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SYMPOSIUM. THE DIRECTIONAL THEORY OF ISSUE VOTING: II

DIRECTIONAL AND PROXIMITY MODELS OF VOTER UTILITY AND CHOICE: A NEW SYNTHESIS AND AN ILLUSTRATIVE TEST OF COMPETING MODELS

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ABSTRACT

Under the assumption that a voter's utility is maximized when s/he chooses the candidate/party that is closest to the voter's own most preferred set of policies, the Downsian proximity model of voter choice has become the standard method for modeling the linkage between the policy preferences of voters and the policy positions of candidates. Alternative spatial models of voter utility and voter choice – based on directional criteria – have been proposed by Matthews and by Rabinowitz and Macdonald. The relative fit of models can best be addressed by nesting seemingly disparate models in a unified statistical framework which embodies proximity, directional and intensity components and which has each of the 'pure' models as a special case. Theory suggests the need to distinguish the ability to predict distinct shapes of voter *utility* functions from the ability to predict voter *choice*. Using data on the voter utility functions for major candidates for the US presidency during the period 1980–92, we show that the best fit incorporates all three components with intensity significantly more prominent for challengers while the Matthews directional model – which de-emphasizes intensity – is preferred to the Rabinowitz/Macdonald version for incumbents. Differing utility functions for incumbent and challenger imply that the former should seek the center while the latter espouses strong stands. We show that the marked preference for the model obtained by Rabinowitz and Macdonald using mean issue placements of the candidates is greatly reduced with voter-specific candidate placements, even after adjusting for projection. However, when we shift from utility functions to voter choice, we find no significant difference in predictive power between the proximity and directional models.

KEY WORDS • directional model • Downsian model • projection • utility • voter choice

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I. Introduction

A cornerstone of Downsian models of party competition is the notion that voters can be thought of as having preferences over policy positions. The standard Downsian proximity model implies, *ceteris paribus*, that (1) voter utility reaches its maximum for candidates whose policy views are identical to those of the voter and (2) voters will choose among the available alternatives that candidate/party whose expected policies come closest to those the voter desires. Moreover, (3) in one dimension, for two-party competition, if parties are vote-maximizers, the simple Downsian model predicts convergence of party positions to that of the median voter.

For US politics, there are reasons to be skeptical about at least the first and third of these expectations. With respect to voter utility functions, it appears that the greatest financial support for a given candidate may come not from the voters whose views are closer to hers, but rather from voters with more extreme views who see her as strongly preferable to the candidate of the opposing party. With respect to party convergence, despite the undoubted pressures for moderation, on many of the most important issues that divide the nation, parties and candidates in the United States simply do not look like Tweedledum and Tweedledee. US senators from the same state but of opposite parties average over a 30-point difference in ADA scores, with Democrats consistently to the left of Republicans (Bullock and Brady, 1983; Poole and Rosenthal, 1984; Grofman et al., 1990); similarly, when a congressional seat changes in party control the new representative votes very differently from the old (Fiorina, 1974; Brady and Lynn, 1973).

In large part motivated by the theoretical and empirical difficulties with the Downsian proximity model, an alternative spatial model of voter utility and voter choice, the directional model, has recently been proposed by Rabinowitz et al. (Rabinowitz and Macdonald, 1989; Macdonald et al., 1991; Rabinowitz et al., 1991; Macdonald and Rabinowitz, 1993; Rabinowitz et al., 1993; Listhaug et al., 1994).[1] The intuition underlying this

1. Carroll (1972; see also Carroll, 1980; De Soete and Carroll, 1983) provides a utility function as a tool for psychological scaling which is mathematically identical to that given in Rabinowitz and Macdonald (1989). He refers to it as the '(wandering) vector' model and contrasts it with the proximity model – a model he refers to as the 'Coombsian unfolding model' after Coombs (1964). De Soete and Carroll (1983) provide applications of the random vector model (and other multidimensional spatial models) to a wide variety of data, including data on political party locations in Italy and Sweden. A very useful general survey of the mathematical psychology literature on multidimensional scaling is Carroll and De Soete (1991). Other relevant early work is Reynolds (1974) who, motivated by ideas in Fishbein (1963), used a scalar product to aggregate a voter's beliefs about a candidate's positions and the voter's own opinion on the issues. Reynolds demonstrates substantial correlations between these scalar products and attitudes toward candidates.

approach, which we refer to as the RM model, is based on the premise that 'voters do not have clear preferences for particular policies; they simply have general preferences for the *direction* they would like policy to go' (Listhaug et al., 1994; emphasis added), where direction is defined relative to a neutral (zero) point on the issue dimension(s).

The RM model gives rises to very different predictions from those of the Downsian proximity model. First, roughly speaking, voter utility functions in the RM model display a preference for extremists in a voter's direction, rather than a utility peak at the voter's own most preferred policy position. Second, voters need not prefer a candidate who shares their views to one who does not. Indeed, sometimes voters would reject a candidate with views identical to their own (Merrill, 1993). Third, the RM model can be shown to imply that parties will take non-central positions (Rabinowitz and Macdonald, 1989) even when elections are plurality-based competitions between only two parties.

Two other alternative spatial models that we will consider in this paper are those due to Matthews (1979) and Grofman (1985). Matthews (1979) proposed that candidates be regarded essentially as directional vectors rather than policy locations, and that voters choose among candidates in terms of direction of preferred movement rather than in terms of policy distance.[2] The Matthews model can be regarded as a forerunner to the RM model, although the latter was developed independently. Grofman (1985) posits that voters discount promises made in party platforms based on the expected actual movement from the status quo that is likely to be achieved were a particular candidate/party to achieve office. The Grofman discounted model emphasizes the importance of the location of the status quo point in shaping voter choices – something totally neglected in the standard proximity model – but its logic is consistent with that of the standard proximity model, and we will thus treat it as a variant of that model for the purposes of this paper.

