3.83	4.69	23.17	64.65	312.02
	Isolation	Republican	-69.68	-30.59	-11.46	4.57	21.71	42.64	135.30
Absolute Difference	Exposure	Democratic	0.00	0.01	0.03	0.07	0.15	0.26	0.57
	Exposure	Republican	0.00	0.01	0.04	0.09	0.15	0.23	0.49
	Isolation	Democratic	0.00	0.01	0.03	0.07	0.15	0.26	0.60
	Isolation	Republican	0.00	0.02	0.04	0.09	0.16	0.25	0.49
Absolute Percent Change	Exposure	Democratic	0.46	4.67	12.40	27.00	46.80	69.82	202.01
	Exposure	Republican	0.37	3.81	10.52	24.60	45.69	72.36	251.06
	Isolation	Democratic	0.15	1.51	4.34	12.35	31.14	68.14	312.02
	Isolation	Republican	0.29	2.90	7.56	17.13	31.98	52.10	135.30

Quantiles of exposure/isolation for aspatial segregation measures constructed based on precinct voteshare. The top row presents the nationwide quantiles for exposure and isolation under this definition. The second row presents the individual differences between the main exposure/isolation measures and the precinct-based measure. The third row presents the individual percentage difference between the main exposure/isolation measures and the precinct-based measure. The fourth row presents the individual absolute differences between the main exposure/isolation measures and the precinct-based measure. The fifth row presents the individual absolute percentage difference between the main exposure/isolation measures and the precinct-based measure.

Supplementary Table 18: Correlation with County-level Normal Vote

Party	Correlate	Correlation
Democratic	Imputation	0.922
Republican	Imputation	0.918
Democratic	Weighted Exposure	0.922
Republican	Weighted Exposure	0.917
Democratic	Unweighted Exposure	0.922
Republican	Unweighted Exposure	0.918

Pearson's r correlation between measure of partisanship in column 2 and county-level normal vote as constructed from the average Presidential voteshare of each party from 2008–2012.

Supplementary Table 19: Relative Exposure Significance Tests

Estimate	Std. Error	t value	Pr(>|t|)	95% CI Lower	95% CI Upper	DF	Geography	Party
-0.256	0.009	-29.319	0.000	-0.273	-0.239	50	State	Democratic
-0.256	0.009	-28.936	0.000	-0.274	-0.239	50	State	Republican
-0.221	0.002	-96.106	0.000	-0.226	-0.217	916	CBSA	Democratic
-0.222	0.002	-92.412	0.000	-0.227	-0.218	916	CBSA	Republican
-0.184	0.001	-153.723	0.000	-0.187	-0.182	3142	County	Democratic
-0.185	0.001	-148.504	0.000	-0.187	-0.182	3142	County	Republican
-0.128	0.000	-336.597	0.000	-0.128	-0.127	28621	City/Town	Democratic
-0.128	0.000	-321.807	0.000	-0.129	-0.127	28621	City/Town	Republican
-0.130	0.000	-331.939	0.000	-0.131	-0.129	34049	Zip Code	Democratic
-0.128	0.000	-325.925	0.000	-0.129	-0.127	34049	Zip Code	Republican
-0.113	0.000	-436.261	0.000	-0.113	-0.112	72559	Tract	Democratic
-0.110	0.000	-431.732	0.000	-0.111	-0.110	72559	Tract	Republican

Results of t-test for difference of means between 0 and estimate of relative exposure listed in column 1. Pr(>|t|) is from two-sided test.

Supplementary Table 20: Relative Exposure Significance Tests – No Household Neighbors

Estimate	Std. Error	t value	Pr(>|t|)	95% CI Lower	95% CI Upper	DF	Geography	Party
-0.182	0.009	-21.115	0.000	-0.198	-0.165	50	State	Democratic
-0.184	0.009	-20.934	0.000	-0.201	-0.167	50	State	Republican
-0.147	0.002	-59.687	0.000	-0.152	-0.142	916	CBSA	Democratic
-0.150	0.003	-57.891	0.000	-0.155	-0.145	916	CBSA	Republican
-0.105	0.001	-86.645	0.000	-0.107	-0.102	3142	County	Democratic
-0.107	0.001	-83.150	0.000	-0.109	-0.104	3142	County	Republican
-0.065	0.000	-168.802	0.000	-0.066	-0.064	28621	City/Town	Democratic
-0.067	0.000	-161.986	0.000	-0.068	-0.066	28621	City/Town	Republican
-0.048	0.000	-162.417	0.000	-0.048	-0.047	34049	Zip Code	Democratic
-0.047	0.000	-156.692	0.000	-0.048	-0.047	34049	Zip Code	Republican
-0.030	0.000	-206.056	0.000	-0.031	-0.030	72559	Tract	Democratic
-0.030	0.000	-199.692	0.000	-0.030	-0.029	72559	Tract	Republican

Results of t-test for difference of means between 0 and estimate of relative exposure listed in column 1, with voters living in the same household excluded. Pr(>|t|) is from two-sided test.

Supplementary References

[1] Ansolabehere, S. & Schaffner, B. F. CCES Common Content, 2016 (2017).

[2] Clinton, J., Jackman, S. & Rivers, D. The statistical analysis of roll call data. *American Political Science Review* **98**, 355–370 (2004).

[3] Tausanovitch, C. & Warshaw, C. Measuring constituent policy preferences in congress, state legislatures, and cities. *The Journal of Politics* **75**, 330–342 (2013).

[4] Converse, P. E. The concept of a normal vote. In Campbell, A., Converse, P. E., Miller, W. E. & Stokes, D. E. (eds.) *Elections and the political order*, 9–39 (Wiley, New York, 1966).

[5] Hansford, T. G. & Gomez, B. T. Estimating the electoral effects of voter turnout. *American political Science Review* **104**, 268–288 (2010).