# *An Empirical Evaluation of Alternative Spatial Models of Elections*

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In Enelow and Hinich (1982, 1984a), the spatial theory of elections is augmented to incorporate nonspatial candidate characteristics in the voter's candidate evaluations. In this extension, nonpolicy characteristics are represented by an additive term independent of the policy portion of the voter's evaluation. In Grofman (1985), an interactive voting model is introduced, in which nonpolicy characteristics affect the voter's evaluation of the candidate only through the candidate's policy positions. An empirical question is raised by these two contrasting approaches: do nonpolicy candidate qualities affect voter choice independently of candidate policies, interactively with candidate policies, or through both means?

This paper is designed to answer that question. An extended form of the Enelow-Hinich model is specified with both main and interaction terms. The model is then used to predict voter choice in the 1972, 1976, and 1980 presidential elections. Statistical evidence for the existence of interaction effects is present in each election. But the importance of these effects for predicting voter choice is statistically nonsignificant. The simple additive Enelow-Hinich model is unsurpassed by an expanded form of the model with interaction effects or by Grofman's interactive model which excludes main effects, and is usually better than two simpler models that exclude either policy or nonpolicy variables.

In the classical spatial model of elections (Davis, Hinich, and Ordeshook, 1970), candidates are represented by their policy positions on the issues of the campaign. Voters evaluate candidates by comparing these positions to their own, with each voter casting his vote for the candidate closest to him. It is obvious that some voters base their candidate evaluations on more than just policies. The electoral space postulated by spatial theory

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encompasses more than just policies. Still, it is difficult to interpret candidate attributes such as competence or honesty as dimensions in this space. To get around this problem, Enelow and Hinich (1982, 1984a) incorporate nonpolicy candidate characteristics into the spatial model as a nonspatial component of the voter's overall candidate evaluation. In this extension, nonpolicy characteristics are represented by an additive term whose effects are independent of the policy portion of the voter's evaluation.

In a recent paper (Grofman, 1985), an alternative spatial model is proposed that postulates a multiplicative relationship between a candidate's policy and nonpolicy attributes. Briefly stated, this second model views a candidate's policy position as a promise to continue or alter the status quo policy. For a policy position other than the status quo, a competence weight is used to adjust the candidate's position to some point between the status quo policy (for a totally incompetent candidate) and the promised policy (for a totally competent candidate).

While theoretically intriguing, Grofman's model begs the empirical question of whether nonpolicy candidate characteristics work additively and/or interactively (nonlinearly) with candidate policy characteristics in forming the voter's overall evaluation of candidate differences. It is the purpose of this paper to explore the interaction of policy and nonpolicy factors from a general standpoint. Grofman's model can be seen from a statistical point of view as an interactive model which omits any main effects that policy and nonpolicy characteristics might have on the vote. To remedy this omission, we test the predictive and classification properties of the general form of the spatial model specified in Enelow and Hinich (1982, 1984a), allowing for a test of multiplicative interactions between each policy and nonpolicy variable. This test is accomplished using survey data from the 1972, 1976, and 1980 National Election Studies.

The results of these tests indicate that certain interactions are statistically significant in each of these three elections, but that from the standpoint of classifying voters by candidate choice, the simple additive model specified in Enelow and Hinich (1982, 1984a) is unsurpassed by a more complex form of the model with interaction terms and is usually better than two simpler forms of the spatial model, omiting either policy or nonpolicy variables. Further, Grofman's interactive model does not classify voters by candidate choice better than the simple additive model.

For all the seeming generality of interactive effects, models that postulate such effects between policy and nonpolicy factors may offer no improvements with respect to classifying voters, over the simple additive model of Enelow and Hinich. These empirical results, coupled with the theoretical characteristics of the Enelow and Hinich model (Enelow and Hinich, 1982, 1984a, 1984b), enhance the attractiveness of the model as a tool for understanding elections.

## MODEL AND METHODOLOGY

The augmented spatial model of Enelow and Hinich (1982, 1984a) postulates that voter i prefers candidate R to candidate D, if and only if

$$e_{iD} - e_{iR} < (D_i - x_i)^T A_i (D_i - x_i) - (R_i - x_i)^T A_i (R_i - x_i) \quad (1).$$

Defining terms, $e_{iD}$ is voter i's valuation of the nonpolicy characteristics of candidate D, $D_i$ is a vector representing i's perception of D's policy positions, $x_i$ is a vector of i's most preferred positions on these same policies, and $A_i$ is a matrix of weights that reflects the salience of the policy issues to voter i as well as any trade-offs that exist for him between any pair of issues. The R terms are defined identically for candidate R. T denotes transpose.

The preference model expressed by inequality (1) is based on a quadratic voter utility function, with the voter's utility for a candidate's nonpolicy characteristics represented by a single additive term, e, and his utility for the candidate's policy characteristics represented (negatively) by the weighted, squared Euclidean distance between the voter and the candidate in a space whose dimensions correspond to the policy issues of the campaign.