This paper seeks to make both theoretical and empirical contributions. Our major theoretical contribution is to show that proximity, directional and intensity components can all be embedded in a two-parameter unified model of the shape of voter utility functions, of which the traditional proximity spatial model, the RM model and the Matthews directional model are all special cases. In developing this unified model we show that the RM directional model, despite its name, is best viewed as a mixed model with both directional and intensity components, while the Matthews (1979) model best represents a pure directional component. A third parameter incorporates the

2. A similar directional model was independently suggested by one of the present authors. After the first draft of this paper was nearly complete, we realized that the identical basic model had already been proposed by Matthews (1979).

Grofman discounting model as well. We show that various 'pure' models give rise to quite different predictions as to shape of voter utility functions, but that – at least for two-party American politics – the expected differences between the predictions of the proximity and directional models are expected to be minimal when it comes to voter choices between candidates.

With respect to empirical hypothesis testing, within the statistical framework of the unified model, which permits testing of nested submodels, we look at the nature of voter utility functions and voter choice preferences for major candidates for the US presidency during the period 1980–92. We have three main empirical findings with respect to voter utility functions and one main empirical finding with respect to voter choices.[3]

When we seek to resolve contradictory empirical findings of previous research as to whether the RM model better describes voter utility functions than the Downsian proximity model (Platt et al., 1992; Rabinowitz et al., 1993; Iversen, 1994; Krämer and Rattinger, 1997; Merrill, 1994, 1995; Dow, 1997; Pierce, 1997), we find that when like Rabinowitz and Macdonald, we use mean ideological placements of the candidates, the RM model far outperforms the proximity model. This preference, however, is either greatly reduced or reversed when we permit individual voters to vary in where they locate any given candidate, the modeling decision customary in the public choice literature (see, e.g., Palfrey and Poole, 1987: 522; Enelow et al., 1993: 132). However, we also find that the unified model with a non-zero mixing parameter for directional and proximity components nearly always offers the (statistically significantly) best fit regardless of whether we use mean or individualized ideological placements, i.e. a 'mixed' model appears best. But, the improved fit of the mixed model over the best pure model is rather small.

Second, we consider the existence of projection/rationalization effects in which a voter adjusts the policy location of the candidate s/he prefers so as to move it closer to the voter's own ideal point. We find that there are substantial projection effects, but that even after adjusting for them, a mixed model with substantial proximity and directional components still matches better with the shape of voter utility functions than either pure model.

Third, we find that the intensity component of the unified model for voter utility functions is statistically different from zero only when we look at voter utility for candidates who are not incumbents. Thus, when we also take into account differences in model fit that depend upon whether the candidate being evaluated is an incumbent or a challenger, like Enelow et al. (1993), we find suggestive evidence for different models of utility functions being best for different types of candidates. The intuition here is a rather simple one: incumbent locations can be reasonably precisely located,

3. In a companion paper (Merrill et al., 1996) we look at the competing predictions of different models for party convergence and divergence.

while challengers' positions are seen primarily in terms of intensity and direction of change.

Fourth, with respect to voter choice, we find, as expected, that differences in the predictive power of the various models are minimal, because the models simply do not differ enough in their predictions.

Fifth, when we turn from voter choice to candidate behavior in two-party politics, we find the implications of the incumbent/challenger dichotomy are significant. The incumbent is led to seek the center while the challenger stakes out strong positions.

II. A Unified Framework for the Proximity, Directional and Intensity Components of Utility

A. Definitions and Basic Properties of Pure Models: RM (Rabinowitz/ Macdonald) and Matthews Directional Models and Proximity Models

Under the *RM directional model*, a voter's or candidate's location on each issue-dimension represents direction and intensity, relative to a neutral point (which can be taken to be zero). As perceived by the voters, each issue is assumed to have only two possible positions, represented by the positive and negative directions. The neutral point is the point at which the voter (or candidate) is indifferent between the two positions. Intensity is measured by the distance from the neutral point to the voter or candidate location. The voter's utility for the candidate is proportional to both the voter's and the candidate's intensity; the sign of the utility is positive if they agree in direction, and negative if they do not. Overall, RM utility is obtained by summing over issues the products of these signed intensities.

Thus the Rabinowitz/Macdonald (RM) utility for the ith issue-dimension is the product of the voter and candidate locations, i.e. V_iC_i. Summing over n dimensions, $i = 1,\dots,n$, yields the RM directional utility function:

$$U(\mathbf{V},\mathbf{C}) = \mathbf{V}\bullet\mathbf{C} = \sum_{i=1}^{n} V_iC_i \tag{1}$$

where $\mathbf{V} = (V_1,\dots,V_n)$ and $\mathbf{C} = (C_1,\dots,C_n)$ are the vectors of spatial locations of voter $\mathbf{V}$ and candidate $\mathbf{C}$, respectively, and $\mathbf{V}\bullet\mathbf{C}$ is the scalar or dot product.[4]

4. In one dimension, $\mathbf{V}$ and $\mathbf{C}$ are scalars, and the RM utility is simply their product. In the RM model, voter V prefers candidate A to candidate B if $VA > VB$. If candidates are located on opposite sides of the neutral (zero) point, N, the RM directional model implies that all voters to the left of N vote for the candidate on the left, and all voters to the right of N vote for the candidate on the right, while if both candidates are on the same side of the neutral point the one furthest to the left will receive all the votes of the voters to the left of N and the one furthest to the right will receive all the votes of the voters to the right of N.

Alternatively, voter utility might reflect only the direction and not the intensity of voter and candidate positions. With this in mind, the utility function of the *Matthews directional model* depends only on the angle between the voter and candidate location vectors which emanate from the neutral point. This utility varies from $+1$, when voter and candidate agree completely in direction, to -1 for complete disagreement. The origin, $\mathbf{0}$, is interpreted as the neutral point. The Matthews utility function captures the pure directional relation between voter and candidate locations without any intensity component. Thus, the Matthews utility function can be defined as the cosine of the angle between voter and candidate, or equivalently by the formula

$$U(\mathbf{V},\mathbf{C}) = \frac{\mathbf{V}\bullet\mathbf{C}}{|\mathbf{V}||\mathbf{C}|} = \cos\Theta \qquad (2)$$

where $|\mathbf{V}|$ and $|\mathbf{C}|$ are the lengths of the vectors $\mathbf{V}$ and $\mathbf{C}$, respectively, and Θ is the angle between $\mathbf{V}$ and $\mathbf{C}$. If either $\mathbf{V}$ or $\mathbf{C}$ is 0, the utility is defined to be 0.[5] Hence the RM utility defines a mixed model, of which the Matthews directional function represents the pure directional component.

