be manipulated with a supercomputer. Estimating a two-dimensional model with a linear trend for the House of Representatives required about three hours of CPU time on a Cyber 205 supercomputer.

Summary of the Model and Estimation Methods

The technically inclined reader will find the details of our model and the estimation procedure in appendix A. To summarize: First, we have adopted a simple spatial model with probabilistic voting. Second, assuming this model is a correct model of actual behavior, we have developed a method for recovering the positions of legislator and roll call outcomes solely from observed individual roll call decisions; that is, the method is blind to any external information, such as political parties, about the legislators and the roll calls. The direct linkage of the recovery method to the spatial model is our innovation to modern methods of roll call analysis introduced by MacRae (1958, 1970). Third, the recovery of legislator positions and roll call cutting lines is likely to be very accurate even if the technical assumptions of our procedure are violated. And fourth, the recovery of roll call outcomes may be very sensitive to the technical assumptions.

In the remainder of this book, we employ D-NOMINATE to estimate dynamic models of roll call voting. To estimate static models for a single Congress, we used W-NOMINATE, an improved version of NOMINATE. Having established the methodological basis for the remainder of the book, we can now proceed to a discussion of the results of the analysis.

3

The Spatial Model: Accuracy and Dimensionality

In this chapter, we investigate the performance of low-dimensional spatial models and discuss the substantive meaning of the dimensions. With respect to performance, we show that a simple spatial model adequately accounts for the roll call data. Our preferred model has only two dimensions; it limits temporal change in the positions of individual legislators to simple linear functions of time. In fact, this very simple model improves only marginally, albeit significantly, on an even simpler model that is one-dimensional, with legislators being constrained to a fixed position throughout their congressional careers. These basic results are presented in the first section of this chapter, which gives the overall fit of the various spatial models that we estimated.

In the second section, we address the issue content of the first and second dimensions; the first dimension almost always picks up the fundamental economic issues that separate the two major political parties of the time, while the second dimension divides the parties internally over regional issues (usually race). In the third section, we offer supporting evidence for our basic finding of low dimensionality; this section also confronts the controversy this finding has created in the relevant literature.

Overall Fit of the Spatial Models

We applied the D-NOMINATE algorithm to all roll call votes cast in the House and the Senate from 1789 to 1985 (the first 98 Congresses and the first session of the 99th).[1] All roll calls with at least 2.5 percent minority voting were included (97 – 3 and closer votes if 100 Senators voted). For a given Congress, every legislator who cast at least 25 votes was included.[2] Applying these criteria, 9,759 members of the House and 1,714 senators were included in the analysis. For the House, 32,953 roll calls were analyzed, and the total number of individual decisions was 8,110,702. For the Senate, there were 37,281 roll calls and 2,317,915 decisions.

One-, two-, and three-dimensional spatial models were estimated, and time polynomials up to degree 3 (cubic) were estimated for the legislators. A two-dimensional model with a linear time trend (like the one shown in figure 2.8) for the legislators accounts for about 85 percent of the individual decisions. Adding dimensions and higher-order time trends did not appreciably increase the fit of the model.

A straightforward method to measure the fit of the model is simply to count, across all roll calls, the percentage of correct classifications.[3] The classification results for the two-century history of both houses of Congress are shown in table 3.1. The table reports classifications for all roll calls in the estimation and for close roll calls, in which the minority got over 40 percent of the vote cast. With a two-dimensional model, classification is better than 80 percent for close votes, as well as for all votes.

A reasonable fit is obtained from a one-dimensional model in which each legislator's position is constant throughout his or her career. On the other hand, there is considerable improvement—about three percentage points—from adding a second dimension. Allowing for a linear trend in legislator positions adds another percentage point. That we get a smaller boost in the percentages from the time trend than from the dimensions is expected (see the box on adding parameters to the model).

Introducing more parameters to a dynamic spatial model—through extra dimensions or higher-order polynomials—does not appreciably add to our understanding of

Table 3.1 Classification Percentages, Proportional Reduction in Errors, and Geometric Mean Probabilities (1789–1985)

	House			Senate		
	Number of Dimensions			Number of Dimensions		
Degree of Polynomial	1	2	3	1	2	3
	Classification Percentage: All Scaled Votes					
Constant	82.7[a]	84.4	84.9	80.0	83.6	84.1
Linear	83.0	85.2	—[c]	81.3	84.5	85.5
Quadratic	83.1	85.3	—	81.5	84.8	85.9
Cubic	83.2	85.4	—	81.6	85.0	86.1
	Classification Percentage: Votes with at Least 40 Percent Minority					
Constant	80.5[b]	82.9	83.7	78.9	82.7	83.4
Linear	80.9	83.8	—	79.4	83.6	84.8
Quadratic	81.0	83.9	—	79.7	83.8	85.1
Cubic	81.1	84.1	—	79.8	84.0	85.3
	Aggregate Proportional Reduction in Error (*APRE*): All Scaled Votes					
Constant	.479	.531	.546	.435	.512	.530
Linear	.489	.553	—	.448	.543	.571
Quadratic	.494	.559	—	.453	.549	.583
Cubic	.494	.562	—	.456	.553	.589
	Geometric Mean Probability: All Scaled Votes					
Constant	.678	.696	.707	.660	.692	.700
Linear	.682	.709	—	.666	.704	.716
Quadratic	.684	.712	—	.668	.708	.721
Cubic	.684	.714	—	.670	.708	.725

a. The percentage of correct classifications is for all roll calls that were included in the scalings—i.e., those with at least 2.5 percent or better on the minority side.
b. The percentage of correct classifications is for all roll calls with at least 40 percent or better on the minority side.
c. Higher polynomial models for 3 dimensions were not estimated because of computer-time considerations.

Adding Parameters to the Model

When legislator positions are allowed to have a time trend, we add parameters to the model. We add only one parameter per legislator for each dimension. If, for example, we add a time trend to the one-dimensional, constant-position model for the House, we would add 9,759 parameters if we had a time trend for every representative included in our analysis of the first 99 Congresses; but as we have time trends only for members voting at least 25 times in at least 3 Congresses, we in fact add only 4,185 parameters. When a dimension is added to a model, the number of roll call parameters added equals twice the number of roll calls (32,955), because each roll call is represented by Yea and Nay points in the space. In addition, legislator parameters are added. (The number of parameters added for a legislator equals the degree of the time polynomial for the legislator [see appendix A].) For example, adding a second dimension to the one-dimensional, constant-position model means 2 × 32,955 + 9,759 = 75,669 parameters.

More generally, since roll calls outnumber legislators by more than 5 to 1, we add about 10 times as many parameters in adding a dimension as we do in adding another polynomial term in legislator positions. It is thus not surprising that our classification shows more improvement when we increase the dimensionality of the space than when we increase the order of the time polynomial.

the political process. That is, the additional dimensions have no obvious interpretations, nor does the complexity inherent in higher-order polynomials. Moreover, adding extra parameters results in only a very marginal increase in our ability to account for voting decisions. For example, consider adding parameters to the two-dimensional linear model in the Senate. Allowing for a quadratic term in the time polynomial improves classification only by 0.3 percent, at a cost of 1,456 additional parameters (2 dimensions × 728 senators serving in 4 or more Congresses). Allowing for a third dimension improves classification by only 1.0 percent at a cost of 77,479 more parameters (two more per roll call and one or two additional parameters per legislator). Allowing for both generates an improvement of only 1.1 percent.

Another way to evaluate the fit of the models is to focus on the proportional reduction in error, or the *PRE,* of the models.[4] A *PRE* measure allows us to see how much the D-NOMINATE model improves on a suitable benchmark model. In other words, does D-NOMINATE make substantially fewer classification errors than the benchmark? Our benchmark number of errors is the minority vote—that is, the minimum number of the Yea votes and the Nay votes. In technical lingo, the majority-minority split on a roll call is known as the "marginals."

Why is the minority vote an attractive benchmark? Suppose the actual vote was 65 Yeas to 35 Nays. Without any information from the spatial model, one could always predict on the basis of the marginals. In the example, one would correctly classify 65 of the votes by predicting that everyone would vote Yea. There would be 35 classification errors from this prediction. Clearly, if there is useful information on the legislator positions and the roll call outcomes estimated by D-NOMINATE, classification should result in fewer than these 35 benchmark errors. When the minority vote is the benchmark, the *PRE* is equal to the minority vote minus the number of D-NOMINATE classification errors, with the difference being divided by the minority vote. That is:

$$PRE = \frac{\text{Minority Vote} - \text{D-NOMINATE Classification Errors}}{\text{Minority Vote}}$$

This measure is 1 if there are no classification errors and zero if the spatial-model errors equal the minority vote. In the example, if D-NOMINATE also leads to 35 errors, the *PRE* is 0. Suppose, alternatively, that the first dimension classifies 75 legislators correctly, and that adding the second dimension results in 88 legislators being correctly classified—that is, the first dimension has reduced the 35 benchmark errors to 25; and adding the second dimension has reduced the errors to 12. The *PRE* would equal (35 − 25)/35, or .286, for one dimension; and (35 − 12)/35, or .657, for two dimensions. In this book, we will frequently use the *PRE* measure to analyze individual roll call votes because it controls for the margin of the roll call and facilitates comparisons of votes. (Note that the *PRE* can be negative if the spatial model makes more errors than the marginals.) We denote the *PRE* for the one-dimensional linear model as *PRE1*, and we use *PRE2* for the two-dimensional linear model.

Groups of roll calls may be evaluated by focusing on the aggregate proportional reduction in error (*APRE*). Specifically, we sum all roll calls, indexed by j, $j = 1, 2, \ldots, n$, with n denoting the number of roll calls in the group being aggregated.

$$APRE = \frac{\sum_{j=1}^{n} \{\text{Minority Vote} - \text{D-NOMINATE Classification Errors}\}_j}{\sum_{j=1}^{n} \text{Minority Vote}_j}$$

APRE1 and *APRE2* are defined analogously to *PRE1* and *PRE2*. Table 3.1 shows the *APRE* for the various spatial models.[5]

In addition to computing classification percentages, the model may be evaluated by an alternative method that gives more weight to errors that are far from the cutting line than to errors close to the cutting line—for example, a vote by Edward Kennedy (D-MA) to confirm Judge Robert Bork as a Supreme Court justice would be a more serious error than a similar decision by Sam Nunn (D-GA). Such a measure is the geometric mean probability (GMP) of the actual choices (see the box on GMPs).