In Enelow and Hinich (1985), the left-hand side of inequality (1) is modeled as a normally distributed random variable to reflect the diversity of views among voters about the difference between the nonpolicy values of two candidates. It is then possible to view this unobserved continuous random variable as exhibiting two observed values: voter preference for candidate D over R or candidate R over D. Dichotomous probit analysis then permits the estimation of the mean of the underlying variable (the nonpolicy bias for one candidate over the other) as well as the salience of each issue for the group of voters being analyzed. All estimates are measured in standard deviation units of the unobserved variable. If there are two separable policy issues, then the probit model specifies that the probability that voter i prefers candidate R to candidate D is

$$F\{-m + a_{i1}[(D_{i1} - x_{i1})^2 - (R_{i1} - x_{i1})^2] + a_{i2}[(D_{i2} - x_{i2})^2 - (R_{i2} - x_{i2})^2]\} \quad (2).$$

F is the standard normal distribution function, m is the mean of the underlying dependent variable, and the two independent variables are the differences in squared distance between i and each of the two candidates on policy issues 1 and 2.

This paper takes the preceding analysis two steps further. First, we introduce an explicit nonpolicy variable to represent a portion of the nonpolicy bias between the two candidates; and, second, we include interaction terms to measure the combined effect of each policy and nonpolicy variable. Including an explicit nonpolicy variable gives us a direct measure of some of the nonpolicy influence on relative candidate

evaluations (the rest being captured by the estimate of the constant term). Including interaction variables for all policy-nonpolicy variable pairs allows us to test for the existence of combined policy-nonpolicy effects.

## A Comparative Analysis of Three American Presidential Elections

In this section, we describe how survey data from the 1972, 1976, and 1980 National Election Studies can be used to evaluate the predictive and classification properties of the augmented spatial model described in the previous section. The baseline model with which all other models will be compared is the simple Enelow-Hinich spatial model (at times denoted as "(N+P)") with a single nonpolicy variable and separate policy variables, each representing the difference in squared distance between the voter and two candidates on a policy scale. What will be called the complex model (and at times denoted "(N+P+N*P)") is this same model with an interaction term for each policy-nonpolicy variable pair (i.e., nonpolicy variable j times policy variable k). A third model is the simple model minus the nonpolicy variable (called the policy only model and at times denoted by "(P)") and a fourth model is the simple model minus the policy variables (called the nonpolicy only model, and at times denoted by "(N)"). Grofman's model, which we denote by "(G)", is the fifth and last model (although due to additional data requirements, it can be tested only for 1980).

For two reasons, we use only pre-election data from the 1972, 1976, and 1980 NES surveys. First, post-election data is subject to rationalization caused by the election result. More importantly, however, the data on nonpolicy candidate characteristics is always contained in the pre-election wave of the interview.

### *The 1972 Presidential Election*

The 1972 NES data contain nine seven-point issue scales in the pre-election wave of the traditional pre-post interview. These issues are Guaranteed Jobs, Tax Rate Change, Vietnam Withdrawal, Government Action Against Inflation, Legalization of Marijuana, Busing to Achieve Integration, Health Insurance Plans, Pollution, and Equal Role for Women. Each issue is a seven-point scale that is presented to the respondent with the instruction to locate himself and each candidate on the scale. The two end-points are labeled, suggesting a policy continuum (e.g., on Health Insurance "1" is labeled "Government Insurance Plan" and "7" is labeled "Private Insurance Plan"). The respondent's placement of himself, Nixon, and McGovern on each of these policy scales allows for the computation of the difference in squared distance between respondent and McGovern and respondent and Nixon.

There are four candidate evaluation questions asked about Nixon and McGovern in the pre-election wave of the interview. These questions provide us with an explicit nonpolicy variable for our analysis. They ask if Nixon (or McGovern) could be "trusted" as president, if Nixon (or McGovern) has the kind of personality a president ought to have, if Nixon (or McGovern) would control crime as president, and if Nixon (or McGovern) would bring peace in Vietnam as president. The answers to each question are coded from 1 to 7 ("Strongly Agree" to "Strongly Disagree"). Since our variable of theoretical concern is the difference in candidate ratings, we subtract McGovern's rating on each question from Nixon's to give us four nonpolicy variables. We then factor analyze these four variables to see if they can be reduced further. Using principal factoring with iteration, a single factor was found to explain 78.5% of the variance with an associated eigenvalue of 3.14. The analogous statistics for the second factor are 8.6% and .34, so it is apparent that one factor accounts for most of the covariance in the data. The four loadings for "Trust," "Presidential Personality," "Crime," and "Peace" are .92, .85, .80, and .80. To avoid any possibility of contaminating the purity of our nonpolicy index, "Crime" and "Peace" were not used in the index. The coding was reversed so that 7=Strongly Agree and 1=Strongly Disagree, and a simple additive index was constructed from the "Trust" and "Presidential Personality" questions ranging from -12 (pro-McGovern) to 12 (pro-Nixon). The same approach is used by Markus (1982) to construct a nonpolicy index for the 1980 presidential election.

The 1972 questionnaire was administered in Forms 1 and 2, and not all of the nine issue questions were asked of any one voter. Instead, on Form 1 are Jobs, Tax Rate, Marijuana, Busing, Health Insurance, and Women's Role; while on Form 2 are Vietnam, Inflation, Marijuana, Busing, Pollution, and Women's Role. This provides us with two sets of independent variables (variable sets 1 and 2) to be used to explain and predict the observed (pre-election) choice of Nixon or McGovern.