In contrast to the directional models, the *Downsian proximity model* (the traditional spatial model) specifies that utility is a declining function of distance from voter to candidate. We will consider the formulation in which that function is quadratic, i.e.

$$U(\mathbf{V},\mathbf{C}) = -|\mathbf{V}-\mathbf{C}|^2. \qquad (3)$$

The indifference (hyper)plane is the perpendicular bisector of the segment joining the candidates.

B. The Unified Model

Pure models have a number of implausible implications, e.g. the RM model implies that sometimes candidates may not vote for themselves and the one-dimensional Matthews model implies indeterminacy when both candidates lie on the same side of the neutral point. Similarly, the most basic proximity model does not appear to predict the prevalence of divergence observed in real campaign strategy; while the RM model appears to over-

5. In the Matthews (1979) formulation of this pure directional model, all voters and candidates are restricted to the unit sphere (with the exception of totally indifferent voters at the origin). With an eye to our unified framework in section II, we permit voters and candidates to assume any position in space but define utility in terms of the normalized positions, $\mathbf{V}/|\mathbf{V}|$ and $\mathbf{C}/|\mathbf{C}|$, so that political actors are assumed to behave *as if* they lay on the unit sphere. Under the Matthews directional model, voters respond as if all candidates were at equal distance from the neutral point. In one dimension, if both candidates are on the same side of N, voters vote for either candidate with probability 0.5.

predict it. These inadequacies motivate the development of a less restrictive model.

Moreover, we believe that it is reasonable to combine directional and proximity ideas in a single model, because voters may use proximity to evaluate some candidates (e.g. incumbents whose locations can be reasonably well identified in terms of their previous policies), but use direction of likely change to evaluate other candidates whose policy positions may not be so precisely identifiable (e.g. challengers without a track record). It is important to recognize that mixing directional and proximity ideas is not mixing apples and oranges, since these pure models can be shown to be arrayable on a single continuum, and thus distinguishable by a single parameter.

We offer a unified model with two components (parameters): (1) β, which defines a proximity versus directionality continuum anchored by the pure proximity (Downsian) model at one end and a directional/intensity (RM or Matthews) model at the other; and (2) q, which defines an intensity continuum anchored by the Matthews model at one end and the RM model at the other.

First we turn to an explication of the intensity factor, q. The RM utility is the product of a pure directional utility (the Matthews utility) and a pure intensity factor (the product of the lengths of the location vectors given by $|\mathbf{V}||\mathbf{C}|$), that is

$$U(\mathbf{V},\mathbf{C}) = \mathbf{V}\bullet\mathbf{C} = \left(\frac{\mathbf{V}\bullet\mathbf{C})}{|\mathbf{V}||\mathbf{C}|}\right)(|\mathbf{V}||\mathbf{C}|).$$

Both the RM and Matthews directional models can be embedded in a common one-parameter model whose utility function is the product of the purely directional Matthews utility and an intensity factor which involves the lengths of the location vectors. This combined utility function, defined by

$$U(\mathbf{V},\mathbf{C}) = \left(\frac{\mathbf{V}\bullet\mathbf{C}}{|\mathbf{V}||\mathbf{C}|}\right)([|\mathbf{V}||\mathbf{C}|]^{q}) \tag{4}$$

if $\mathbf{C} \neq 0$ and $\mathbf{V} \neq 0$, and 0 otherwise, will be referred to as the *damped directional* utility function. The first factor on the right is purely directional while the second reflects only intensity. Here q is interpreted as an intensity parameter and varies from 0 to 1. If $q = 0$, intensity has no bearing on utility and the damped model is the Matthews directional model. If $q = 1$, intensity is fully combined with direction and the RM model is defined. Relative to the RM model, the damped directional utility dampens the increase in the utility of candidates as they become more extreme.

For a one-dimensional model, Figure 1 compares several pure utility functions (RM, Matthews and proximity) with a damped directional utility ($q = 1/2$) as functions of the spatial position of the voter.

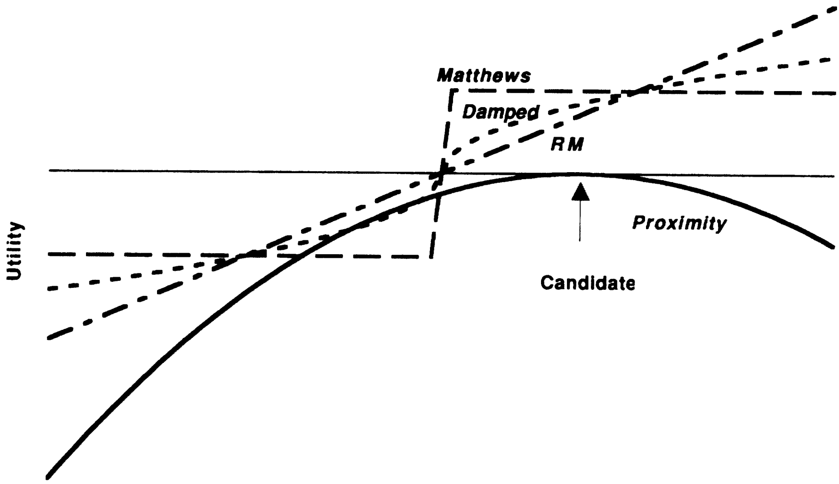

Figure 1. Utility as a Function of the Spatial Position of the Voter for (one-dimensional) Directional and Proximity Models

Clearer differences between the RM and Matthews models emerge in two (or more) dimensions. For the RM model, the elementary properties of the scalar product (see Merrill, 1993) imply that the indifference line (hyperplane in higher dimensions) between two candidates, **A** and **B**, is perpendicular to the line segment joining **A** and **B** and passes through the neutral point, **N** (see Figure 2a). In the Matthews directional model, however, the indifference line is perpendicular to the segment joining **A**/|**A**| and