Summary GMPs for the various estimations are presented in table 3.1. The pattern matches that found for the classification percentages—little is gained by going beyond two dimensions or a linear trend.[6]

Figure 3.1 plots the percentage correctly classified for the one- and two-dimensional dynamic models for every Congress. The striking point about figure 3.1 is how closely the Senate and House track each other over time. The correlations between the Senate and House classifications are .74 for the one-dimensional dynamic model and .69 for the two-dimensional dynamic model. The spatial model breaks down during two periods. The first, from 1815 to 1825 (the period of the 14th through the 19th

Geometric Mean Probability

The *likelihood* of an observed choice is simply the probability the model assigns to that choice. Thus, if a legislator who actually voted Yea was predicted to vote Yea, with a probability of 0.9, by the D-NOMINATE two-dimensional linear model, the likelihood of the choice for that model would be 0.9. Since all choices are assumed to be independent, the likelihood of all the choices for all the legislators is just the product of all the likelihoods.

The *log-likelihood* is the natural logarithm of the likelihood. As examples, the natural logarithm of 0.9 is − 0.105; of 0.5, − 0.693; and of 0.1, − 2.303. The log-likelihood for all the choices for all the legislators is just the sum of all the log-likelihoods for the choices.

The *geometric mean probability is the exponential (or anti-log) of the average log-likelihood*—that is:

$$GMP = \exp[\text{log-likelihood of all observed choices}/N],$$

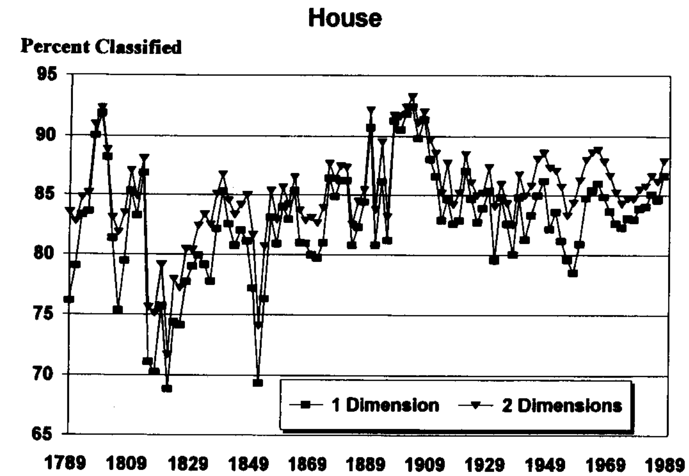
where N is the total number of choices.

Since the GMP is a probability, its maximum value is 1.0. This would occur if the model assigned a probability of 1.0 to every observed choice. The minimum value is 0.0, which occurs if the model assigned a probability of 0.0 to every observed choice.

As a measure of fit, the GMP penalizes models that assign very low probabilities to observed choices. For example, compare a model that assigned a probability of 0.5 to every observed choice to one that assigned a probability of 0.9 to half the choices and 0.1 to the other half. The average probability assigned by both models is 0.5. But the geometric mean probability for the latter model is 0.3 [$\exp(((\ln(0.9)+\ln(0.1))/2) = \exp((-0.105-2.303)/2) = 0.3$].

Congresses) is marked by the collapse of the Federalist party and the Era of Good Feelings when the United States had, in effect, a one-party government. The era perhaps reached its peak with the elections of 1820, when only a single electoral vote was cast against President Monroe's reelection, and when the Jeffersonian Republicans won more than 85 percent of the seats in the House of Representatives. The second period was in the early 1850s (during the 32nd and 33rd Congresses), when the conflict over slavery led to the collapse of the Whig party. Later in this chapter, we offer evidence that allowing for more dimensions in these breakdown periods does not improve the model—that is, either the spatial model fits with one or two dimensions, or there is "chaos" in the voting.

Another way of measuring how well our dynamic spatial model fits the roll call data is to look at the residuals—that is, the distribution of the errors (involving those legislators whose roll call votes are not predicted correctly). As discussed in chapter 2, the errors should be close to the cutting line. In our model, the probability of voting either Yea or Nay is ½ for a legislator whose ideal point is on the cutting line. Legislators far from the cutting line will have either very high or very low probabilities of



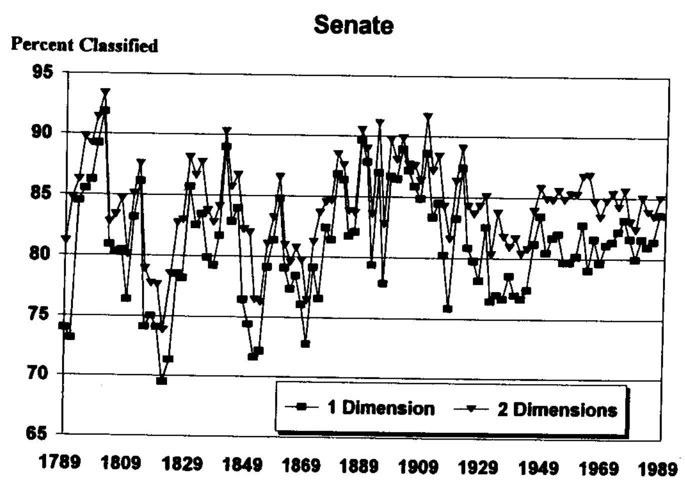


Figure 3.1. Classification in the dynamic spatial model. These graphs show the percentage correctly classified for all roll call voting decisions in each Congress. Each symbol corresponds to a Congress. The one-dimensional model usually classifies almost as well as the two-dimensional model. The patterns for the House and Senate are very similar. The model shown is the dynamic model with a linear trend in legislator positions. (In all the time-series graphs in this book, each plotted point refers to a Congress or a two-year period. The year that corresponds to each Congress is the year following congressional elections. Many early Congresses did not have their first votes until December of that year and had their last votes in March of the year used to designate the next Congress.)

voting Yea (see the box on the GMP). Consequently, if our model is correct, the errors should drop off sharply as distance from the cutting line increases. Figure 3.2 shows the distribution of errors for our preferred two-dimensional dynamic model, along with the theoretical distribution of errors.[7] The graphs for the Senate are very similar to those shown for the House.

Figure 3.2 shows the percentage of the total choices that were errors as a function of the legislator's distance from the cutting line. (Recall that, as the cutting line is distinct for each roll call, each legislator's distance from the cutting line will vary with the roll call.) The distances are grouped in intervals of 0.1 units of the space. Since the space is 2 units in diameter, the maximum distance of a legislator from the cutting line is 2 units, but most of the distances are less than 0.5 units. For example, the "All" graph in figure 3.2 is based on all of the individual roll call vote choices included in our dynamic two-dimensional model for the first 99 Houses.[8] The estimated legislator ideal point was within 0.1 unit of the estimated roll call cutting line for 2,039,460 actual choices. But, for a more distant interval of 0.1, that where the legislator ideal point was 0.5 to 0.6 units from the cutting line (corresponding to ".6" in the figure), there were only 572,307 actual choices. Note that the error rate decreases sharply with distance from the cutting line. The error rate for the 0 to 0.1 interval is 34.8 percent. In sharp contrast, the error rate for the 0.5 to 0.6 interval is a mere 4.4 percent.

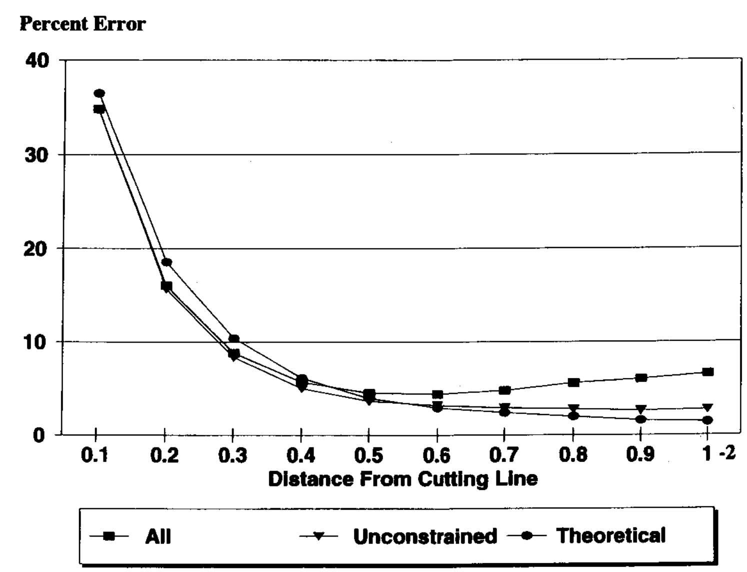


Figure 3.2. Classification errors, by legislator's distance from the cutting line in the House of Representatives (1789–1985). The error rate falls sharply as legislators become more distant from the cutting line. The "0.1" refers to all instances where a legislator's ideal point was 0.1 units or less from the cutting line on a roll call. The "All" line includes all roll call votes; the "Unconstrained" line has all roll call votes where the D-NOMINATE cutting-line estimate was unconstrained.

Figure 3.2 also shows the theoretical error distribution and the actual error distribution for just those roll calls that were "unconstrained." As we explain in appendix A, the estimated policy locations for very lopsided roll calls—for example, 95–5—often had to be constrained. That is, if the estimated cutting line fell outside the legislators' locations, so that a unanimous vote was predicted, we constrained the cutting line to be at the edge of the space.[9] When these constrained roll calls are included in the error calculations, the error distributions turn slightly upward after 0.6 units away from the cutting line. Until this point, the actual distribution of errors corresponds to the theoretical distribution very closely. Removing the constrained roll calls continues the correspondence beyond 0.6 units.

The reason for the very small upward turn is that on some near-unanimous votes (for example, 95–5), members may engage in "protest" voting while knowing that their protest (for example, voting against funding for the State Department) will have no effect on the outcome.

As we pointed out above, either the spatial model fits with one or two dimensions, or there is chaos in voting. Chaos is rare, as the information in table 3.1 and in figures 3.1 and 3.2 has disclosed. Quite the contrary: The important regularity we have found is that 84 percent of all individual decisions can be accounted for by a two-dimensional model, in which individual legislators have ideal points that are fixed throughout their tenures in office. Put differently, the PRE measure shows that the spatial model explains over half the decisions not explained by the minority-vote benchmark. This regularity is an important pattern, but the pattern does not arise from a well-specified theoretical model that would fix the dimensionality of the space.

It is clear that what is not explained by a low-dimensional model with stable individual positions is not explained by a higher-dimensional, more dynamically flexible model. We can allow for substantial readjustment in legislator positions by estimating each Congress separately. Later in this chapter, we show that separate estimates for various Congresses disclose little improvement over the two-dimensional linear fit, even with as many as 15 dimensions. The unexplained votes thus reflect either responses to specific constituency interests on particular issues, special-interest lobbying, and logrolls, or other forms of strategic behavior.