Table 1 summarizes the results of the probit analysis. Here the statistical criterion for evaluating the complex model, or equivalently the interactions between the nonpolicy variable and the policy variables, is the observed change in log likelihood on deleting these terms. In each case -2.0 times the difference in log likelihood on going from a more restrictive model (no interaction terms) to a less restrictive model (a model with interaction terms) is distributed as chi-square with degrees of freedom equal to the number of additional parameters in the less restrictive model. Equivalently, one can simply subtract the value of chi-square associated with going from a no-variable model to the model given. Thus, for example, to evaluate the significance of the interactions between the nonpolicy variable and the policy variables for those who responded to Form 1, we subtract the chi-square value associated with the model

containing only the main effects of policy variables and the nonpolicy variable (referred to in table 1 as "SIMPLE") from the chi-square value associated with the model containing main effects plus interaction terms (referred to in table 1 as "COMPLEX"). This quantity is distributed as chi-square with degrees of freedom equal to the number of additional variables in the complex model. Thus, in the case of the 1972 Form 1 data set, we have chi-square equal to 3.26 (226.50-223.24), degrees of freedom equal to 6 (13-7) and a nonsignificant p value of 0.75, so we conclude that the interaction terms are jointly nonsignificant.

One can, however, also consider the $R^2$ values reported in table 1. While the statistical tests indicate that the observed increase in the chi-square value could be due to chance variation, we can also simply observe the small increase in $R^2$ from 0.83 to .0.84.

We have several other results. For the set of individuals who were administered Form 1, all policy variables are significant in both probit models (with and without the interaction terms) at the 0.02 level or below, with the exception of Women's Role, which is statistically nonsignificant for both probits. None of the interaction variables is statistically significant at even the .10 level. The estimated coefficients of the complex model with interaction variables can be found in the appendix. As a final test for statistical significance, the interaction variables were dropped one at a time by backwards deletion, beginning with the variable with the smallest absolute estimate to error ratio, with the remaining variables refitted to the probit model. None of the individual interaction variables is significant at the 0.10 level.

While nonpolicy-policy interactions are nonsignificant for the variables of Form 1, nonpolicy alone and policy alone are each important relative to the simple nonpolicy and policy model. Not shown in table 1 are the results of a study in which the nonpolicy variable alone is entered as the only independent variable (with the same cases). In this case, the log likelihood test (relative to the simple nonpolicy and policy model) yields a highly significant chi-square value of 164.87 with 6 degrees of freedom ($p.<0.001$). Considering a model for policy alone versus a policy-plus-nonpolicy model, the change in log likelihood is less but also significant, resulting in an observed chi-square value of 4.53 with 1 degree of freedom ($p. < 0.04$). Dropping either policy or nonpolicy hurts the explanatory power of the model, with policy producing a bigger decline. Put differently, both the policy-alone and nonpolicy-alone models are misspecified.

The picture is slightly different for those individuals whose vote in the 1972 election is considered with respect to the variables in Form 2. Here the policy variables are Vietnam, Inflation, Marijuana, Busing, Pollution, and Women's Role. As indicated by the chi-square value of 15.80 reported in table 1, the combined effect of all the interaction variables is statistically

TABLE 1

RESULTS OF PROBIT ANALYSIS

| DATA SET | MODEL | N | $R^2$ | $X^2$ | DF | $X_6^2$ | DF | LOS |
|---|---|---|---|---|---|---|---|---|
| 1972 FORM 1 | SIMPLE | 287 | 0.83 | 223.24 | 7 | | | |
| | | | | | | 3.26 | 6 | .75 |
| 1972 FORM 1 | COMPLEX | 287 | 0.84 | 226.50 | 13 | | | |
| 1972 FORM 2 | SIMPLE | 327 | 0.80 | 224.32 | 7 | | | |
| | | | | | | 15.80 | 6 | .025 |
| 1972 FORM 2 | COMPLEX | 327 | 0.89 | 240.12 | 13 | | | |
| 1976 | SIMPLE | 432 | 0.89 | 370.86 | 6 | | | |
| | | | | | | 20.31 | 5 | <.005 |
| 1976 | COMPLEX | 432 | 0.92 | 391.17 | 11 | | | |
| 1980 | SIMPLE | 195 | 0.89 | 173.56 | 6 | | | |
| 1980 | COMPLEX | 195 | 0.94 | 192.65 | 11 | | | |

(a) $X^2$ denotes -2.0 times the change in the log of the likelihood function on adding the variables included in the model indicated.
(b) Form 1 and Form 2 are defined in the section on the 1972 election.
(c) SIMPLE denotes an additive model including the main effect of policy variables and the main effect of the nonpolicy variable.
(d) COMPLEX denotes a model which includes the main effects of the nonpolicy variable, the main effect of the policy variables plus interactions between the policy variables and the nonpolicy variable.
(e) $X_6^2$ denotes the difference between the chi-square observed for the complex model minus the chi-square observed for the simple model.
(f) DF denotes degrees of freedom associated with $X^2$ or $X_6^2$.
(g) LOS denotes the level of significance of $X_6^2$.

significant relative to the simple nonpolicy and policy model. In addition, the difference in $R^2$ for the two models is 0.09 (0.89-0.80). Not shown in the tables are the results of an analysis involving backwards deletion of the nonsignificant interaction terms, which reveals that two interactions account for this significance. The variables having a significant interaction with the nonpolicy variable are Vietnam and Marijuana; these interaction variables accounting for 11.03 (2 df) of the 15.80 (6 df) chi-square value that distinguishes the complex and simple models. The positive sign of these coefficients indicates that attractive nonpolicy characteristics increase the extent to which closeness on Vietnam and on Legalization of Marijuana makes the voter more likely to vote for the favored candidate. The estimated coefficients of the complex model with interaction variables can be found in the appendix.