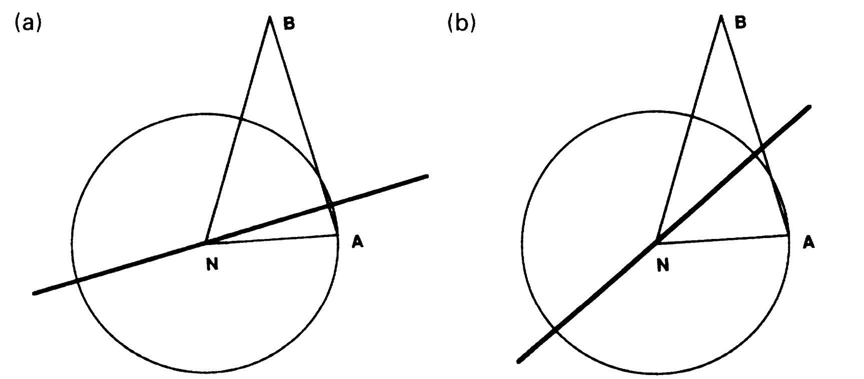

Figure 2. Indifference Lines under Alternative Directional Models. (a) RM Directional Model: Indifference Line is Perpendicular to $\overline{\mathbf{AB}}$; (b) Matthews Directional Model: Indifference Line Bisects Angle **ANB**

$\mathbf{B}/|\mathbf{B}|$. This segment is a chord of the unit circle (see Figure 2b) and the indifference line not only passes through **N** but also bisects the angle between **A** and **B** (i.e. the angle ANB in the two-dimensional diagram depicted in Figure 2b). For the damped directional model, indifference planes are intermediate between those for the pure models.

Now we turn to an explication of the proximity versus directional factor, β.

Beginning with the RM model, Iversen (1994) has argued that the restraint implicit in Rabinowitz and Macdonald's (1989) idea of a circle of acceptability can better be modeled by a function idiosyncratic to each voter. He suggests subtracting from the scalar product $\mathbf{V}\bullet\mathbf{C}$ that defines the RM utility function a quantity that grows slowly while **C** is near **V** but increases more rapidly when **C** is far from **V**, e.g. the quantity, $|\mathbf{V} - \mathbf{C}|^2$, which defines the proximity utility. This yields what we term the *RM model with proximity restraint* (called the representation policy leadership model by Iversen),[6] defined by the utility

$$U(\mathbf{V},\mathbf{C}) = 2(1-\beta)\, \mathbf{V}\bullet\mathbf{C} - \beta|\mathbf{V}-\mathbf{C}|^2 \qquad (5)$$

where the parameter, β, indicates the strength of the restraint. Note that if $\beta = 0$, then the last term of Equation 5 becomes zero, i.e. the proximity component of the voter utility function drops out. Mathematically, Equation 5 defines the 'mixed' RM and proximity model introduced by Rabinowitz and Macdonald (1989), with mixing parameter, β.[7]

Pulling together these two strands of generalization, we have a two-parameter *unified model*:

$$U(\mathbf{V},\mathbf{C}) = 2(1-\beta)\frac{\mathbf{V}\bullet\mathbf{C}}{|\mathbf{V}||\mathbf{C}|}\;[|\mathbf{V}||\mathbf{C}|]^q - \beta|\mathbf{V}-\mathbf{C}|^2 \qquad (6)$$

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6. As Iversen (1994) argues, the scalar product utility (which is proportional to candidate intensity) reflects policy leadership; the restraint (which drops off with the candidate's distance from the voter's ideal point) reflects representation. For a fixed voter position, utility under the directional model with proximity restraint is maximized for a candidate in the same direction as the voter but more extreme by the factor $1/\beta$. Thus, this model accounts for candidate behavior more extreme than that of proximity but less than that of the RM model. Iversen (1994) found, for example, that – for a large number of European parties – the mean position of a party's officials (assumed to represent true party position) tends to be about twice as extreme as the mean for the party's supporters. This would suggest a value of β in the vicinity of 0.5, if voters, on the average, choose parties of maximum utility.

7. The use of the constant, 2, permits the following simple and useful interpretation of the parameter, β, in the RM model with proximity restraint. When $\beta = 0$ we have the pure RM directional model; when $\beta = 1$ we have the pure Downsian proximity model; and, moreover, if $\beta = 1/k$ the best-fitting model has an indifference curve (plane) that is $1/k$th the way between the indifference planes of the two pure models. Values of $\beta > 1/2$ imply that we are closer to the proximity model than to the RM directional model; values of $\beta < 1/2$ imply that we are closer to the directional model.

where β is a mixing parameter and q is an intensity parameter. If $q = 1$, Equation (6) is equivalent to the RM model with proximity restraint.[8] If, furthermore, $\beta = 0$, Equation 6 defines the RM directional model. The combination of $\beta = 0$ and $q = 0$ specifies the Matthews directional model. If $\beta = 1$, a pure proximity model is defined. To better understand the relationships among the parameters, β and q, and the various models, the chart in Table 1 may be useful.[9]

Table 1. Parameter Values Defining Nested Models as Special Cases of the Unified Model

Model	β	q	d
Pure Proximity (Downs)	$\beta = 1$	inapplicable	$d = 1$
Pure Direction (Matthews)	$\beta = 0$	$q = 0$	inapplicable
Direction plus Intensity (RM)	$\beta = 0$	$q = 1$	inapplicable
Proximity plus Discounting (Grofman)	$\beta = 1$	inapplicable	$0<d\leq1$
Unified Model	$0\leq\beta\leq1$	$0\leq q\leq1$	$0<d\leq1$

III. Testing Alternative Models

A. Previous Research

Prediction of voter behavior may involve either (1) voter choice or (2) voter utility. Whom one votes for may be the ultimate question, but utility – which relates to enthusiasm for (or against) a candidate – has important secondary effects. For example, is the citizen motivated to vote and to participate in politics as an opinion leader, activist, or financial contributor?