The Issue Content of the First and Second Dimensions: An Overview

What is the substantive content of the space? To begin with, consider what the space would look like in a classical British two-party system with a very high degree of party discipline in roll call voting. The space would be largely one-dimensional, with the ideal points of the members of the Left party forming one tight cluster, and the ideal points of the Right party forming another tight cluster. The roll call cutting lines would all be vertical or nearly vertical and tightly clustered, equidistant from the two party clusters. The tight clusters would in fact be single points or lines except for the fact that occasionally discipline breaks down and free votes are allowed.

In many figures in this book, the American political parties also present distinct clusters, even though the parties are not as disciplined as they are in Great Britain. Indeed, throughout most of American history, we found that numerous roll calls in nearly every Congress had cutting lines through the space that perfectly, or nearly perfectly, divided the two parties. These would be the cutting lines for party-line votes. We show below that these cutting lines typically define votes that fall on the first dimension.

The political parties, either through the discipline of powerful leaders or through successful trades, function as effective logrollers. Parties thus help to map complex issues (to bundle diverse economic interests) into a low-dimensional space. The first dimension represents conflict over the role of government in the economy. The historical exceptions to this statement are 1817–35, during the Era of Good Feelings, and 1853–76, before and after the Civil War. When party is coterminous with the first dimension, the second dimension allows party members to be differentiated with respect to a second set of issues. For example, in the 1840s, the first dimension was largely concerned with internal improvements and the second, with slavery (which was a sectional economic issue [Fogel and Engerman, 1974], as well as a moral issue [Fogel, 1989]).

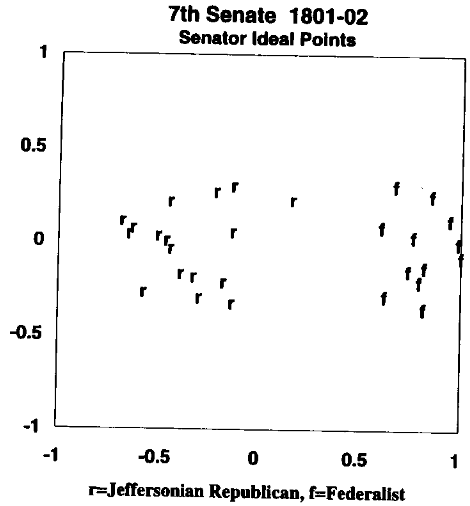
To indicate the issue content of the two dimensions more systematically, we discuss, in the next section, the history of the spatial positions of legislators from the major political parties. We then discuss the issue content of the first and second dimensions.

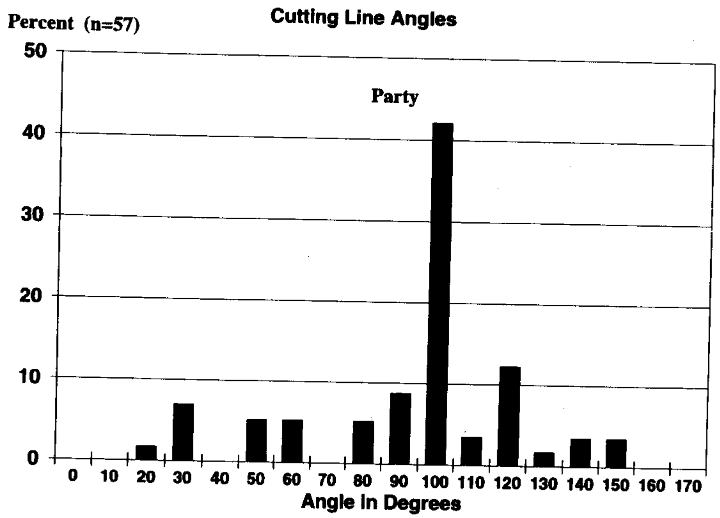
Spatial Maps of the Party Systems

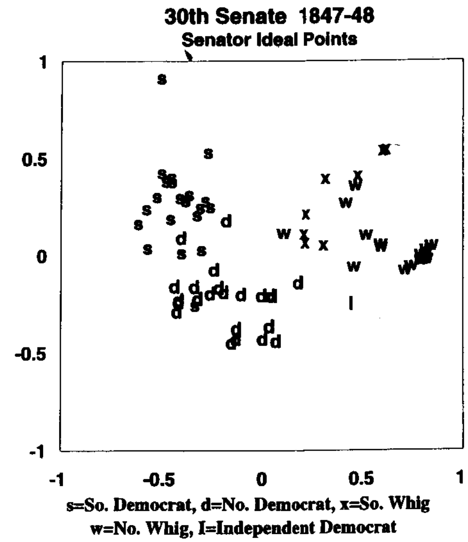
The United States has had three periods with distinct two-party systems. The first, the Jeffersonian Republican/Federalist party system, ended with the Era of Good Feelings. The second, the Democratic/Whig system, was organized after the Era of Good Feelings and lasted until the early 1850s. The third, the Democratic/Republican system, was organized by the late 1850s and continues today, although we will frequently refer to this system as having been perturbed into a three-party system (northern Democrats, southern Democrats, Republicans) by civil-rights issues that arose in the mid-twentieth century. Figures 3.3 and 3.4 show two-dimensional spatial maps for representative Senates and Houses in each of the three two-party systems and in the three-party perturbation. As we note below, the first dimension almost always divides the two major political parties, whereas the second dimension picks up divisions within the parties.

We noted in chapter 2 that votes that involve only the first dimension will have vertical cutting lines—that is, cutting lines at an angle of 90°to the horizontal axis of the space. In contrast, purely second-dimension votes will have angles of 0°(or, equivalently, 180°). Votes that mix the two dimensions, such as our draft-evasion punishment example in figure 2.5, will have angles that vary from 0°to 180°. Consequently, just as we can summarize the information about the distribution of legislators' ideal points in a scatter plot (the top plots, of figures 3.3 and 3.4, for each of the Senates and Houses covered), we can summarize the information about the distribution of roll calls in a bar graph (a histogram) of cutting-line angles (the bottom plots of figures 3.3 and 3.4).

On the bar graphs, we have indicated where the party-line votes fell. For these plots, we defined a party-line vote as one where at least 65 percent of one party opposed at least 65 percent of the second party.[10] Since the first dimension always divides the political parties during stable periods, the cutting-line angle of a party-line vote will be







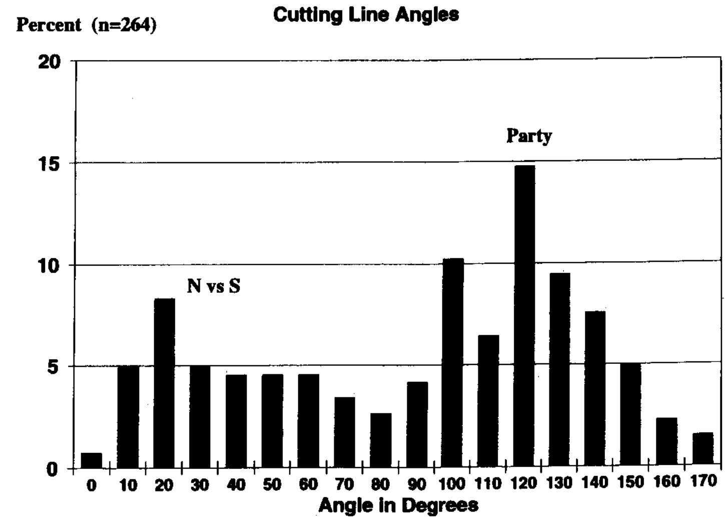
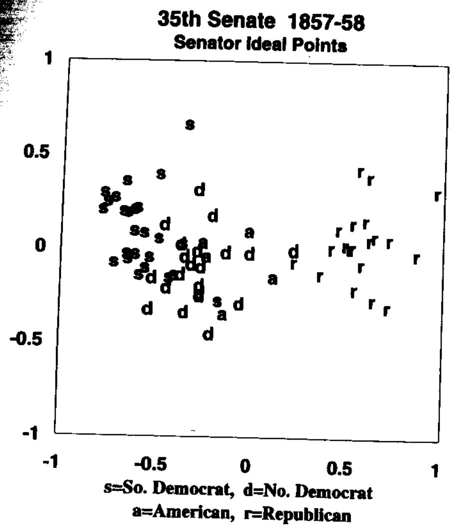


Figure 3.3. Ideal-point and cutting-line angle estimates for selected Senates. In the top panel for each Senate, each lowercase letter represents a legislator. The bottom panel shows the distribution of cutting-line angles. The values shown by the bars sum to 100 percent. The label "Party" shows where the party-line votes were concentrated. Where relevant, "N vs S" and "Conservative Coalition" show, respectively, the concentrations of votes that were regional North-South splits and votes that pitted Republicans and southern Democrats against northern Democrats. Votes in the 80 bar are those with cutting lines between 80° and 90°. These votes and those in the 90 bar represent vertical cutting lines or first-dimension votes. Those in the 0 and 170 bars represent second-dimension votes. The graphs show that pure second-dimension votes are very rare.

close to 90°. We exclude constrained roll calls because they almost always are constrained at the left or right edge of the first dimension and therefore have an angle of 90°. Including them would exaggerate the number of party-line cutting angles.

The Federalist period. By the 3rd Congress, the factions associated with Jefferson and Hamilton began to solidify into the Jeffersonian Republican and Federalist parties, respectively. This division initially occurred because of the sharp disagreements over foreign policy regarding the French Revolution and its aftermath and Hamilton's economic program of excise taxes, tariffs, a national bank, and the payment of the Revolutionary War debt of the States and the Continental Congress. Figure 3.4 covers the 5th House (1797–98), during which the infamous Alien and Sedition Acts were passed; and figure 3.3 covers the 7th Senate (1801–2), during which Jefferson served



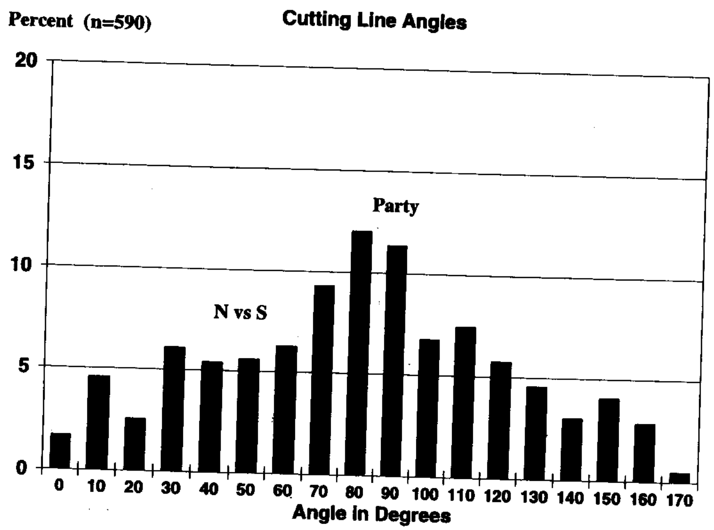
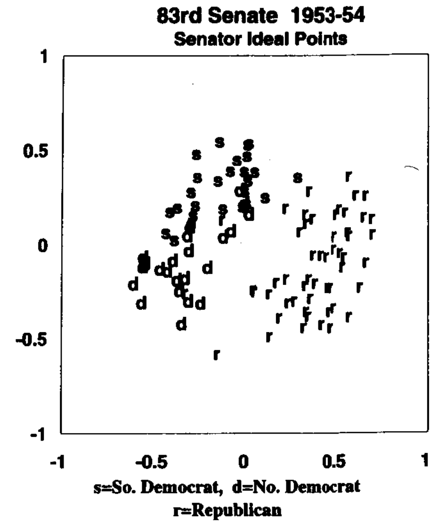


Figure 3.3. *(continued)*

his first term. The gap between the Republicans and Federalists, and the grouping of the cutting-line angles around 90°, are typical of a well-organized political-party system.

