NOMINATE: A Short Intellectual History

by

Keith T. Poole

When John Londregan asked me to write something for *TPM* about NOMINATE and "why we (Howard Rosenthal and I) went high tech" rather than using simpler descriptions of roll call data, I was puzzled for some time on how to explain why we did what we did. The problem is that my whole career has been devoted to testing a "high-tech" spatial theory so of necessity the methods I have employed over the years have been complicated. However, in the spirit of John's request, I will give a short intellectual history of how and why Howard and I developed NOMINATE in the form we did.

Almost all of my published work has been concerned with the measurement of ideology. In graduate school at the University of Rochester in the early 1970s I read both Converse (1964) and Riker and Ordeshook (1973) and came away convinced that the correct way to measure ideology or Conversian belief systems was through empirical estimation of spatial models of choice. The language of politics is full of spatial terms like left, right, and center, and it seemed to me that the spatial model was the ideal model of political choice.

In 1974 I took a course on scaling methods from Dick McKelvey and was struck by the fact that in the psychometrics literature on multidimensional scaling almost all the empirical applications resulted in low dimensional maps. For example, the experimental data on the perception of color and the perception of sound fit simple two-dimensional maps. The same was true of the early published work applying these methods to political

data – Duncan MacRae's (1958, 1970) pathbreaking work on Congressional roll calls using factor analysis, and the use of multidimensional scaling on feeling thermometers by Herb Weisberg and Jerrold Rusk (1970; 1972) and George Rabinowitz (1974).

I was puzzled how standard spatial theory could be reconciled with these empirical results. After all, standard spatial theory posited a multidimensional issue space with each issue having its own dimension. In 1976 I had an after dinner conversation with Peter Ordeshook at Dick McKelvey's house in Pittsburgh that resolved this puzzle for me. Peter told me his theory of the "Basic Space" – a small number of underlying fundamental dimensions that generate all the specific issue dimensions (see Ordeshook, 1976). (Mel Hinich was independently working on the same theory – see Hinich and Pollard, 1981, and for a comprehensive defense and discussion of the theory, see Hinich and Munger, 1994).

I was now convinced I had the right theory. Converse's belief system theory with its emphasis on "constraint" fit like a key into a lock with the Ordeshook-Hinich spatial theory of choice.

So in sum, in the late 1970s I had what I felt was the correct theory and my subsequent career has been devoted to figuring out ways to test it. In this regard, I view myself more as an *engineer* than a theorist or methodologist. My aim has been to construct *scaling machines* that extract basic spaces from data. My early work on interest group ratings epitomizes this (see my 1985 APSR piece).

During AY 1981-82 I was a Post-Doctoral fellow at Carnegie-Mellon University and had the very good fortune of linking up with Howard Rosenthal. Howard was also interested in ideology because of his in depth studies of French politics and he was also

very knowledgeable about spatial theory. In addition, Howard is a skilled methodologist and he convinced me that we ought to try modeling congressional roll call voting. Thus, NOMINATE was born 1982-83 (Howard invented the acronym – *NOMINA*l *T*hree-Step *E*stimation).

When we first started working together on modeling roll call voting, we took as a point of departure a simple scaling program I had developed at the University of Oregon in 1978. The program was called Edith (my wife's middle name) and it, in effect, does a simple Guttman-like scaling of roll calls. The rationale behind Edith is the following. Suppose voting in Congress is entirely driven by one basic dimension -- liberalism-conservatism – so that a legislator's degree of liberalism determines all his/her issue positions. Translated into standard spatial theory, members are arrayed from left to right on a single dimension, have symmetric utility functions centered at their ideal points, and when faced with a choice between the two alternatives corresponding to Yea and Nay on a roll call, they vote for the alternative closest to them on the dimension. Therefore, given the legislator ideal points, all roll call votes should look something like the following:

```
YYYYYYYYYYYYYYYYNNNNNNNNNNNNNNNNN
                              *
NNNYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
    *
YYYYYYYNNNNNNNNNNNNNNNNNNNNNNNNN
            *
                                    Etc.
```

The asterisks indicate the "cutting point" for the roll call; that is, the midpoint of the Yea and Nay outcomes. A legislator located exactly on the midpoint would be indifferent between voting Yea or voting Nay.