To complete our discussion of statistical significance, the log likelihood difference was computed between the simple policy and nonpolicy model and, first, the nonpolicy-alone model. The chi-square value (not reported in table 1) is observed to be 178.38 with 6 df ($p < 0.001$), suggesting the statistical importance of policy variables. The second comparison is between the simple nonpolicy-plus-policy model (N+P) and the policy-alone model. Here we find no statistical difference (chi-square value = 2.13 with 1 df, $p = 0.15$), suggesting that nonpolicy has a weak effect in the second variable set. This result is consistent with other analyses of the 1972 election that view it as mainly a policy contest (Miller et al., 1976; Miller and Levitin, 1977).

We are now ready to take up the question of classification. The above discussed probit results indicate that for the sample who received Form 1 questions on the 1972 election, the interaction terms did not significantly improve the precision of our estimate of the proportion of voters who would choose one candidate over the other, whereas for the sample who received Form 2 questions, involving a somewhat different set of issues, the interaction terms did make a significant difference. However, in considering classification, we are asking how well we can classify the voters as to who would choose candidate R, say, based on the predicted probabilities using the model. Here we classify a voter as being for candidate R if his predicted probability (based on the data he provides and the estimated parameters) exceeds 0.5 and otherwise classify him as most likely to choose candidate D. Thus a second issue is whether or not estimating the probability using the model with interactions results in significantly more correct classifications than the model in which we delete the interactions.

In order to evaluate the sensitivity of this comparison of models (based on the comparison of misclassification rates), we will also compare the classification results of the nonpolicy model to the simple nonpolicy plus policy model. The motivation for doing this comparison, as well as a

comparison of the policy model to the simple policy-plus-nonpolicy model, is to observe whether statistical comparisons of the percentages correctly classified have reasonable power in a data base such as this one.

Table 2 reports the percentage of correctly classified individuals for four models in the case of the samples represented in the 1972 and 1976 data and for five models in the sample represented in the 1980 data. For the data on the 1972 and 1976 elections, the four models considered are the policy-alone model (P), the nonpolicy-alone model (N), the simple nonpolicy and policy model (N+P), and the complex nonpolicy and policy model with interaction variables (N+P+N*P). For the 1980 data we also consider the classification capabilities of Grofman's model (G). In the case of (N+P+N*P), the complex model that is chosen is the one with the best predictive success (i.e., highest percentage correct-choice predictions). For the sample receiving Form 2 questions on the 1972 election, the best complex model excludes the inflation and pollution interaction variables, while for those who received Form 1, all interaction variables are included. We henceforth refer to (N+P+N*P) as the best complex model.

TABLE 2

ACCURACY OF THE CLASSIFICATION RESULTS FOR THE PROBIT MODEL: PERCENTAGE OF CASES CORRECTLY CLASSIFIED

| DATA SET | | MODEL (P) | (N) | (N+P) | (N+P+N*P) | (G) |
|---|---|---|---|---|---|---|
| 1972 | FORM 1 | 89% | 74% | 88% | 90% | - |
| 1972 | FORM 2 | 88% | 71% | 87% | 88% | - |
| 1976 | | 81% | 88% | 90% | 91% | - |
| 1980 | | 88% | 89% | 92% | 91% | 89% |

The following notation is used for the models:

(P) denotes an additive model including only the main effects of the policy variables.

(N) denotes an additive model including only the main effect of the nonpolicy variable.

(N+P) denotes an additive model including only the main effects of the policy variables and the main effect of the nonpolicy variable.

(N+P+N*P) denotes the complex model that best classifies voter choice. This model includes the main effects of the policy variables plus the main effect of the nonpolicy variable plus interactions between policy variables and the nonpolicy variable.

(G) denotes Grofman's (Grofman, 1985) model, which is described in the text.

The significance of the observed differences in the percentage correctly classified was evaluated by comparing each model with the simple model (N+P). Each pairwise comparison involves a single subsample of individuals being classified by two methods. Hence, we have paired data,

## TABLE 3

### ANALYSIS OF THE CLASSIFICATION RESULTS: COMPARISONS WITH THE MODEL CONTAINING MAIN EFFECTS OF POLICY AND NONPOLICY VARIABLES