8. A pure intensity model, without a directional component, makes no sense behaviorally and is not a special case of the model defined by Equation 6.

9. The *Grofman* (1985) *discounting model* modifies the standard proximity model by assuming that voters compare candidate claims with their perception of current policies, i.e. the status quo, **S**, and believe that a candidate, say **A**, will not actually implement policies at **A** but at an intermediate location $d\mathbf{A} + (1-d)\mathbf{S}$, where d is a discounting factor. If $\mathbf{S} = \mathbf{O}$, this model could be incorporated into Equation 6, by simply replacing the proximity term $|\mathbf{V}-\mathbf{C}|^2$ with $|\mathbf{V}-d\mathbf{C}|^2$ where d is the common discounting factor for both candidates (Table 1 incorporates the parameter, d, in the nesting of models).

Moreover, such participatory and contributory activities on the part of one voter may well influence how others vote.

A priori, proximity would appear more likely to be related to voter choice while intensity might be more likely to affect utility. Thus, we might think that the RM directional model would provide a better fit to voter utility functions than the pure proximity model, but the reverse might be true in predicting voter choices, although the evidence is much less clear.

For data from the US and Scandinavia, Rabinowitz and his colleagues generally find their directional model far superior in fit to the proximity model with respect to voter utility (Rabinowitz and Macdonald, 1989; Macdonald et al., 1991; Rabinowitz et al., 1991); however, other scholars who have done comparative testing of the two models for voter utility functions find the proximity model to yield a better fit (Platt et al., 1992; Westholm, 1997), or find a mixed model that combines directional and proximity elements to fit better than either pure model (Iversen, 1994; Merrill, 1994, 1995; Dow, 1997; Pierce, 1997). As we will show, the reasons for these differences are methodological and are described in detail later.

The Matthews model – either by itself or as part of a larger model – has to our knowledge not previously been fit to data on either voter choice or voter utility.

The comparative fit of a hybrid proximity model which includes non-issue-based candidate-specific components versus a Grofman discounting model is examined for US presidential choice data by Enelow et al. (1993). They find their hybrid model offers a marginally better fit than the pure discounting approach, but that the best fit comes from positing discounting of the position of the challenger but no discounting of the position of the incumbent. We return to this idea that different models may work best for different types of candidates below.

B. Testing the Proximity and Directional Models of Voter Utility within a Common (Nested) Statistical Framework

1. Measurement issues. Nested alternative models were operationalized using thermometer feeling scores (interpreted as utilities) and multidimensional model predictions based on respondent issue positions from the American National Election Studies (NES) for 1980–92. Respondents in NES provide voter self-placement and placements of candidates on seven-point scales that can be interpreted spatially for a number of issues.

Eight issues were available in 1980, 1984 and 1988 and five in 1992. Responses were obtained on seven-point scales in all four NES studies for liberal-to-conservative placement (L/C), government services, defense spending and government responsibility for jobs. Responses were also obtained in 1980, 1984 and 1988 for government effort for blacks (called minority aid in 1980) and US attitude toward Russia; in 1980 for inflation/ unemployment and women's rights; in 1984 for government effort for women and US involvement in Central America; in 1988 for women's role and national health care; and in 1992 for abortion. Scales were reversed when necessary so that '1' represents the most liberal and '7' the most conservative position on each issue. The four-point abortion scale in 1992 was expanded to a seven-point range. All scales were shifted in order to be centered at zero.[10]

Computation of model utilities can be performed using either individual placements of candidates or the mean candidate placement of the set of respondents. Individual placement has been used by Markus and Converse (1979: 1065) for the proximity model and Krämer and Rattinger (1997), Merrill (1995) and Dow (1997) in the comparison of models, whereas mean placement has been used by Rabinowitz et al. in a number of papers referenced earlier. Iversen (1994) uses mean self-placements by party officials as a measure of true party position. Pierce (1997) compares results from both scoring methods as do Merrill (1995) and Krämer and Rattinger (1997).

As noted earlier, whether the proximity model or the RM model is found to have the better fit to voter utility functions appears to depend heavily on which method is used. Yet, it would seem obvious that a voter's evaluations are more closely attuned to the voter's own assessment of a candidate's position than to the national mean placement which is not known to the voter. As Dow (1997) points out, spatial utility theory requires that a voter's issue position be compared with his/her perception of a candidate's issue position, not with someone else's perception of that position.

Use of mean placements biases the results in favor of a directional model, as explained in Merrill (1995), because random guessing by uninformed voters tends to draw mean placements toward the neutral point,

10. Following Markus and Converse (1979), Rabinowitz and Macdonald (1989) and Merrill (1995), scalar products and quadratic distances were normalized – for each voter – by dividing by the number of issues with usable data. This maximizes the number of usable cases, by including cases with incomplete data, while at the same time weighting all cases equally. Respondents were restricted to those who reported voting for one of the two major candidates and could place themselves and the Democratic and Republican nominees on the seven-point liberal/conservative scale (and who did not place the Democrat to the right of the Republican). Respondents placing the Democrat to the right of the Republican were omitted because of apparent misunderstanding of the meaning of the scale. Partial analysis with all respondents included suggests that this omission has little effect on the results (see also Dow, 1997).

accounting for much of the disparity in results between researchers who do or do not use mean placements. If computation is based on the mean, thermometer scores of voters who place themselves between the mean placement of the candidate and their own placement of the candidate may appear to correlate well with directional predictions but poorly with proximity predictions because the mean misspecifies candidate position as viewed by the voter.

However, use of individual placements has its own bias, in favor of the proximity model, because a voter may place a favored candidate near his/her self-placement on the issue scales (Markus and Converse, 1979; Page and Jones, 1979). This issue of projection is a point that Rabinowitz and Macdonald have emphasized. If faced with a choice between mean and individual placements, we prefer the latter for the reasons discussed earlier. But it would be better still to present results based on individual placements with adjustment for projection. In the following tables, we do just that. The details of this adjustment are given in Section C along with a comparison of the effects of individual and mean placements and placements adjusted for projection.