Suppose roll call voting is in accord with this model. Then the scaling problem consists of taking a roll call matrix and "unscrambling" it – that is, finding a rank ordering of legislators and the correct "polarity" (Yea to the left of the cutpoint or Yea to the right of the cutpoint) for each roll call such that patterns like those above are produced for each roll call. This is what Edith is designed to do. Interestingly, if the data is perfect, then the solution is easy and the correct rank ordering is always found.

However, when there is error in the data, things get a bit complicated. When there is error the aim is to find a rank ordering that maximizes the correct classification of the observed Yeas and Nays. This is easier said than done because if there are n legislators, then there are n!/2 possible rank orders to check to find the best one. For example, for 50 legislators this number is about $1.52 * 10^{64}$ – a formidable number even with modern supercomputers. Consequently, Edith embodies a "sensible" search procedure (what the Operations Researchers call a "Heuristic") to find a solution. Namely, a good starting rank order of the legislators is generated and the corresponding cutting points are found. These cutting points are used to get a new rank ordering of the legislators, and so on. At each step the correct classification increases until a rank order is found that produces cutting points that in return reproduce the rank order.

Howard and I thought Edith produced, on balance, reasonable one-dimensional rank orders. But we knew on substantive grounds that during the 60s and 70s (the period we studied first) that there were three loosely aligned voting blocs in Congress – Northern Democrats, Southern Democrats, and Republicans – and this strongly implied that we needed *two* basic dimensions to adequately account for roll call voting. In addition, Howard argued that *even if* voting was one dimensional, Edith treated all errors

exactly alike and this clearly did not make sense on substantive grounds. For example, Ted Kennedy defecting from his fellow liberals and voting with Jesse Helms seems to be a bigger error than a moderate like John Heinz defecting from his fellow moderates and voting with Jesse Helms.

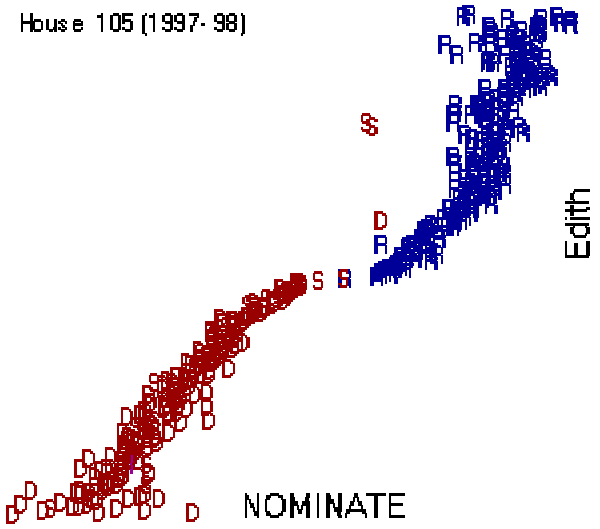
Our solution was to go "high tech" in that we transferred a standard decision model from economics to a legislative setting. In this model legislators have utility functions and they vote for the alternative on a roll call for which they have the highest utility. This utility function consists of (1) a *deterministic* component that is a function of the distance between the legislator and a roll call outcome in the basic space; and (2) a *stochastic* component that represents the idiosyncratic component of utility.

We assumed that the stochastic component was a random draw from the logit distribution. Given these random draws, we could then calculate the probabilities of each legislator voting Yea or Nay. Therefore, given a matrix of roll calls the problem is to estimate legislator ideal points and roll call outcomes that maximize the joint probability of the observed votes. That is what NOMINATE was designed to do.