| DATA | SET | MODEL | ++ | +- | -+ | -- | CHI-SQUARE | LOS |
|---|---|---|---|---|---|---|---|---|
| 1972 | FORM 1 | (N+P+N*P) | 252 | 7 | 1 | 27 | 3.78 | 0.06 |
| 1972 | FORM 1 | (P) | 251 | 4 | 2 | 30 | 0.38 | 0.55 |
| 1972 | FORM 1 | (N) | 199 | 13 | 54 | 21 | 24.48 | <0.001 |
| 1972 | FORM 2 | (N+P+N*P) | 281 | 7 | 4 | 35 | 0.57 | 0.45 |
| 1972 | FORM 2 | (P) | 282 | 5 | 3 | 37 | 0.28 | 0.60 |
| 1972 | FORM 2 | (N) | 215 | 18 | 70 | 24 | 30.14 | <0.001 |
| 1976 | | (N+P+N*P) | 386 | 6 | 4 | 36 | 0.23 | 0.64 |
| 1976 | | (P) | 334 | 18 | 56 | 24 | 19.00 | <0.001 |
| 1976 | | (N) | 373 | 8 | 17 | 34 | 2.89 | 0.09 |
| 1980 | | (N+P+N*P) | 175 | 3 | 5 | 12 | 0.28 | 0.60 |
| 1980 | | (P) | 166 | 5 | 14 | 10 | 3.80 | 0.06 |
| 1980 | | (N) | 169 | 4 | 11 | 11 | 2.82 | 0.10 |
| 1980 | | (G) | 151 | 5 | 10 | 10 | 1.35 | 0.25 |

(++) denotes the number of cases for which BOTH MODELS CORRECTLY CLASSIFIED the voter.

(+-) denotes the number of cases for which the ALTERNATIVE MODEL CORRECTLY CLASSIFIED the voter and the SIMPLE (N+P) MODEL INCORRECTLY CLASSIFIED the voter.

(-+) denotes the number of cases for which the ALTERNATIVE MODEL INCORRECTLY CLASSIFIED the voter and the SIMPLE (N+P) MODEL CORRECTLY CLASSIFIED the voter.

(--) denotes the number of cases for which BOTH MODELS INCORRECTLY CLASSIFIED the voter.

CHI-SQUARE denotes the observed value of the McNemar chi-square statistic, which in every case is distributed as Chi-square with 1 degree of freedom.

LOS denotes the level of significance associated with the observed chi-square value.

For definitions of (N), (P), (N+P), (N+P+N*P), and (G) see table 2.

so the appropriate statistic for comparing these percentages pairwise is the McNemar chi-square statistic (Fleiss, 1981), which in every case is distributed (under a null hypothesis of no difference between these percentages) as chi-square with 1 degree of freedom. The results of these comparisons are given in table 3.

As tables 2 and 3 indicate, the McNemar chi-square test to determine whether the classification results of one model are superior to another (by examining the distribution of different predictions) reveals no significant improvement at the .05 level by the best complex (N+P+N*NP) over the simple model (N+P) for either 1972 variable set (the p values are based on a two-sided hypothesis). The policy-alone model (P) is predictively no worse than the simple nonpolicy and policy model (N+P) or the best complex model (N+P+N*P) for both variable sets. The nonpolicy-alone model (N) is worse than (N+P) for both variable sets. What these results show is that the simple model (N+P) is unsurpassed by any other model with respect to its classification properties, but the policy-alone model (P) does as well. Here we gain more evidence in support of the policy nature of the 1972 contest between Nixon and McGovern.

*The 1976 Presidential Election*

Continuing our analysis, we replicate the same steps taken with the 1972 data to analyze the 1976 election. Seven questions were asked in the pre-election wave of the 1976 pre-post interview about candidate qualities. Respondents were asked whether Ford (or Carter) could be trusted as president, whether Ford (or Carter) has a presidential personality, whether Ford (or Carter) would bring moral and religious standards to government, and whether Ford (or Carter) would make the government run better. Three more questions were excluded because they dealt with unemployment, the power and size of government, and inflation. Carter's ratings on each of the four questions were subtracted from Ford's, and principal factoring with iteration was performed. Again, a one-factor solution appeared appropriate: 77.5% of the variance explained by the first factor with associated eigenvalue of 3.10; 8.6% explained by the second factor with associated eigenvalue of .35. The loadings of the four variables "Trust," "Presidential Personality," "Moral and Religious Standards," and "Make Government Run Better" are .87, 0.82, .80, .86; and so, as for the 1972 data, a simple additive index is justified. Again, responses were recoded so that 7=Strongly Agree and 1=Strongly Disagree. This leaves us with a scale that ranges from 24 (pro-Ford) to -24 (pro-Carter).

The 1976 questionnaire was administered in one form, so that all the pre-election issue questions can be analyzed together. The five seven-point scale questions included in the pre-election wave of the interview are: Guaranteed Jobs and Living Standards, Rights of the Accused, Busing to Achieve Integration, Aid to Minorities, and Medical Insurance Plan.

Table 1 reports the results of the probit analyses of the simple nonpolicy and policy model, and the complex model with interaction variables included. The interaction variables are jointly significant ($p<.005$). Stepwise deletion of the nonsignificant interaction terms indicates that the interaction between Nonpolicy and Rights of the Accused (Nonpolicy/Rights of the Accused) and the Nonpolicy/Medical Insurance Plan interaction accounts for most of the difference in the chi-square values between the simple and complex models (19.43 out of 20.31). The reduced complex model with only these two interaction variables is also the best choice predictor among the complex models (predicting one more case correctly than the full complex model). The estimated coefficients of the complex model with all interaction variables can be found in the appendix.

The policy-alone and the nonpolicy-alone models are misspecified relative to the simple nonpolicy-plus-policy model. For policy alone, the log likelihood test yields a chi-square value of 131.51 with 1 df ($p < .001$), while for the nonpolicy-alone model, the chi-square value is 42.00 with 5 df ($p < .001$). This is simple evidence that both factors affect vote choices in this sample.