2. Comparing correlations from alternative models of voter utility. We begin with a preliminary analysis of the relation between model predictions and thermometer scores via Pearson correlation coefficients. In Table 2 we use individual placements of candidate positions that have been adjusted for projection in a fashion described in Section C later. Table 2 shows that the mean correlations for the three separate models – proximity, RM and Matthews – do not differ greatly overall, but mean correlations (using paired, two-tailed t-tests, which control for candidate identity) are significantly higher for the directional models than that for proximity ($p = .01$ for the RM model and $p = .001$ for the Matthews model). They are also significantly higher for the Matthews model than the RM model ($p = .05$). However, the best-fitting unified model (see later) yields higher correlations than each pure model ($p \leq .001$ in each case).[11]

When the candidates are broken down between incumbents and challengers, however, somewhat different patterns begin to appear. The advantage of the Matthews model over the RM model is greater among the incumbents (mean model difference in correlation = .032) than among challengers (.005),[12] although the significance level for the comparison t-test is only .07. By contrast, the advantage of the RM model over proxim-

11. An RM model with proximity restraint yields intermediate correlations.
12. George Bush in 1988 represented the incumbent party.

Table 2. Correlation between Model Predictions and Thermometer Scores using Projection Adjusted Placements of Candidates for the 1980–92 American National Election Studies

	1980 (n = 430)		1984 (n = 1091)		1988 (n = 930)		1992 (n = 901)		Means		
Model	Carter	Reagan	Reagan	Mondale	Bush	Dukakis	Bush	Clinton	Incumbents	Challengers	All
Proximity (quadratic)	.455	.609	.702	.517	.596	.558	.592	.548	.586	.558	.572
Rabinowitz–Macdonald	.516	.670	.703	.602	.606	.627	.588	.594	.603	.623	.613
Matthews directional	.550	.694	.725	.584	.651	.649	.613	.584	.635	.628	.632
RM with proximity restraint	.521	.682	.729	.613	.637	.639	.612	.605	.625	.635	.630
Unified model	.552	.702	.755	.627	.669	.667	.633	.612	.652	.652	.652

ity is apparent among all four challengers, but – with the exception of Carter in 1980 – not among the incumbents. In fact, the mean difference in correlation between the RM and proximity models for challengers is .065, significantly higher than the corresponding value for incumbents, .017 (the p-value for the difference-in-means t-test is .03). We will return to this incumbency effect later.

3. Comparing alternative models of voter utility via non-linear regression. The significance of nested models can be tested with a non-linear regression relating thermometer scores to voter issue positions via the unified model defined by Equation 6. Through maximum likelihood estimation (see Dixon, 1990: 921–58), we can find the best fitting value of the intensity parameter, q, that is used to distinguish between the RM and Matthews directional models and the mixing parameter, β, that specifies the mix of proximity and directional components. We propose to test several hypotheses involving the two-parameter unified model. Rejection of the hypothesis $\beta = 0$ would imply a proximity component; rejection of $\beta = 1$, a directional component. Rejection of both would imply a mixed directional and proximity model. A significant intensity component would be implied by rejection of $q = 0$. If one or more of these hypotheses is rejected, we wish to use the size of the parameter estimates in an exploratory sense to assess the extent of mixing of the various pure models and to investigate possible incumbency effects.

Table 3 provides estimates for the intensity parameter, q, and the mixing parameter, β, based on the four NES studies conducted in 1980–92. Table 3 uses the same information as that used to obtain the correlation coefficients reported in Table 2 and likewise reports data from individual candidate placements corrected for projection effects.

In the unified model with parameters β and q, the small values of q for the four incumbents (for none of whom is $q = 0$ rejected at the .05 level) support the Matthews model with little need for an intensity component. Since, also, $\beta = 0$ and $\beta = 1$ are rejected for three of the four incumbents, the utility functions of incumbents appear primarily as Matthews directional with proximity constraint.[13] For each of the four challengers, however, the hypothesis, $q = 0$, is rejected ($p < .001$), suggesting that – for challengers – both pure directional and pure intensity factors play a role,

13. Note, however, that the standard errors for q are quite large and that the locations of indifference curves are not linear functions of q.

Table 3. Parameter Estimates for the Directional/Intensity/Proximity Unified Model Using Projection Adjusted Placements of Candidates for the 1980–92 American National Election Studies

	1980 (n = 430)		1984 (n = 1091)		1988 (n = 913)		1992 (n = 890)	
Parameter	Carter	Reagan	Reagan	Mondale	Bush	Dukakis	Bush	Clinton
Unified model (projection-adjusted placements)								
q	.11	.28**	.11	.53**	.17	.31**	.13	.51**
	(.16)[a]	(.11)	(.09)	(.08)	(.09)	(.08)	(.13)	(.13)
β	.04	.05	.14**	.10**	.10**	.07**	.15**	.15**
	(.04)	(.03)	(.02)	(.03)	(.02)	(.02)	(.04)	(.05)
Standardized regression coefficients by component:								
Proximity	.07	.10	.32	.13	.21	.12	.25	.16
Directional	.50	.62	.47	.53	.49	.57	.41	.48
RM with proximity restraint (projection-adjusted placements)								
β	.19	.28**	.42**	.22**	.42**	.25**	.46**	.30**
	(.10)	(.08)	(.05)	(.05)	(.06)	(.05)	(.07)	(.07)

[a] Standard errors are in parentheses.
* Significantly different from 0 at the .05 level. ** Significantly different from 0 at the .01 level.

again constrained by a proximity term.[14] The mean estimate of q for challengers is significantly higher (.41) than that for incumbents (.13), with a p-value for the comparison test of .01.