The big advantage of the NOMINATE model over Edith is in its ability to address Howard's point about the errors. If a legislator votes completely at random, that is, deciding to vote Yea or Nay on the basis of a coin flip, then Edith will almost certainly put that legislator at one of the ends of the dimension while NOMINATE will put the legislator near the center of the dimension. To maximize classification, putting the random legislator at the end guarantees about 50 percent correct classification. It is highly unlikely that an interior point will do better and if it does, the interior point is almost certainly near the end of the dimension. In NOMINATE, because the

probabilities are functions of the legislator's distances to the outcomes, putting the random legislator at one of the ends of the dimension will produce a mix of small and large probabilities and the joint probability will be lower than placing the legislator near the center of the space where all the probabilities will be nearer to .5.

Consequently, the two methods will differ in their placement of maverick legislators like former Senator William Proxmire (D-WI) who vote with the liberal position on some issues and the conservative position on other issues. For example, the figure below shows a cross plot of the NOMINATE one-dimensional coordinates (horizontal dimension) against the rank ordering from Edith (vertical dimension) for the 105th House (D denotes Northern Democrat, S Southern Democrat, and R Republican).



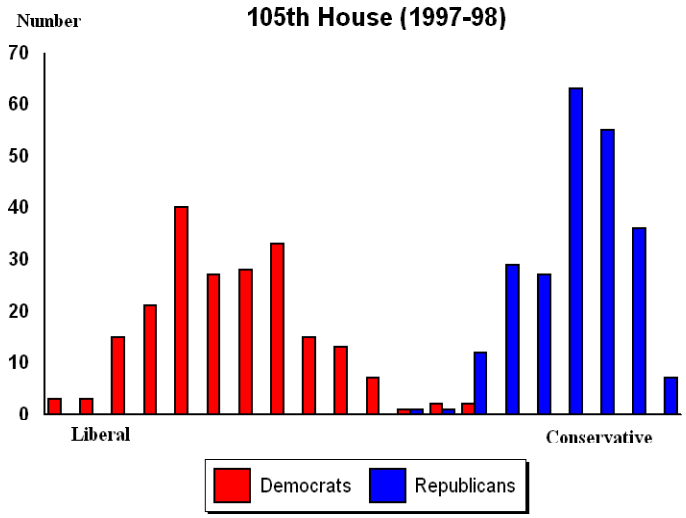
Although the correlation between the two measures is .96, note the slight "flaring" at the ends of the plot and a small number of outliers in the center. The flaring is due to a handful of representatives that Edith is placing near the ends of the dimension while NOMINATE is recovering them more to the interior. A good example of this is Dennis Kucinich (D-OH) the controversial former mayor of Cleveland (1977-79). (Kucinich is

the right-most "D" at the bottom of the plot.) As a member of Congress he has been strongly pro-labor and takes populist positions on economic issues. However, he is strongly opposed to abortion and votes with the Republican majority for the anti-abortion position at every opportunity. Consequently, his fit is low in both scalings – 77.6 percent correctly classified in Edith compared to the overall correct classification of 89.8, and in NOMINATE a geometric mean probability of .616 compared to an overall gmp of .756 (the NOMINATE classifications are 75.6 and 88.1 percent, respectively). His NOMINATE score is -.35 (on a –1.0 to +1.0 scale) and he ranks 3 of 438 (that is, he is 3rd most liberal) in the Edith scaling.

Although no placement of Kucinich is entirely satisfactory given the current issue positions of most liberals and conservatives, I believe that placing Kucinich at a center-left position as NOMINATE does is better than placing him at the far-left. Center-Left legislators who fit the basic space model *sometimes* vote with conservative legislators on economic *and* social issues but far-left legislator who fit the basic space model *always* vote the liberal position on *all* issues. The former strikes me as being closer to Kucinich's actual behavior than the latter.