The Era of Good Feelings. The War of 1812 produced a deep regional split in the United States. New England and the coastal areas of the middle states opposed declaring war on Britain. The South and West largely supported the war.[11] Opposition in New England was so pronounced that the British did not blockade the coast above New London, Connecticut. The War of 1812 destroyed the Federalist party and led to a period of one-party rule from 1815 to 1824. This became known as the Era of Good



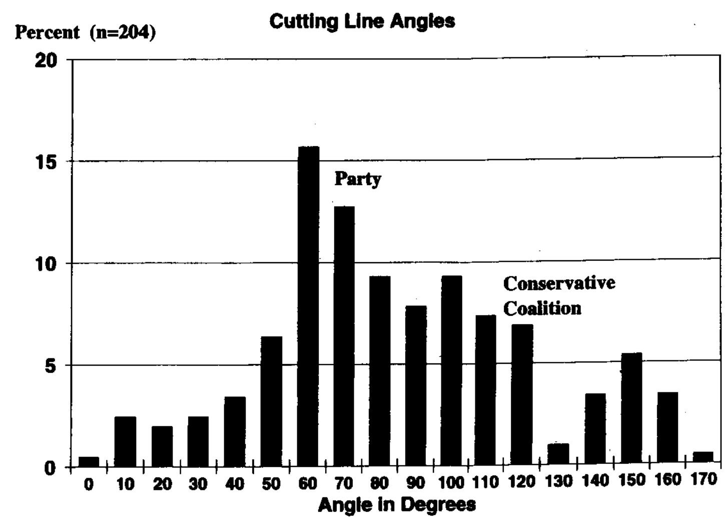
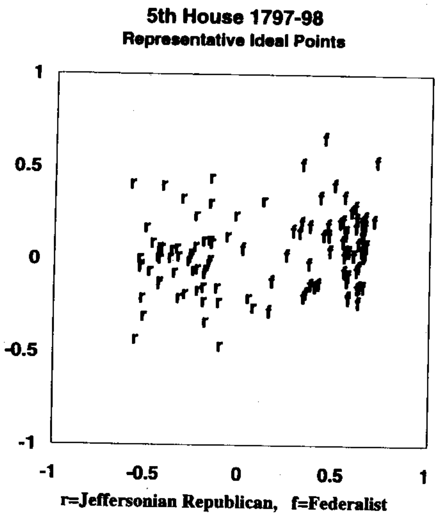


Figure 3.3. *(continued)*

Feelings after President Monroe toured New England in 1817 in large part to bring about greater national harmony.

The effect of this period on congressional voting was dramatic. Figure 3.1 shows that roll call voting through the period fit the spatial model very poorly. With the collapse of the Federalist party, the first dimension becomes a regional dimension pitting the northeastern Jeffersonians of various hues against the southern and western Jeffersonians. As we discuss in chapter 5, the first dimension largely accounts for the voting on the Missouri Compromise of 1820, which occurred largely along sectional lines. The poor fit would have been even worse were it not for such sectional votes.



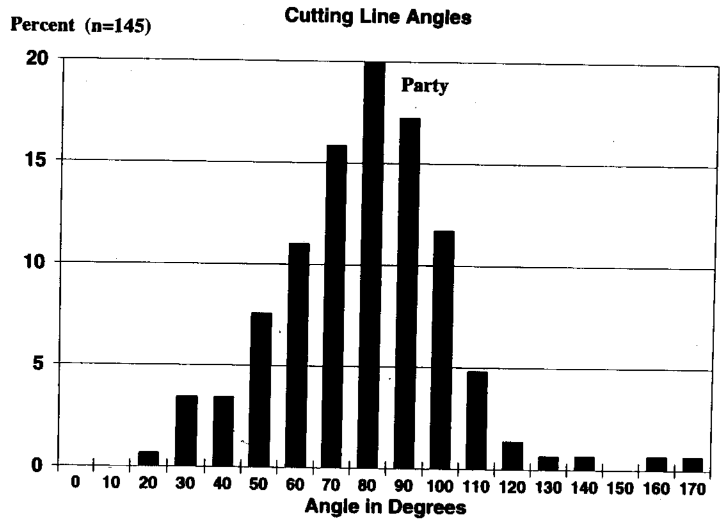
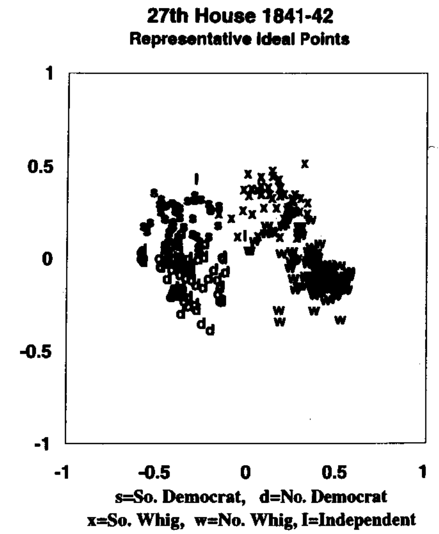


Figure 3.4. Ideal-point and cutting-line angle estimates for selected Houses. See the caption for figure 3.3 for details.

The Whig/Democratic period. During the 1830s and 1840s, the first dimension reverted to a party dimension and the second dimension picked up the conflict between the North and the South over slavery. This can be seen clearly in the spatial maps of the 30th Senate (1847–48) and the 27th House (1841–42). The s token denotes the southern Democrats, and x denotes the southern Whigs.[12] The clear separation of the southern and northern Democrats and of the southern and northern Whigs is evident. On the cutting-line angle plots, we have indicated the cutting-line angle of the North-versus-South votes (shown as "N vs S" in figures 3.3 and 3.4).[13] Note that the cutting-



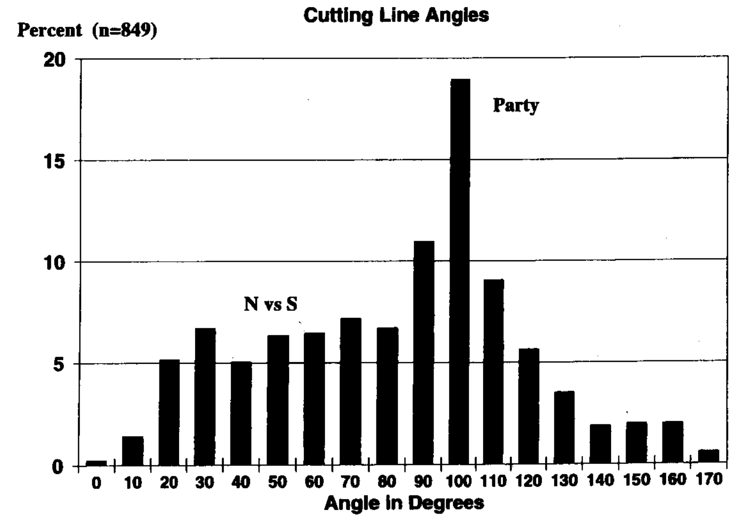


Figure 3.4. *(continued)*

line angle for political party is now tilted toward approximately 110°. As is evident from an examination of the legislator configurations, the first dimension is primarily the party, but it also has a slight regional component in it in that the southern and northern Whigs are slightly separated along it.

The Civil War era. The realignment of the 1850s wiped out the Whig party. It was replaced by the Republican party in the North. The Democratic party was predominant in the South. Consequently, the first dimension, until roughly the 1870s, is concerned mainly with issues related to slavery, the Civil War, and Reconstruction. For the 35th

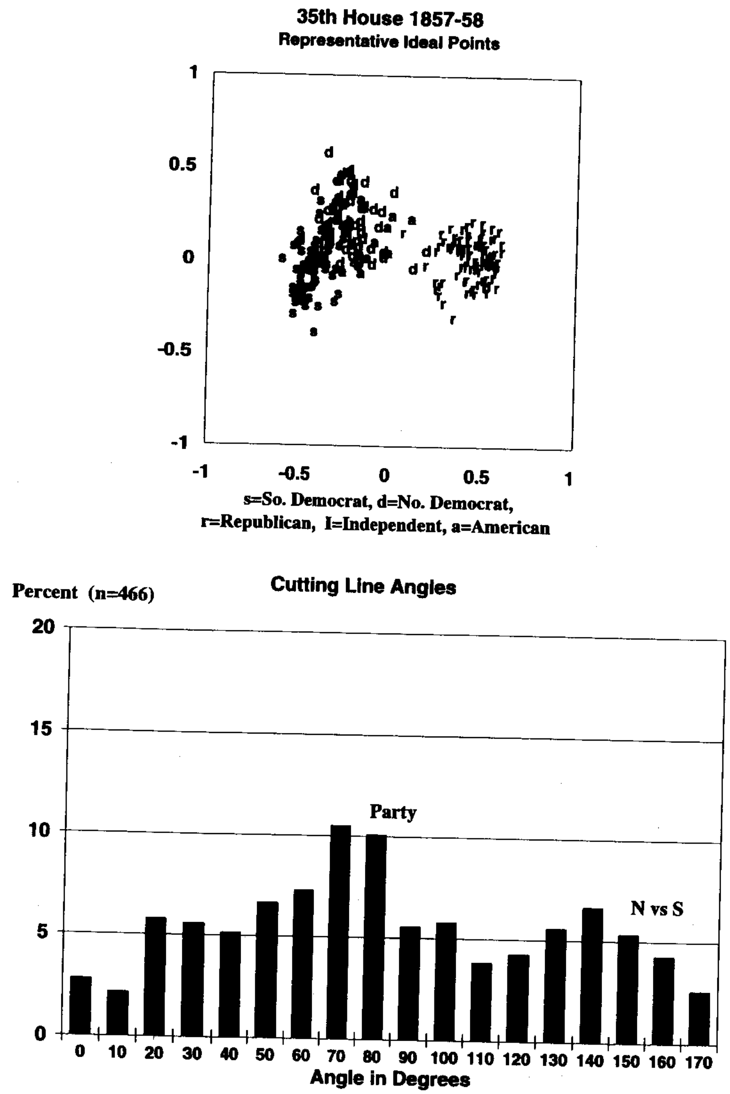


Figure 3.4. *(continued)*

Congress (1857–58), the southern Democrats are found to be to the left of the northern Democrats on this new first dimension. There is still some North-versus-South component in the new second dimension, but it is weak. Indeed, as is evident from the legislator configurations, a 90°cutting line separates the bulk of the southern Democrats from their northern colleagues. But since there were no southern Republicans, all the North-versus-South votes split the Democratic party.