As for classification, we see from tables 2 and 3 the similarity between the simple and best complex models ((N+P) and (N+P+N*P)) is even greater than in 1972. As table 2 indicates, there is virtually no difference between the two models, let alone a statistically significant difference. Interestingly, table 3 also indicates that, statistically, the nonpolicy-alone model (N) is predictively no worse than the simple nonpolicy and policy model (N+P) (though it is slightly worse than the best complex model). Here we have a strong indication of the preeminence of nonpolicy factors in the 1976 election. This conclusion is supported by other analyses of the 1976 election (Miller, 1978; Enelow and Hinich, 1984a).

### *The 1980 Presidential Election*

The 1980 survey features an unusually large set of candidate quality questions. Nine questions are asked of the respondent concerning Reagan's and Carter's personal qualities, of which seven are free of any policy content. These seven questions ask how well the terms "moral," "dishonest," "weak," "knowledgeable," "power-hungry," "inspiring," and "strong leadership" describe each of the candidates. As before, responses to the questions asked about Carter were subtracted from responses to the questions asked about Reagan, and the seven resulting variables were subjected to principal factoring with iteration. Again, a one-factor solution emerges from the data, with 49.4% of the variance explained by the first factor with an eigenvalue of 3.46 (12.9% of the variance is explained by the second factor with an eigenvalue of .91).

Markus (1982) decides on a two-factor solution for this data. However, there are major differences between us in how the data are analyzed. First, Markus enters not only the candidate-quality data on Carter and Reagan, but also the data on Anderson and Kennedy. Second, he factor analyzes the raw responses, instead of the differences between candidates. Finally, he pools the respondents from the third wave of the year-long panel study with the respondents from the pre-election half of the traditional pre-post interview. As a result, his two factors together explain less of the variance (45.6%) than our one factor alone.

The loadings of the seven variables "moral," "dishonest," "weak," "knowledgeable," and "power-hungry," "inspiring," and "leadership" are .65, .37, .58, .64, .54, .80, .84. The last two variables "inspiring" and "leadership" stand out from the rest in the strength of their loadings. Unlike the others, the one recovered factor explains more than half the variance in each of these last two variables. Consequently, our nonpolicy index was constructed for this election using only the two variables "inspiring" and "strong leadership." As before, the data on these questions was recoded so that 4=Extremely Well and 1=Not Well At All. This provides us with a scale ranging from 6 (pro-Reagan) to -6 (pro-Carter).

Five issue scale questions are included in the pre-election wave of the 1980 pre-post interview. Two of these questions are not seven-point scales, but were transformed to the same length. The questions concern Defense Spending, Government Services, Inflation/Unemployment, Abortion, and Tax Cut policy. The results of a probit analysis of the complex model with interaction variables are included in the appendix. All interaction variables together are highly significant ($p<.001$) with Nonpolicy/Government Services and Nonpolicy/Inflation-Unemployment accounting for most of the difference in chi-square values between the simple and complex models (18.61 out of 19.09). Surprisingly, the sign of the government services interaction variable is negative, suggesting that the combined effect of nonpolicy attractiveness and closeness on government services decreases the probability of voting for the advantaged candidate. A good reason to doubt this conclusion is the high intercorrelation between the government services and inflation/unemployment variables ($r=0.57$). As is well known, multicollinearity produces biased estimates in probit or regression analysis. Inspection of the estimates shows that the estimated coefficients of these two variables jump around quite a bit from the simple to the complex model.

Dropping either the policy variables or the nonpolicy variable in the simple nonpolicy and policy model leads to significant deterioration in the model's explanatory ability. The difference in chi-square values for the nonpolicy alone model is 44.40 (5df; $p<.001$), while for the policy alone model this difference is 46.27 (1 df; $p<.001$). The suggestion is strong that policy *and* nonpolicy variables are separately important in the 1980

election for members of our sample. This conclusion is in contrast to the 1972 election, where policy variables outshine nonpolicy variables, or the 1976 election, where nonpolicy variables outshine policy variables.

Turning to classification, tables 2 and 3 indicate that, once again, the simple nonpolicy and policy model is unsurpassed by the best complex model (in this case the model with the full set of interaction variables). In fact, the absolute number of correct predictions drops with the best complex model. Also, there is almost no significant loss of classifying power by going from the simple model to the policy-alone model ($p=.06$) or to the nonpolicy-alone model ($p=.10$). These results suggest that from the standpoint of predicting choice, nonpolicy and policy variables do equally well (the difference in chi-square values between the two models (N) and (P) is .07; 1 df, $p = .75$).