Direction and intensity appear to better predict voter utilities for challenging candidates. Voters are more likely to have only a vague, directional

14. We emphasize that, when the model includes the intensity factor, the value of β loses the simple interpretation it has in an RM model with proximity restraint. For six of the eight candidates, however, rejection of the hypotheses, β = 0 and β = 1, implies statistical significance of the marginal addition of the proximity or directional component to the model; the two other candidates are those in the 1980 race, which has an unusually low sample size. Thus, a mixed model is preferred over either pure model. The small values of β, however, do not imply that proximity plays a smaller role than direction or intensity in explaining utility. A rough assessment of the relative importance of the proximity and directional components can be made by performing a linear regression with thermometer score as dependent variable and with

$$X_1 = -|\mathbf{V}-\mathbf{C}|^2 \quad \text{and} \quad X_2 = 2\frac{\mathbf{V}\bullet\mathbf{C}}{|\mathbf{V}||\mathbf{C}|}[|\mathbf{V}||\mathbf{C}|]^{\hat{q}}$$

as independent variables, where $\hat{q}$ is the estimate for q obtained by non-linear regression. Comparison of the standardized regression coefficients obtained gives an approximate measure of the relative roles of the two components. The results suggest a larger contribution by the directional component. This preference may be overstated, however, since other proximity utility functions (such as the linear form) outperform the quadratic form (see Westholm, 1997).

idea of their stance on issues, while incumbent positions are often uncomfortably cast in stone. Thus, intensity is more important in utility formation for challengers than for a 'known quantity' in the White House.

Previous research has considered the RM model with proximity restraint without a parameter for intensity (effectively, $q = 1$). Under this assumption, our estimates of the mixing parameter, β, range from .19 to .46 with both $\beta = 0$ and $\beta = 1$ soundly rejected in all cases ($p < .01$), except for Carter in 1980 (see Table 3). This implies that the marginal addition of either the proximity or directional component at this stage is statistically significant. Since β can be interpreted in this model as the proportional position of the indifference plane between its position under RM and under proximity (see Merrill, 1993), we may infer support for a model intermediate between these two, i.e. for Iversen's (1994) representation policy leadership model.

In this reduced model, the mean estimate of the mixing parameter, β, for challengers (.26) appears lower than that for incumbents (.37), although the significance level for the comparison test is only .14. Clearly, it is the value for Carter in 1980 that does not fit the pattern; that value has high uncertainty due to the small number of usable cases in that year.[15] In general this limited model, which lumps together intensity and direction, fails to delineate the incumbency effect with the clarity apparent in the unified model.

In summary, the non-linear regression analysis supports and extends the results suggested by the correlation analysis. On the one hand, for challengers, the intensity aspect of the RM model augments the Matthews directional model, whereas, for incumbents, intensity plays little or no role. On the other hand, the proximity constraint is an essential component of voter utility, especially for incumbents.

C. The Nature and Magnitude of Projection Effects

The extent to which projection – the tendency of respondents to place favored candidates near themselves – occurs can be assessed by decomposing the variance of candidate placement over voters. In a one-dimensional model, if V denotes the respondent's self-placement and $\overline{C}$ denotes the mean candidate placement, the effect of projection might be expected to be proportional to $(V-\overline{C})$ for a favored candidate and the negative of this quantity for a disfavored candidate.

Such an analysis was performed by Markus and Converse (1979), who employed the thermometer score less 50 to distinguish between favored

15. Further analysis, based on an expected value version of Westholm's (1997) adjustment for interpersonal comparisons, suggests that the β estimate for Carter in 1980 may be higher. A fuller treatment of this adjustment will be carried out in a subsequent paper.

and disfavored candidates. They found that projection, although statistically significant, accounted for from near zero to only 8 percent of the variation over five issues and two candidates in the 1976 NES data set.

We performed a similar analysis for the eight presidential nominees in the 1980–92 NES data, using placements on the liberal–conservative (L/C) scale for V and C and reported vote choice as the determinant of favored/disfavored status.[16] Although again statistically significant, the projection factor was found to explain only 6 to 18 percent of the variance of candidate placement. These consistently small values – over several elections and issues – suggest that projection constitutes only a small part of variation in candidate placement over voters. Still, conceivably, projection effects might have a more sizeable impact on measures of the relative contributions of the proximity and directional models.

In an attempt to neutralize the effects of projection, we adjusted each respondent's placement of a candidate by subtracting the regression term obtained earlier by regressing C on $(V-\bar{C})$.[17] In other words, we deleted from the respondent's candidate placement our best estimate of the respondent's projection.

To see how much it matters for us to have reported data in a form that had been corrected for projection effects, we provide in Table 4 comparisons of estimates for the intensity parameter, q, and the mixing parameter, β, for individual placements and mean placements, as well as for projection-adjusted rescoring of individual placements, so that we can readily compare the three bases of estimation.[18] Table 4 also provides estimates of the projection parameter: the greater the magnitude of this parameter, the greater the projection effect. The mean projection parameter estimate for the challengers is higher (.24) than that for the incumbent nominees (.18), although the difference-in-means test is not statistically significant (p =.25). Projection may be greater when voters assess challengers without established presidential records.

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16. Thus, for example, projection for Reagan is expected to be positive (i.e. in the conservative direction) for a voter who reports voting for Reagan and places herself more conservative than Reagan's mean placement. Projection for Mondale is expected to be negative (i.e. in the liberal direction) for a voter who reports voting for Mondale and places himself more liberal than Mondale's mean placement. We have used vote choice rather than thermometer score to specify candidate support since otherwise the thermometer score would appear on both sides of the regression equation in our adjusted analysis, rendering the statistical results meaningless.

17. To be precise, using the entire sample of respondents, we fitted the model $C = \beta_0+\beta_1(V-\bar{C}) + \epsilon$, then replaced C by $C-\hat{\beta}_1(V-\bar{C})$, where $\hat{\beta}_1$ is the estimate for $\hat{\beta}_1$. For simplicity, the projection parameter estimate, β_1, was based on the liberal/conservative scale; the replacement was applied to all issue scales.