From Reconstruction to the New Deal. In the late nineteenth century, the second dimension weakly separates the western and southern states from the northeastern

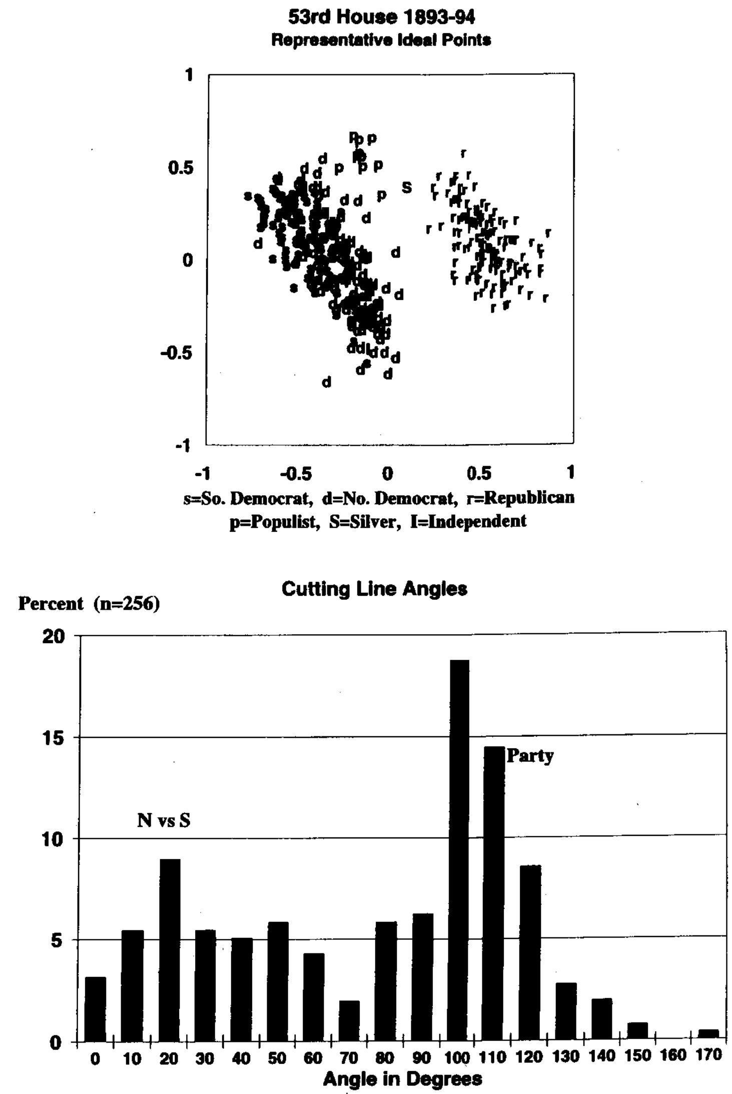
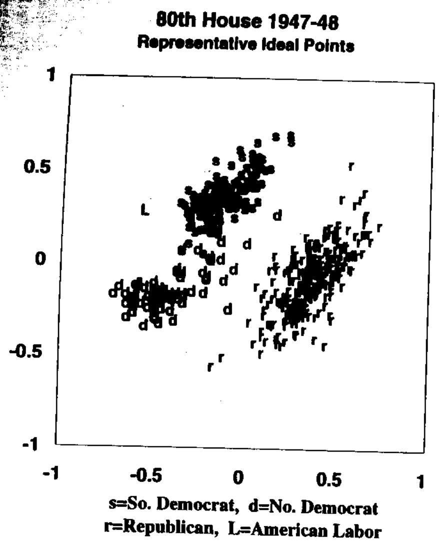


Figure 3.4. *(continued)*

states. This effect was stronger in the House than in the Senate. For example, figure 3.4 shows the 53rd House (1893–94), which came just before the realignment of the 1890s.[14] The d tokens in the southeast quadrant are from the northeastern states. The North-versus-South votes during this period were really a case of the South plus the West against the Northeast—the regional lineup on bimetalism that we discuss in chapter 5. The second dimension in this period thus involved an agrarian-industrial, or urban-rural, contrast. Representatives from the largest cities were at the bottom of the plot on the second dimension.[15]



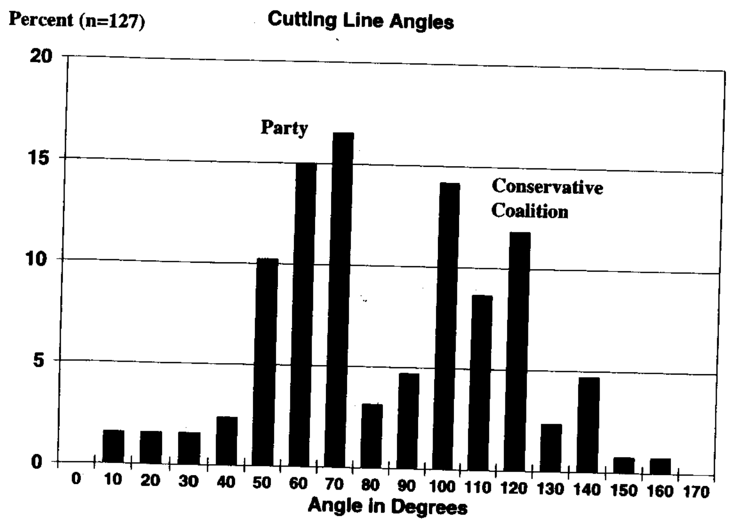
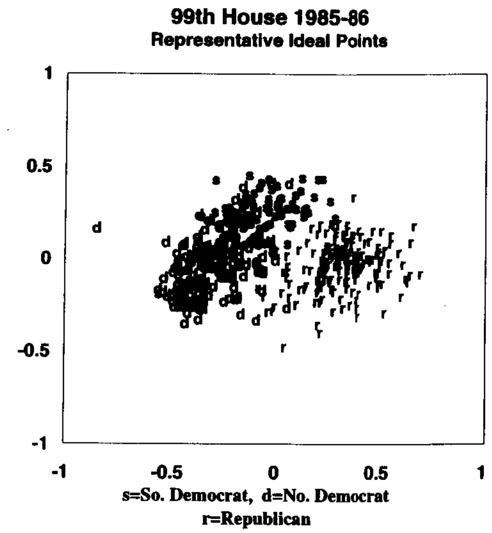


Figure 3.4. *(continued)*

The three-party system of the mid-twentieth century. The period from the late New Deal until the mid-1970s saw the development of the only genuine three-political-party system in American history. The southern and northern Democrats may have joined together to organize the House and Senate, but as the plots of the 83rd Senate (1953–54) and the 80th House (1947–48) show, they were widely separated on the second dimension. This dimension picked up the conflict over civil rights. The approximate inclination of 45°for the two parties reflects the high degree of conservative-coalition voting (southern Democrats and Republicans versus northern Democrats) that occurred throughout this period on a wide variety of non-race-related matters.



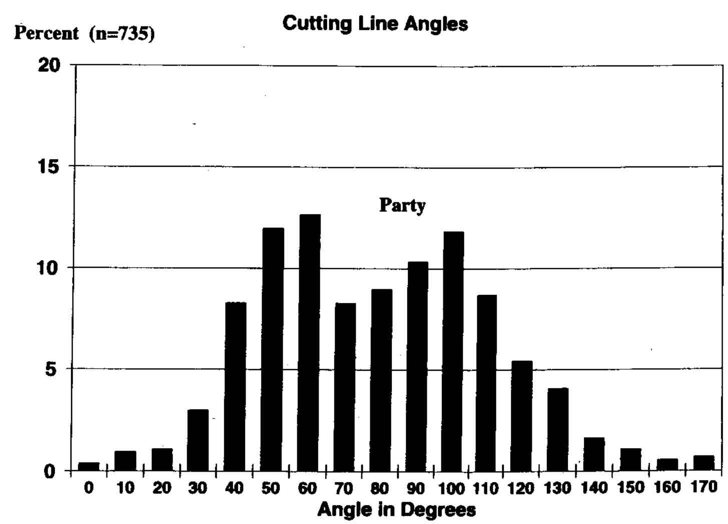


Figure 3.4. *(continued)*

In the three-party-system period, it is useful to think of a major-party loyalty dimension as defined by the axis through the space that captures party-line votes. This dimension can be thought of as ranging from strong loyalty to the Democrats to weak loyalty to either party and to strong loyalty to the Republicans. (In other periods, when party cutting lines are vertical, the horizontal dimension can be thought of as both a party-loyalty dimension and an economic dimension.) An axis perpendicular to the party-loyalty dimension would then express a liberal/conservative dimension that is independent of party loyalty. Votes with cutting lines that are on neither the party-loyalty axis nor the independent liberal/conservative axis represent votes in which legislators make a trade-off—instead of voting on their liberal/conservative positions, they maintain some loyalty to their parties. Almost all votes reflect, to some degree, this type of trade-off.

The contemporary Congress: a return to unidimensional politics. Finally, figure 3.4 shows the spatial map for the 99th House. Note that the separation between northern and southern Democrats has decreased. This process has continued through the 101st Congress, to such an extent that the second dimension has all but disappeared. Indeed, the modern Congress is truly unidimensional. (See McCarty et al. [1996] for evidence through the 104th Congress.)

In sum, one way of interpreting the dynamics of the space is that the horizontal axis usually picks up the conflict between, roughly speaking, rich and poor (or, more accurately, rich and less rich). Other issues (slavery, civil rights, currency inflation) cross-cut this basic conflict. If (to anticipate chapter 5) one of these other issues becomes too intense, dimensional alignments break down and a reorganization of the party system results.