Both Edith and NOMINATE embody the basic space theory in one dimension. In my judgement, NOMINATE is superior because of the way voting errors are weighted. Unfortunately, this weighting can only be done by "going high tech" and introducing complexity. Complexity has a price. Edith is easier to explain to people and the computer code is simpler to implement. But complexity also has benefits. It produces better *substantive* interpretations of politics. For example, here is a histogram of the NOMINATE scores for the 105th House. The distribution of the scores is bimodal with

hardly any overlap of the two parties. In contrast, a histogram of the NOMINATE scores for any House in the 1970s would show considerable overlap of the two parties. This polarization of the political parties has been steadily increasing since the mid 1960s (Poole and Rosenthal, 1984; McCarty, Poole, and Rosenthal, 1997; King, 1998).



The bulk of our book – *Congress: A Political-Economic History of Roll Call Voting* – is devoted to showing that important episodes in American political and economic history can be better understood by supplementing and/or reinterpreting more traditional analyses with the basic space theory of ideology as measured by the NOMINATE scores. This is no accident. This was our goal from the beginning. NOMINATE was never an end in itself. We believed we had the right theory and we set out to build an "instrument" to test it.

I have confined my remarks to one aspect of the error in the one dimensional basic space model. In reality, Howard and I had to push the complexity of NOMINATE to the point that we were working with a dynamic multidimensional model (D-NOMINATE) which required a supercomputer to perform the estimation. We could only

study our results by turning them into animations that we could then view on videotape (these can now be viewed on our website – http://k7moa.gsia.cmu.edu or http://voteview.gsia.cmu.edu -- in the form of animated gifs). These videotapes were the culmination of our efforts. The animations are relatively easy to understand and interpret despite the tremendous complexity of the theory and the computer programming that produced them. This simplicity of understanding of political events over time would have been impossible without our "going high-tech".

References

Converse, Philip E. (1964). "The Nature of Belief Systems in Mass Publics." In David E. Apter, ed., *Ideology and Discontent*. New York: Free Press.

Hinich, Melvin J. and Walker Pollard (1981). "A New Approach to the Spatial Theory of Electoral Competition." *American Journal of Political Science*, 25:323-41.

Hinich, Melvin J. and Michael Munger (1994). *Ideology and the Theory of Political Choice*. Ann Arbor, Mich.: University of Michigan Press.

King, David C. (1998). "Party Competition and Polarization in American Politics." Paper presented at the 1998 Annual Meeting of the Midwest Political Science Association, Chicago, Illinois.

MacRae, Duncan (1958). *Dimensions of Congressional Voting*. Berkeley: University of California Press.

MacRae, Duncan (1970). *Issues and Parties in Legislative Voting*. New York: Harper and Row.

McCarty, Nolan M., Keith T. Poole, and Howard Rosenthal (1997). *Income Redistribution and the Realignment of American Politics*. Washington, D.C.: AEI Press.

Ordeshook, Peter C. (1976). "The Spatial Theory of Elections: A Review and a Critique." In Ian Budge, Ivor Crewe, and Dennis Farlie, eds., *Party Identification and Beyond*. New York: Wiley.

Poole, Keith T. and R. Steven Daniels (1985). "Ideology, Party, and Voting in the U.S. Congress, 1959-80." *American Political Science Review*, 79:373-99.

Poole, Keith T. and Howard Rosenthal (1984). "The Polarization of American Politics." *Journal of Politics*, 46:1061-1079.

Poole, Keith T. and Howard Rosenthal (1997). *Congress: A Political-Economic History of Roll Call Voting*. New York: Oxford University Press.

Rabinowitz, George (1974). *Spatial Models of Electoral Choice: An Empirical Analysis*. Chapel Hill, N.C.: Institute for Research in Social Science.

Riker, William H. and Peter C. Ordeshook (1973). *An Introduction to Positive Political Theory*. Englewood Cliffs, NJ: Prentice Hall.

Rusk, Jerrold and Herbert Weisberg. (1972). "Perceptions of Presidential Candidates." *Midwest Journal of Political Science*, 16:388-410.

Weisberg, Herbert F. and Jerrold Rusk (1970). "Dimensions of Candidate Evaluation." *American Political Science Review*, 64:1167-85.