18. Dow (1997) obtains similar estimates for mean and individual scoring but does not adjust for projection.

Table 4. Comparative Parameter Estimates under Different Scoring Methods: 1980–92 American NES

Candidate Placement	1980 Carter	1980 Reagan	1984 Reagan	1984 Mondale	1988 Bush	1988 Dukakis	1992 Bush	1992 Clinton
Estimates for the intensity parameter, q, in the Unified Model								
	(n = 430)		(n = 1091)		(n = 913)		(n = 890)	
Individual	−.13	.26	.05	.44	.12	.14	.06	.40
Mean	−.03	.72	.54	.49	.30	.13	.67	.71
Projection-adjusted	.11	.28	.11	.53	.17	.31	.13	.51
Estimates for mixing parameter, β, in the RM Model with Proximity Restraint								
	(n = 430)		(n = 1095)		(n = 932)		(n = 901)	
Individual	.37	.28	.52	.25	.44	.34	.57	.55
Mean	.24	.16	.13	.09	.13	.13	.04	.20
Projection-adjusted	.19	.28	.42	.22	.42	.25	.46	.30
Estimates for projection parameter								
	.28	.16	.15	.28	.13	.25	.16	.25

In the unified model, the incumbency pattern for the intensity parameter, q, is obscured when using mean placements, but is apparent for individual placements whether adjusted for projection or not (see Table 4). Projection-adjusted estimates for β in the unified model are generally intermediate between those (not shown) for the other two scoring methods.

For the RM model with proximity restraint, a pure RM model corresponds to $\beta = 0$ whereas $\beta = 1$ defines a pure proximity model. Estimates of β using mean placements are much lower than those for individual placement. Rabinowitz and Macdonald (1989) present (the reciprocals of) these estimates (which they refer to as *model ratios*) for several NES data sets through 1984, and conclude a strong preference for the RM model (their estimates of .12 for Reagan and .10 for Mondale in 1984 are similar to ours; their values of .38 for Carter and .09 for Reagan in 1980 are somewhat different due to different numbers of cases used). Note that this preference is heavily dependent on their use of mean candidate placements. Projection-adjusted estimates of β, while uniformly lower than those based on individual placement, are much nearer the individual placement values than the mean-placement estimates. Table 4 also reveals that the pattern related to incumbency is obscured in the estimates based on mean placements, but emerges clearly for individual placements, especially after projection adjustment.

Now we move away from issues having to do with the shape of voter utility functions and turn to the question of voter choice.

D. Voter Choice

The models studied here are much less able to discriminate between voter choice than between the shape of utility functions. This is to be expected in contests between only two candidates, particularly ones in which the candidates are perceived to be at comparable distances from the neutral point. In such a case, the indifference lines for the various models are nearly coincident.

To assess voter choice, a logistic regression model was fit with voter choice as the dependent variable and the difference between the model-predicted utilities of the two candidates as independent variable. A respondent was classified as predicted to vote for a candidate if the probability of voting for that candidate as predicted by the logistic equation exceeded 0.5. Table 5 presents the results (based on logistic regression) for correct prediction of voter choice in 1980–92. The predictive performance of the various models for voter choice is very similar: no preference for either the proximity, RM or Matthews model appears ($p>.50$ in each case) when means are compared.

Table 5. Correct Model Predictions of Voter Choice in Percent Using Projection Adjusted Placements: American NES 1980–92

	1980 (n = 430)	1984 (n = 1095)	1988 (n = 932)	1992 (n = 901)
Proximity model	84	88	88	88
RM model	88	86	87	84
Matthews model	87	86	88	84
RM model with proximity restraint	87	88	88	88

IV. Discussion

There are a number of new and potentially significant results presented in this paper. In general, we have shown how to embed four different (pure) models of voter choice, the Rabinowitz–Macdonald directional/intensity model, the Matthews pure directional model, the standard Downsian proximity model and the Grofman discounted proximity model in a common geometric and nested statistical framework, where two or three parameters capture the differences among the various models and allow us to specify a very general class of hybrid models. In the process of developing our unified model we have separated the directional and intensity components of the Rabinowitz–Macdonald directional model, with a variant of the model in Matthews (1979) best thought of as embodying a pure directional model. The modeling of voter choice as reflecting some combination of proximity, directionality and perhaps also intensity effects, as well as the incorporation of Grofman's (1985) idea of discounting into a unified spatial framework, offers, we believe, an important theoretical extension of the existing literature on formal models of voter choice. Moreover, we also offer new ideas on how to measure the significance of projection effects.

On the empirical side, we have been able to provide a test of our unified model with data from the 1980, 1984, 1988 and 1992 American NES. Even from the simplified operationalizations of the various models that we conducted without any attempt to extract underlying ideological dimensions (see Enelow and Hinich, 1994; Hinich and Munger, 1994), it appears quite clear that voter utilities have both directional and proximity components and that intensity plays a role for challengers but perhaps not for incumbents.

The paper also provides an explanation for the contradictory results of earlier research in assessing the relative predictive power of the proximity and RM models for the shape of voter utility functions, offers important new results on the magnitude of projection and its effects on parameter estimation, and provides evidence supportive of the view that the same model may not be best at explaining both voter evaluations of challengers and voter evaluations of incumbents.

Finally, this paper offers strong support for the need to distinguish carefully between the value of different models in terms of whether they help us explain the shape of voter utility functions as opposed to whether they help us explain voter choice. Although voter *utilities* differ substantially over models, regions in which voter *choice* differs may be small in elections with a pair of candidates placed roughly symmetrically with respect to the neutral point, as in most US presidential elections.

But this by no means implies that the distinction between models and their components is unimportant. If intensity is significant in the formation of voter utilities for a challenger, that candidate is likely to respond by adopting strong stands. At the same time an incumbent – whose intensity appears to have much less effect on voter opinion – may be motivated to move to the center.

Further work is needed to test the unified model with additional data sets, both US and non-US, including replicating earlier studies using our new more general statistical model.[19] In future empirical testing, it may be useful to concentrate on the particular subsets of voters and on the characteristics of candidates or parties for whom different models would predict

19. Also, because we did not have a good operationalization of **S**, the status quo point, whose location is critical to the Grofman discounted proximity model, we have not really been able to offer a fair test of the comparative power of the Grofman variant of the proximity model vis a vis the other models. Of necessity, in effect, we took **N** and **S** to be identical.

different behavior.[20] Theoretical work also needs to be done concerning the strategic behavior of candidates when they are evaluated by different models in the same election. Moreover, it would be useful to explore alternative explanations of why voter utility functions might include an intensity-related component.

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