The First Dimension Captures Party Loyalty

Except for very brief periods, the first dimension divides the two major political parties (as noted previously). This dimension can be thought of as ranging from strong loyalty to one party (the Jeffersonian Republicans or the Democrats) to weak loyalty to either party and to strong loyalty to the second, opposing party (Federalists, Whigs, or Republicans). The second dimension differentiates the members by region within each party.

In figure 3.5, we show the *APRE* for party-line votes in the House and the Senate for the first 100 Congresses. We use a more stringent definition of party-line voting than we used in figures 3.3 and 3.4 in order to isolate the effect of political party as much as possible. We define a party-line vote as one where 90 percent of the majority party votes against 90 percent of the minority party. We graph *APRE1* and the gain in *APRE* from adding the second dimension (*APRE2* − *APRE1*). We show only those Houses and Senates in which there were at least five party-line roll calls.[16]

In the House the patterns are very clear. The second dimension plays no role in party-line voting until after the 80th Congress. As we will discuss in chapter 5, the striking pattern in the *APRE* plots of the House is due to the emergence of a three-party system in the late 1930s—northern Democrats, southern Democrats, Republicans—brought about by race. Almost by definition, to get 90 percent of Democrats to vote the same way on a roll call meant that southerners and northerners were in agreement. Since the second dimension of the space throughout this period separated northerners from southerners, a party-line vote fell along both dimensions. After the passage of the civil-rights laws in the 1960s, this division in the Democratic party slowly faded in the mid-to-late 1970s so that party-line voting returned to a more normal pattern.

The pattern of party-line voting in the Senate is essentially the same as in the House (and for the same reasons). The exception is the period from the 69th Senate through the 74th (1925–36), when the second dimension also plays an important role. During

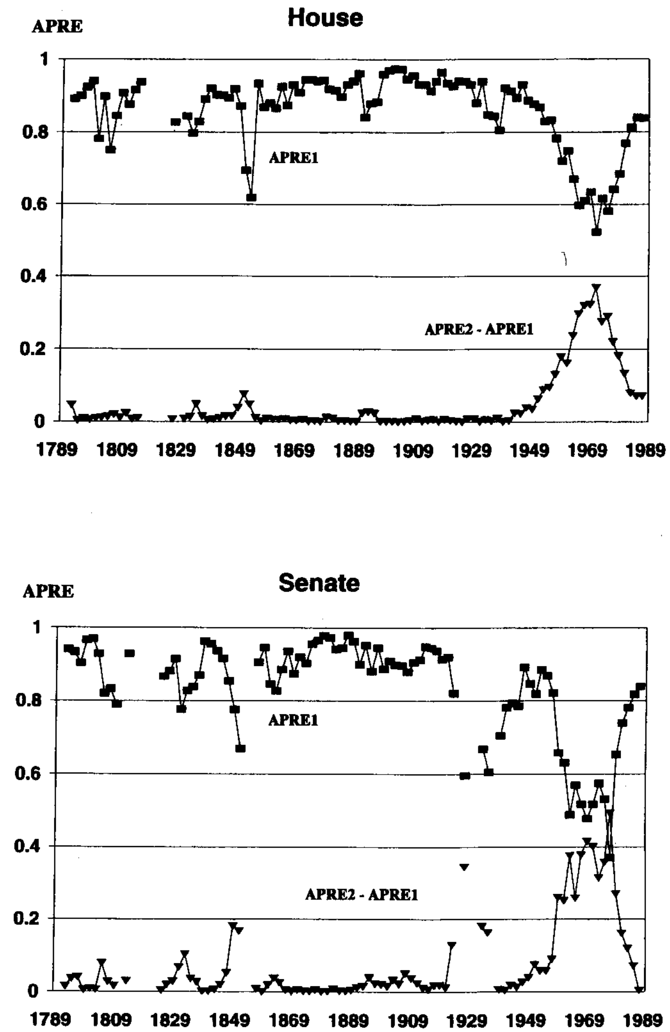


Figure 3.5. Aggregate proportionate reduction in error (*APRE*) on party-line votes (1789–1988). Party-line votes are ones for which at least 90 percent of the majority party opposes 90 percent of the minority party. *APRE1* refers to the first dimension, and *APRE2* − *APRE1*, to the additional reduction in errors brought about by the second dimension. The *APRE1* graph shows that party-line votes always fit the spatial model very well, except for three periods: the time of the collapse, around 1852, of the Democratic/Whig system; the period of the three-party post–World War II system; and, only in the Senate, the Progressive Republican era in the 1920s. In contrast to the "chaos" around 1852, party-line voting in the three-party period is still a good fit for the spatial model, but two dimensions are required. The Senate during the Progressive era is an intermediate case.

this period, a small group of midwestern Republican senators voted with the Democrats to such an extent that they were located among the Democrats along the first dimension but above the Democrats on the second dimension. These included the two prominent Progressives: George Norris of Nebraska and Robert M. La Follette, Jr., of Wisconsin (La Follette, Sr., had bolted the Republican party and run for president as a third-party candidate in 1924).[17] Consequently, a party-line vote fell along both dimensions, with a cutting-line angle of about −45°. By the middle of the New Deal, most of these Republicans were replaced by Democrats, and party-line voting returned to a more normal pattern along the first dimension.[18]

The Content of the Second Dimension

Relatively few issues have consistently sparked a second dimension in spatial terms. We coded all the roll calls for all 100 Houses and Senates on a wide variety of issues: slavery; presidential impeachment; the national bank; voting rights; disputed elections; price controls; and so on.[19] (Appendix C shows the specific issue codes we used to categorize the roll calls.)[20] To isolate strongly second-dimensional votes, we listed all issue areas in which there were at least 10 roll calls with a gain in the *APRE* of at least 0.2 from adding the second dimension (*APRE2 − APRE1*). These are shown, for the House, in table 3.2 and, for the Senate, in table 3.3 (issue areas for which *APRE1* is less than 0.2 are indicated in italics).

Before the formation of the Democrat-Whig party system in the mid-1830s,[21] the public-works issue is the one most often picked up by the second dimension. After 1837 (the first year of the 25th Congress), slavery and the disposition of public lands dominate until the fateful 32nd Congress and the Compromise of 1850, after which slavery becomes a first-dimension issue (see chapter 5). From the Civil War until the realignment of the 1890s (see chapter 5), the predominant second-dimension issue is bimetallism (U.S. currency; banking and finance). After the turn of the century, there is no consistent pattern on the second dimension in either the House or the Senate until after World War II, when civil-rights issues split the Democratic party and created the three-party system we discussed above in connection with figure 3.5.

There are more second-dimension issues in the Senate than in the House, which is consistent with the finding (in table 3.1) that the second dimension is, overall, more important in the Senate than in the House. For example, in the linear model, classifications are improved by 3.8 percent in moving from a one-dimensional model to a two-dimensional model for the Senate but by only 2.9 percent in the House. The increase in the second-dimension issues in the Senate dates from the late nineteenth century. For the period preceding the 52nd Congress (1891–93), the number of entries in the House table exactly equals that in the Senate table. Some of the increase in the Senate may reflect the absence there of closed rules and an agenda that is correspondingly more open than in the House. On the other hand, a very large number of entries in the Senate concern civil rights and voting rights during the time of the three-party system, with 11 entries in these categories, as against only one in the House. This almost certainly reflects the fact that the Senate was the body in which southern legislators, using the filibuster, sought to block legislation that occasioned much less debate in the House, where it enjoyed broad majority support. Thus, on the whole, race-related matters—slavery in the nineteenth century and civil rights in the twentieth—

Table 3.2 Second-Dimension Issues in the House

Congress	No. of Votes	*APRE1*	*APRE2*	*APRE2 − APRE1*	Issue
2	17	.394	.643	.249	Ratio of representatives to population
9	*13*	*−.006*	*.260*	*.266*	*Slavery*
14	*18*	*.130*	*.349*	*.219*	*Tariffs*
16	10	.430	.647	.217	Tariffs
17	*15*	*.063*	*.395*	*.332*	*Public works*
18	*10*	*.167*	*.691*	*.524*	*Public works*
19	13	.326	.578	.252	Public works
20	39	.363	.588	.225	Public works
22	18	.237	.511	.273	Military pensions/ veterans benefits
23	41	.213	.579	.367	Public works
24	*23*	*.072*	*.587*	*.515*	*Public works*
25	39	.495	.731	.237	Slavery
	30	.309	.595	.286	Public works
26	27	.490	.695	.205	Slavery
27	*20*	*.022*	*.335*	*.313*	*Election of House officers*
28	44	.433	.719	.286	Slavery
30	29	.324	.793	.469	Slavery
31	26	.357	.678	.320	Slavery
32	111	.215	.439	.225	Public lands
	14	.279	.495	.216	Slavery
33	*65*	*.164*	*.370*	*.206*	*Public lands*
	75	.238	.524	.286	Public works
39	*20*	*.156*	*.368*	*.211*	*Banking and finance*
41	49	.225	.445	.220	Public lands
43	*14*	*.026*	*.248*	*.222*	*Congressional pay and benefits*
	30	*.156*	*.376*	*.220*	*U.S. currency*
44	18	.440	.682	.242	U.S. currency
45	15	.368	.672	.304	U.S. currency
52	29	.375	.638	.262	U.S. currency
53	41	.372	.742	.370	U.S. currency
62	*10*	*−.016*	*.365*	*.381*	*Immigration/naturalization*
66	*18*	*−.024*	*.437*	*.461*	*Temperance and liquor*
69	11	.222	.480	.259	Agriculture
81	10	.484	.692	.208	Union regulation/ Davis-Bacon
82	11	.429	.633	.204	Price controls
89	22	.527	.757	.230	Civil rights/ desegregation/busing
91	*12*	*.171*	*.409*	*.238*	*Agriculture*
92	16	.314	.557	.244	Agriculture
93	*32*	*.136*	*.459*	*.322*	*Agriculture*
96	*20*	*.141*	*.359*	*.218*	*Public works*
97	14	.109	.380	.271	Public works

Note: This table shows only those Congresses with an issue area in which there were at least 10 roll calls with a gain in *APRE* of at least 0.2 from adding the second dimension. Issue areas for which *APRE1* is less than 0.2 are indicated in italics.