Finally, let us compare our simple additive model of nonpolicy and policy variables with Grofman's (1985) interactive model without main effects. If $SQ_{ij}$ is the status quo policy on policy issue j as perceived by voter i, $C_{ip}$ is i's perception of candidate p's competence ($0 \leq C_{ip} \leq 1$) and $P_{ij}$ is i's perception of p's position on policy issue j, then Grofman postulates that the "adjusted" policy position i actually credits p with holding is

$$AP_{ij} = SQ_{ij} + C_{ip}(P_{ij} - SQ_{ij}) \qquad (3).$$

$AP_{ij} = SQ_{ij}$ if $P_{ij} = SQ_{ij}$ or if, in i's estimation, p is totally incompetent (i.e., $C_{ip} = 0$). $AP_{ij} = P_{ij}$ if $P_{ij} = SQ_{ij}$ or if, in i's estimation, p is totally competent (i.e., $C_{ij} = 1$). Otherwise, $AP_{ij}$ assumes some value between $SQ_{ij}$ and $P_{ij}$, depending on i's feeling about the likelihood that p can carry out the policy he is advocating (it is not altogether clear why $AP_{ij}$ is not allowed to assume values outside the interval between SQ and P).

A new data requirement is introduced by Grofman's model, namely, some measure of where the respondent locates the status-quo policy on a given issue. Fortunately, the 1980 survey asks the respondent to locate "what the Federal Government is doing at the present time" on the same issue scales on which the respondent locates himself and the candidates. We can therefore compute the "adjusted" policy positions of Carter and Reagan on each of the five issue questions in the pre-election wave of the pre-post interview. The nonpolicy scale of 2 to 8 for each separate candidate is simply transformed linearly to range from 0 to 1 (coincidentally, Markus labels the dimension to which he assigns "inspiring" and "strong leadership" a competence dimension). The federal government questions are absent from the 1972 and 1976 surveys. Using the incumbent's position in place of the federal government was tried, but it was found that probit predictions differed considerably for the 1980 data if this were done (the percentage correct predictions drop by 8% if Carter's position is taken as the status quo). We will, therefore, limit our comparison to the 1980 election.

We cannot include a statistical test to compare the likelihood observed for Grofman's model to that observed for the simple model because the two models are not nested (i.e., Grofman's includes an extra term, $SQ_{ij}$,a special configuration of interaction terms, and no additive terms). Still, it is of interest to note that the log of the likelihood under the (N+P) model is -44.45, whereas for Grofman's model it is -57.33, indicating that the likelihood of the data under the (N+P) model is at least $e^{12.88}$ times that of the data under Grofman's model. This increase is even more impressive when it is realized that Grofman's model has one more parameter than the (N+P) model.

Tables 2 and 3 report the results of our comparison of classification results. Statistically, there is no difference in misclassification rates on comparing Grofman's interactive model to the simple nonpolicy and policy model that postulates only main effects (if a comparison is done based on post-election data, we estimate Grofman's model to be predictively worse by 8%). Our conclusion, therefore, is that whatever attractiveness Grofman's model might have (although its theoretical properties are as yet unexplored), it offers no improvement from an empirical standpoint over our simple additive model of nonpolicy and policy variables.

## Conclusion

The picture we have painted throughout this paper is a very simple one. The additive model of voter choice described in Enelow and Hinich (1982, 1984a), in which nonpolicy and policy variables exert separate main effects, is either unimproved or negligibly improved with respect to its potential for correctly classifying voters by extending the model to include interaction effects. While we find evidence for the existence of interaction effects in the three presidential elections of 1972, 1976, and 1980, empirically, these effects are so small that, in our samples, they make no significant difference in the ability of the model to correctly predict voter choice.

We may also point out that the simple nonpolicy and policy model predicts voter choice as well as totally different models, such as the logistic model used by Markus (1982) that predicts the two-candidate vote in 1980 with party identification and thermometer score differences. The 91.7% predictive accuracy of this logistic model compares with 92.3% predictive accuracy for the simple nonpolicy and policy model. Other comparisons might be made, but, hopefully, our point is sufficiently clear. If the purpose of the investigator is the correct classification of respondents by vote choice, the simple additive model of Enelow and Hinich performs quite well.

In closing, we wish to stress that the spatial model of elections is more than just an interesting set of the theoretical propositions. It is a model

with predictive as well as explanatory power. Focusing on policies and candidate attributes that are independent of policies, the model produces two things: a consistent theory of candidate behavior, and an ability to successfully predict voter choice in survey data. Such a record is certainly no small accomplishment.

## APPENDIX

RESULTS OF PROBIT ANALYSIS OF COMPLEX NONPOLICY AND POLICY MODEL (1972 VARIABLE SET 1)

| VARIABLE OR CONSTANT | COEFFICIENT (MAXIMUM LIKELIHOOD ESTIMATE) | ESTIMATED STANDARD ERROR | MLE/SE | p |
|---|---|---|---|---|
| CONSTANT | .400 | .128 | 3.129 | .00 |
| NONPOLICY | .075 | .037 | 2.033 | .02 |
| JOBS | .042 | .014 | 3.034 | .00 |
| TAX RATE | .024 | .011 | 2.267 | .01 |
| MARIJUANA | .032 | .011 | 3.019 | .00 |
| BUSING | .033 | .010 | 3.268 | .00 |
| HEALTH INSURANCE | .027 | .012 | 2.293 | .02 |
| WOMEN'S ROLE | -.003 | .014 | -.211 | .58 |
| NP x JOBS | -.003 | .004 | -.686 | .75 |
| NP x TAX RATE | .001 | .003 | .269 | .39 |
| NP x MARIJUANA | .001 | .003 | .554 | .29 |
| NP x BUSING | .001 | .003 | .264 | .40 |
| NP x HEALTH INS | -.000 | .003 | -.094 | .54 |
| NP x WOMEN'S ROLE | .003 | .003 | 1.173 | .12 |