Table 3.3 Second-Dimension Issues in the Senate

Congress	No. of Votes	*APRE1*	*APRE2*	*APRE2 − APRE1*	Issue
1	27	.286	.641	.355	Banking and finance
2	20	.313	.656	.344	Ratio of representatives to population
14	12	.397	.675	.278	Military pensions/veterans' benefits
17	*18*	*.045*	*.270*	*.225*	*Public lands*
18	57	.375	.580	.205	Tariffs
18	*13*	*.097*	*.531*	*.434*	*Public works*
19	18	.394	.643	.249	Public works
20	16	.235	.562	.327	Public lands
	20	.410	.686	.276	Public works
23	14	.222	.676	.454	Public works
24	*42*	*.119*	*.415*	*.296*	*Public works*
30	14	.265	.475	.210	Impeachments and investigations
	12	.331	.799	.468	Slavery
31	*49*	*.181*	*.437*	*.256*	*Public lands*
	77	.379	.774	.395	Slavery
	12	*−.068*	*.233*	*.301*	*Treaties*
32	29	.235	.454	.219	Public lands
33	73	.220	.432	.213	Public lands
40	*11*	*.073*	*.318*	*.245*	*Public lands*
	11	*.055*	*.411*	*.356*	*Public works*
41	*12*	*.163*	*.378*	*.215*	*Supreme court*
	19	*.056*	*.375*	*.319*	*U.S. currency*
43	*20*	*.083*	*.576*	*.493*	*Banking and finance*
	30	*.190*	*.453*	*.263*	*Public works*
	46	*.055*	*.712*	*.657*	*U.S. currency*
45	11	.256	.604	.348	Banking and finance
	37	*.180*	*.639*	*.459*	*U.S. currency*
47	10	.251	.536	.285	Public lands
52	17	.290	.804	.515	Banking and finance
	16	.328	.856	.527	U.S. currency
	10	*.078*	*.278*	*.200*	*Judiciary*
53	*49*	*.157*	*.765*	*.609*	*Banking and finance*
	52	*.180*	*.758*	*.578*	*U.S. currency*
62	14	.218	.491	.273	Agriculture
	21	.205	.522	.317	Tariffs
63	18	.228	.526	.298	Judiciary
	27	.280	.549	.269	Interstate commerce/antitrust
65	*41*	*.128*	*.569*	*.441*	*Tax rates*
	16	.301	.533	.232	Banking and finance
	27	*.028*	*.274*	*.246*	*Temperance and liquor*
	116	*.172*	*.445*	*.273*	*World War I*
66	*11*	*.133*	*.464*	*.330*	*Interstate commerce/antitrust*
71	*10*	*.120*	*.536*	*.416*	*Tax rates*
	33	.297	.501	.204	Agriculture
73	12	.215	.508	.293	Tax rates
	17	.365	.619	.254	Banking and finance
	14	.504	.711	.206	Tariffs
	10	*.152*	*.388*	*.236*	*Public works*
74	*11*	*.126*	*.378*	*.252*	*Military pensions/veterans' benefits*

Table 3.3 *(continued)*

Congress	No. of Votes	*APRE1*	*APRE2*	*APRE2 − APRE1*	Issue
77	*14*	*.152*	*.421*	*.269*	*Agriculture*
81	*10*	*.128*	*.583*	*.455*	*Civil rights/desegregation/busing*
86	16	.306	.579	.273	Civil rights/desegregation/busing
87	10	.221	.687	.466	Civil rights/desegregation/busing
	24	.381	.614	.233	Education
88	13	.282	.520	.239	Tax rates
	59	*.158*	*.779*	*.621*	*Civil rights/desegregation/busing*
	10	.429	.717	.289	Impeachments and investigations
	25	.255	.661	.407	Education
	13	.340	.616	.275	Campaign contributions/ethics/lobbying
	16	.226	.776	.551	Workplace conditions/8-hour day
	13	*.066*	*.789*	*.723*	*Judiciary*
90	23	.380	.682	.303	Civil rights/desegregation/busing
	10	.369	.578	.208	Campaign contributions/ethics/lobbying
	13	.314	.514	.200	Interstate commerce/antitrust
	17	.305	.617	.312	Housing/housing programs/rent control
91	16	.485	.770	.285	Civil rights/desegregation/busing
	18	.392	.627	.235	Education
92	44	.395	.612	.217	Tax rates
	47	.402	.713	.311	Civil rights/desegregation/busing
	38	.376	.657	.280	Education
	27	.460	.764	.304	Campaign contributions/ethics/lobbying
	20	.562	.785	.223	Judiciary
94	21	.555	.771	.216	Civil rights/desegregation/busing
	28	.543	.861	.318	Disputed elections to congress
	22	.521	.740	.219	Voting rights
96	15	.473	.692	.219	Civil rights/desegregation/busing
97	19	.399	.675	.276	Civil rights/desegregation/busing
98	12	.219	.475	.256	Debt ceilings

Note: This table shows only Congresses with an issue area in which there were at least 10 roll calls with a gain in *APRE* of at least 0.2 from adding the second dimension. Issue areas for which *APRE1* is less than 0.2 are indicated in italics.

predominate among the issues where the second dimension results in a big gain in the *APRE*. This observation supports our view that a one-dimensional model typically provides a good fit to the data, with a second dimension being needed in periods when race issues are distinct from economic ones.[22]

The Dimensionality of Congressional Voting

Since low dimensionality is an important and, to many, an unexpected, empirical result, we will discuss a variety of sets of supporting evidence for it, including two sets of quite technical evidence. In appendix B, we ask whether the true dimensionality of roll call voting can be determined. The answer is a *qualified* yes. We offer evidence that it is extremely unlikely that there are more than three—and, in most Congresses, no more than two—dimensions of voting. Also in appendix B, we compare our ability to classify with a one-dimensional model with what might be expected if legislators and roll calls were distributed within a multidimensional sphere and if there were perfect voting in this higher-dimensional space. We show that our empirical results are very unlikely to have been generated by "perfect" voting in a high-dimensional (that is, more than two) voting space.

In this section, we discuss four sets of less technical evidence. First, restricting ourselves to three Houses, we show the increments in the percentage classified correctly when W-NOMINATE is estimated with as many as 15 dimensions. Second, we evaluate the classification ability of the second dimension from the dynamic, two-dimensional model, with linear-trend estimation, and compare this to the first dimension. Third, we show that the results of W-NOMINATE are reasonably stable when the algorithm is applied to subsets of roll calls that have been defined by substantive content. Fourth, since dimensionality may depend on the agenda, we compare the model's performance with measures of the diversity of the agenda.

What Happens When a High-Dimensional Model Is Estimated?

To check the dimensionality of our dynamic models, we selected three Houses and estimated the constant or *static* model (to distinguish it from our various dynamic estimations on multiple Congresses) up to 15 dimensions. We chose the 32nd House (1851–52), the 85th House (1957–58), and the 97th House (1981–82) for our high-dimensional analyses. The 32nd is one of the worst-fitting Houses in two dimensions and thus a good candidate to exhibit high dimensionality. The 85th House represents the post–World War II civil-rights era, when the two-dimensional linear model clearly dominates the one-dimensional linear model.[23] The 97th House is included because it appears that roll call voting became nearly unidimensional by the 1980s.

Figure 3.6 displays the classification gains for the second through the fifteenth dimensions for each of the three Houses. The classification percentage for the first dimension was 70.3 for the 32nd House, 79.0 for the 85th, and 84.6 for the 97th. The lines in the figure indicate how much the corresponding dimension adds to the total of correctly classified. Note that the lines do not drop off smoothly because, as we explained in chapter 2, W-NOMINATE is maximizing log-likelihood, not classification.

The 97th House is, at most, two-dimensional, with the second dimension being very weak. After two dimensions, the added classification gains are minuscule, for there is a clear pattern of noise fitting beyond two dimensions. Even though, in contrast to the 97th, the 85th House is strongly two-dimensional, there is little evidence of classification gains from the addition of dimensions. The 32nd does show evidence of gains for up to four dimensions, but even four dimensions account for only 80 percent of the decisions, and ten, for only 85 percent.

The results for the 32nd House carry over to our other period of "spatial collapse," the Era of Good Feelings. Classification on the first dimension is 70 percent for the 17th House and reaches only 80 percent in four dimensions and 88 in ten. These results show that either voting is accounted for by a low-dimensional spatial model, or it is, in effect, spatially chaotic. There appears to be no middle ground. In other words, there is never a period in American history in which, if we do not obtain a good fit with a one- or two-dimensional model, we can obtain a good fit with a three- or four-dimensional model.

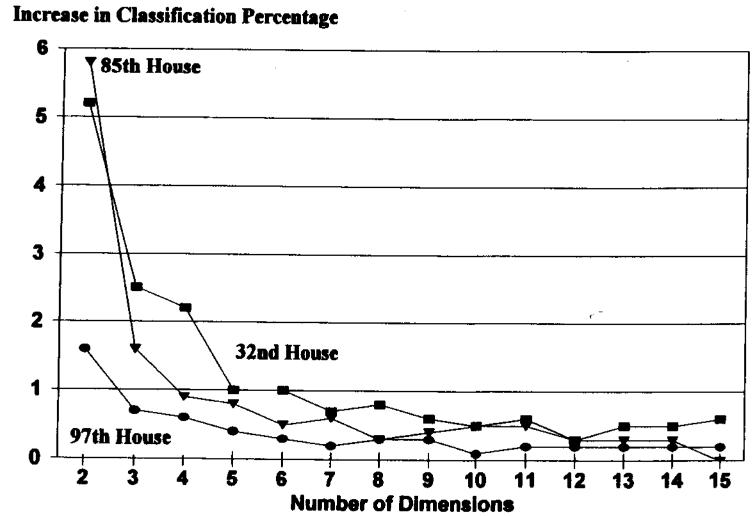


Figure 3.6. Classification gains from adding dimensions for three Houses. The lines plot the increase that occurs in the classification percentage as dimensions are added. The 97th House (1981–82) shows a strong one-dimensional result, to which additional dimensions add very little. The 85th House (1957–58) was elected during the period of the three-party system and shows a substantial gain from adding a second dimension. The "chaotic" 32nd House (1851–52) shows gains but the overall level of classification remains low. Additional dimensions are largely fitting "noise" in the data. The results are from W-NOMINATE.

The Relative Importance of the Second Dimension

Although the evidence presented above suggests a marginal role for (at most) a second dimension—and a weak one at that—it is important to evaluate the second dimension by other than its marginal impact. Specifically, Koford (1989, 1991) argues that a one-dimensional model will provide a good fit even when spaces have higher levels of dimensionality. For example, in a truly two-dimensional space, one dimension will have some success at classifying any vote that is not strictly orthogonal to the dimension. As a result, the marginal increases in fit, on the order of 3 percent, may understate the importance of the second dimension.

The natural question, then, is, How well does the second dimension do in classifying by itself? To study this problem, we took the second-dimension legislator coordinates from our preferred model—two dimensions with a linear trend—and, for each roll call, found a cutpoint that minimized classification errors. We used the minimum number of errors to compute classification percentages. We made the same computation for the first dimension.

The results of these computations for the House are shown in figure 3.7. The average percentage classification for the first 100 Houses, using the first dimension, is 84.3 percent; but the second dimension accounts for only 70.8 percent. The 70.8 per-

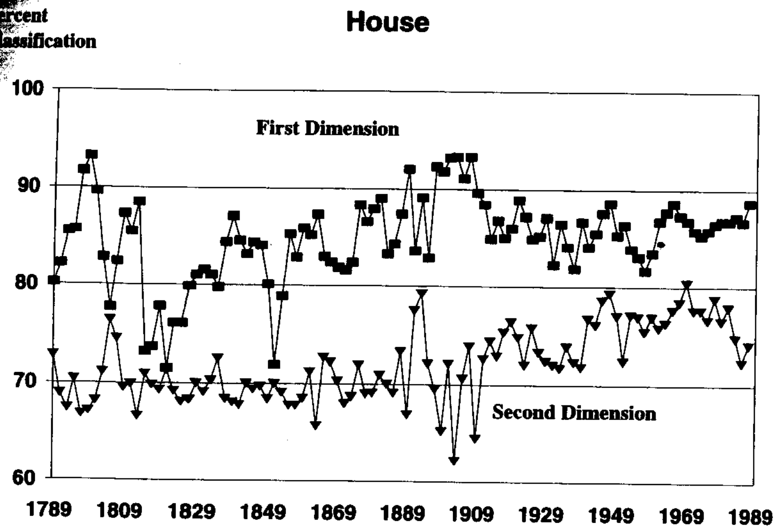


Figure 3.7. Classification on the first and second dimension. These graphs show the results when roll calls are placed to minimize classification errors, while keeping the D-NOMINATE legislator coordinates fixed. The first-dimension coordinates almost always classify at a rate of 80 percent or better. The second dimension barely betters the benchmark model of the percentage vote on the winning side.

cent is particularly unimpressive if we consider that predicting by the marginals would lead to a 66.7 percent classification. If the two dimensions were indeed of equal importance, then in some Congresses, dimension two might do better than dimension one. But in all 100 Houses, the first dimension did best (although the difference between the two was slim in the 17th House). The Senate results are a tad weaker—83.8 percent for dimension one versus 73.6 percent for two. The marginals here led to a 66.1 percent classification. In addition, dimension two does better in Senates 2, 17, and 18. But the second dimension is clearly a second fiddle.

Our overwhelming results that show that the first dimension dwarfs the second and higher dimensions convinced even Koford (1991), who admitted that his first analysis was incorrect. At the same time, however, he claimed that we would find gains from higher dimensionality if we, unparsimoniously, allowed a variation in the salience the legislators place on the dimensions. That is, legislators, in addition to having ideal points, would also be assigned weights on each dimension. Their squared distances to roll call alternatives would then be computed as a weighted sum of the dimensions.[24] But we were also able to show (Poole and Rosenthal, 1994b) that allowing for variable salience would not result in a high-dimensional model that yielded important gains in classification over a low-dimensional, constant-salience model.

Do Different Issues Give Different Scales?

In contrast to our emphasis on low dimensionality, Clausen (1973) has argued that there are five "dimensions" to congressional voting, represented by the issue areas of

government management, social welfare, agriculture, civil liberties, and foreign and defense policy. We have coded every House and Senate roll call, from 1789 to 1988, according to these five categories; for completeness, we added a sixth category, termed "miscellaneous" (see appendix C). If the issues are really distinct dimensions, we ought to get sharp differences in legislator coordinates when the issues are scaled separately.

To conduct this experiment with separate scalings, we chose the 95th House because it had the largest number of roll call votes (1,540). There were 714 government-management votes; 286 social-welfare votes; 311 foreign-and-defense-policy votes; and, to have enough votes for scaling, 229 in a residual set that combined agriculture, civil liberties, and miscellaneous issues. We then ran one- and two-dimensional (static) W-NOMINATE procedures on each of these four clusters of votes. Because it is difficult to directly compare coordinates from two-dimensional scalings, we based our comparisons on correlations between all unique pairwise distances among legislators. (If there are N legislators, there are $N(N - 1)/2$ unique pairs of legislators.)

Correlations between the management, welfare, and residual categories for one-dimensional scalings are, as shown in table 3.4, all high, around 0.9. Correlations between the foreign-and-defense-policy category and the other three categories were somewhat lower, in the 0.7 to 0.8 range.[25] As a whole, the results hardly suggest that each of these clusterings of substantive issues generates a separate spatial dimension.

When the same subsets of votes are scaled separately in two dimensions, the correlations between categories are somewhat lower than they are in one dimension (see table 3.4). This result is not surprising: The 95th House had nearly unidimensional voting. From the D-NOMINATE unidimensional scaling with a linear trend that was applied to the whole data set, we find one-dimensional correct classifications for 83 percent of the votes in each of the four categories. With two dimensions, the percentage of correct classifications increases only to 84 percent for social welfare and for foreign and defense policy, and to 85 percent for the other two categories.[26]

Moving from one dimension to two doubles the number of estimated parameters, with only slight increases occurring in classification ability. In breaking down the roll calls into four categories and estimating each separately, the number of legislator parameters is effectively quadrupled. With a further doubling of all parameters—in moving from one dimension to two—one is likely to be fitting idiosyncratic noise in the data. The fit to the noise weakens the underlying strong correlations between leg-

Table 3.4 Interpoint Distance Correlations, the Clausen Category Scalings, 95th House

	Correlations			
Clausen Category	(1)	(2)	(3)	(4)
(1) Government management	1.0	.914[a]	.796	.908
(2) Social welfare	.883[b]	1.0	.765	.881
(3) Foreign and defense policy	.770	.654	1.0	.724
(4) Miscellaneous policy, civil liberties, and agriculture	.832	.746	.613	1.0

[a]Numbers above diagonal are correlations from one-dimensional scalings.
[b]Numbers below diagonal are correlations from two-dimensional scalings.

islator positions. We also note that the spirit of Clausen's work suggests that each category should be scaled in only one dimension. In summary, our breakdown of the 95th House by use of Clausen categories indicates that the categories represent highly related, not distinct, dimensions.

The Agenda and Dimensionality

Macdonald and Rabinowitz (1987) argue that American political conflict is basically one-dimensional within the time span of any one Congress, but that the dimension of conflict evolves slowly. One basis for the Macdonald-Rabinowitz argument would be that short-term coalition arrangements enforce a logroll across issues that generates voting patterns consistent with a unidimensional spatial model. Another potential consideration is that short-run unidimensionality may reflect the fact that, in any two-year period, Congress must place some restrictions on the issues that can be given time for consideration.

An explanation related to that of Macdonald and Rabinowitz is a selection-bias argument that was originally made by Van Doren (1990) and developed, in the context of a simple formal model, by Snyder (1992b). Van Doren's basic idea is that only a small fraction of the potential issues ever get voted on, either because they are supported by only a small fraction of the membership or because, even if there is widespread support, an issue is screened from roll call voting by committees. Snyder formalized the role of committees in a simple model where committees had gatekeeping power.[27] If there were more voting, the story goes, there would be more dimensions uncovered by scaling techniques.

The selection-bias story is logically correct but empirically irrelevant. One important observation is that our low-dimensionality result applies not only to the House, but also to the Senate, where gatekeeping is less prevalent. Another is that certain legislation, particularly in regard to appropriations, must be considered annually and cannot be screened. Indeed, a very diverse set of issues gets voted on, even in a relatively small portion of the time that Congress is in session. Consider the three-month period between January 10, 1967, and April 10, 1967, during the 90th Congress, one of the textbook Congresses that inspired the new institutionalism's emphasis on committee jurisdictions and rules (Shepsle and Weingast, 1994), including gatekeeping powers. How winnowed were the issues? During this period, contested votes (over 2.5 percent on the minority side) in the House of Representatives were taken on the following issues:

1. The seating of Adam Clayton Powell, Jr.
2. The debt ceiling
3. Foreign travel by members of the Agriculture Committee
4. The Vietnam War
5. Emergency food assistance to India
6. The interest-equalization tax
7. The establishment of a National Holiday Commission
8. Appropriations for the Trust Territory of the Pacific Islands
9. Appropriations for various cabinet-level departments
10. The Alliance for Progress

11. The size of the staff for the Committee on Science and Astronautics
12. Funds for the House Un-American Activities Committee
13. The copyright law

Winnowing may have occurred, but the range of substantive issues voted on remains vast. If one were to consider the entire length of the 90th House, a much wider variety of issues would appear. Clearly, the breadth of issues is sufficient to manifest high dimensionality.

To make our observation for the 90th House more systematic, at least in a crude way, we computed, for each of the 100 Houses and Senates, the Herfindahl concentration index[28] for the six Clausen categories. The lower the degree of concentration, the more diverse the agenda. The observation that the index is related to trend (the correlation [R] is −0.46 for the House and −0.53 for the Senate) suggests that the congressional agenda has become more diverse as government has expanded. The index is significantly correlated with the geometric mean probabilities from the two-dimensional, linear-trend model, but in a counterhypothesis direction for the House (R = −0.310). The results for the Senate are quite weak (R = 0.145), but in the correct direction. For the House, as the roll call set becomes more diverse, the model fits better. The House result is undoubtedly a spurious one. The worst-fitting years occur early in the time series, but the agenda has become more diverse over time. Indeed, diversity of the agenda, at least as measured by this index, is not significantly related to the ability (the difference in geometric mean probabilities) of the two-dimensional model to improve over the one-dimensional linear model (R = −0.062 for the House and −0.049 for the Senate, respectively).

One reason for these generally negative results for the diversity hypothesis is that the index has exhibited little variation. For Congresses 40 to 100, the index averaged 0.347, with a standard deviation of 0.061, in the House and averaged 0.361, with a standard deviation of 0.166, in the Senate. In the last 120 years, Congress has had a full and wide-ranging agenda, so low-dimensional voting did not occur simply because votes were restricted to a narrow topical area.

In a nutshell, the roll call voting agenda of Congress is always a cornucopia of diverse issues, even if many issues are screened from the agenda. This diversity notwithstanding, to the extent that spatial models are useful in describing the roll call voting data, only low-dimensional models are needed.

Summary

Congressional roll call voting, throughout most of American history, has had a simple structure. A two-dimensional spatial model that allows for a linear time trend accounts for most of the roll call voting. The primary dimension is concerned with political party, whereas the second dimension picks up issues that split the two major parties. Race has indeed been the most important issue dividing the political parties internally.

We now turn to an examination of the temporal stability of individual legislator positions; the changes in position that are brought about by the replacement of legislators; and the polarization of the parties within each of the political-party systems.