-2 TIMES LOG LIKELIHOOD RATIO = 226.50 (CHI SQUARED WITH 13 DF)
ESTIMATED R SQUARED = .84
PERCENT OF CASES CORRECTLY PREDICTED = 90.24
N = 287 (N OF McGOVERN CHOICES = 111; N OF NIXON CHOICES = 176)

RESULTS OF PROBIT ANALYSIS OF COMPLEX NONPOLICY AND POLICY MODEL (1972 VARIABLE SET 2)

| VARIABLE OR CONSTANT | COEFFICIENT (MAXIMUM LIKELIHOOD ESTIMATE) | ESTIMATED STANDARD ERROR | MLE/SE | p |
|---|---|---|---|---|
| CONSTANT | .415 | .124 | 3.348 | .00 |
| NONPOLICY | .040 | .032 | 1.250 | .11 |
| VIETNAM | .060 | .015 | 4.054 | .00 |
| INFLATION | .065 | .017 | 3.730 | .00 |
| MARIJUANA | .043 | .016 | 2.653 | .00 |
| BUSING | .043 | .009 | 4.579 | .00 |
| POLLUTION | .015 | .020 | .762 | .22 |
| WOMEN'S ROLE | .015 | .017 | .907 | .18 |
| NP x VIETNAM | .008 | .003 | 2.441 | .01 |
| NP x INFLATION | .003 | .004 | .605 | .27 |
| NP x MARIJUANA | .006 | .004 | 1.765 | .04 |
| NP x BUSING | .003 | .002 | 1.538 | .06 |
| NP x POLLUTION | -.003 | .004 | -.686 | .75 |
| NP x WOMEN'S ROLE | .007 | .004 | 1.604 | .06 |

-2 TIMES LOG LIKELIHOOD RATIO = 240.12 (CHI SQUARED WITH 13 DF)
ESTIMATED R SQUARED = .89
PERCENT OF CASES CORRECTLY PREDICTED = 87.77
N = 327 (N OF McGOVERN CHOICES = 117; N OF NIXON CHOICES = 210)

RESULTS OF PROBIT ANALYSIS OF COMPLEX NONPOLICY AND POLICY MODEL (1976)

| VARIABLE OR CONSTANT | COEFFICIENT (MAXIMUM LIKELIHOOD ESTIMATE) | ESTIMATED STANDARD ERROR | MLE/SE | p |
|---|---|---|---|---|
| CONSTANT | .051 | .105 | .480 | .64 |
| NONPOLICY | .209 | .024 | 8.704 | .00 |
| JOBS | .032 | .014 | 2.200 | .01 |
| RIGHTS OF ACCUSED | .043 | .020 | 2.132 | .02 |
| BUSING | .011 | .012 | .884 | .19 |
| AID MINORITIES | .051 | .022 | 2.307 | .01 |
| MEDICAL INSURANCE | .032 | .011 | 2.892 | .00 |
| NP x JOBS | -.002 | .003 | -.813 | .79 |
| NP x R OF ACCUSED | .006 | .002 | 2.500 | .01 |
| NP x BUSING | .000 | .002 | -.230 | .59 |
| NP x AID MINORITIES | .000 | .003 | -.120 | .55 |
| NP x MED INSURANCE | .004 | .002 | 2.194 | .01 |

-2 TIMES LOG LIKELIHOOD RATIO = 391.17 (CHI SQUARED WITH 11 DF)
ESTIMATED R SQUARED = .92
PERCENT OF CASES CORRECTLY PREDICTED = 90.51
N = 432 (N OF CARTER CHOICES = 217; N OF FORD CHOICES = 215)

RESULTS OF PROBIT ANALYSIS OF COMPLEX NONPOLICY AND POLICY MODEL (1980)

| VARIABLE OR CONSTANT | COEFFICIENT (MAXIMUM LIKELIHOOD ESTIMATE) | ESTIMATED STANDARD ERROR | MLE/SE | p |
|---|---|---|---|---|
| CONSTANT | -.823 | .303 | -2.718 | .01 |
| NONPOLICY | 1.081 | .236 | 4.579 | .00 |
| DEFENSE | .004 | .025 | .175 | .43 |
| GOVT SERVICES | .092 | .032 | 2.891 | .00 |
| INFLATION/UNEMP | .044 | .046 | .962 | .17 |
| ABORTION | .001 | .025 | .048 | .48 |
| TAX CUT | .026 | .020 | 1.281 | .10 |
| NP x DEFENSE | -.010 | .020 | -.485 | .31 |
| NP x GOVT SERVICES | -.047 | .016 | -2.983 | .00 |
| NP x INFLA/UNEMP | .066 | .021 | 3.128 | .00 |
| NP x ABORTION | -.008 | .015 | -.528 | .70 |
| NP x TAX CUT | .002 | .012 | .146 | .44 |

-2 TIMES LOG LIKELIHOOD RATIO = 192.65 (CHI SQUARED WITH 11 DF)
ESTIMATED R SQUARED = .94
PERCENT OF CASES CORRECTLY PREDICTED = 91.28
N = 195 (N OF CARTER CHOICES = 78; N OF REAGAN CHOICES = 117)

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