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Simulating Models of Issue Voting

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How should one analyze data when the underlying models being tested are statistically intractable? In this article, we offer a simulation approach that involves creating sets of artificial data with fully known generating models that can be meaningfully compared to real data. The strategy depends on constructing simulations that are well matched to the data against which they will be compared. Our particular concern is to consider concurrently how voters place parties on issue scales and how they evaluate parties based on issues. We reconsider the Lewis and King (2000) analysis of issue voting in Norway. The simulation findings resolve the ambiguity that Lewis and King report, as voters appear to assimilate and contrast party placements and to evaluate parties directionally. The simulations also provide a strong caveat against the use of individually perceived party placements in analyses of issue voting.

1 Introduction

Theory testing using statistical methods requires a clear correspondence between theory and statistical technique. Often, however, conventional statistical methods are not well suited to evaluating a particular theory (Signorino 1999). Sometimes this problem can be solved by developing a model-specific method that allows for meaningful parameter estimation and statistical testing. Sometimes the problem is difficult or impossible to solve because of the complexity of the theoretical model or models under consideration.

In this article, we employ a simulation strategy that can be useful for comparing models that are not readily amenable to standard statistical testing. Our use of the method is motivated by a desire to shed new light on the controversy between the directional and proximity models of issue voting. That substantive question is the central focus of this work. The method, however, is of interest in its own right, and one of our goals is to illustrate its potential.

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Substantively, it matters whether an electorate evaluates parties and candidates using the proximity model or the directional model. The proximity model implies success for relatively centrist parties and candidates, particularly in two-party systems. In contrast, the directional model is more favorably disposed to off-center but non-extreme parties and candidates.

These are not the only two models competing to explain voter behavior on the basis of issues. Of recent interest are the strategic decision model of Kedar (2003, 2005) and the discounting model of Adams, Merrill, and Grofman (2005). Notably, both these models have considerable overlap with directional and proximity theory, falling broadly in the domain of mixed directional–proximity models. Both models are more congenial to directional outcomes, but the individual-level motivations are more in line with proximity reasoning. In focusing on the directional versus proximity debate, our investigation will be relevant to all the major models of issue voting and evaluation.

Empirical analyses comparing the directional and proximity models, even those using identical data, have led to divergent conclusions (Macdonald, Listhaug, and Rabinowitz 1991; Westholm 1997, 2001; Macdonald, Rabinowitz, and Listhaug 1998, 2001; Merrill and Grofman 1999; Lewis and King 2000; Kedar 2005). To clarify the basic rationale underlying these varying interpretations, Lewis and King (2000) developed a statistical model designed to show the effect of different assumptions on conclusions. The Lewis and King analysis focused on the two issue voting models in isolation, without considering other factors that might influence empirical results. Yet, a good deal of the directional versus proximity controversy has centered on the question of how voters perceive and place parties and candidates on issue scales. It seems necessary, then, to combine the issue voting models with models of party placement. The resulting models are complex and cannot be readily analyzed by traditional methods. By simulating data that reflect this complexity, we can investigate these models in a meaningful way.

2 Systemic Versus Individual Motivation

We begin by developing a distinction that is critical to any serious consideration of issue voting models. The distinction is between what we will call *systemic motivation* and *individual motivation*. Consider this straightforward question: What is the object (either party or candidate) to which the voter is expected to react? In a *systemically motivated model*, political objects (parties or candidates) have issue strategies that are independent of idiosyncratic voter perception. This suggests that the party or candidate's issue position can be described as either a point or a distribution of points. What is critical from a systemic perspective is that the object of evaluation is the same object across voters or identifiable subsets of voters. In contrast, *individually motivated models* define the political object in terms of each individual's perception of that object.

To make the distinction clear, let us consider two unidimensional models, one of which is systemically motivated and the other individually motivated. An example of a *systemically motivated model* is the classic unidimensional spatial model based on distance (e.g., Downs 1957). In this model, the utility of a party for a voter is a monotonic function of the distance of the party from that voter: $U_{ij} = f(-|v_i - p_j|)$, where U_{ij} is the utility of party j for voter i, and v_i and p_j are the voter and party positions, respectively, and f is a monotone function. In two-party competition, the equilibrium behavior of this model is well known. The party that adopts the position of the median voter is guaranteed to do no worse than a tie, and the position of the median voter is the equilibrium strategy.

The second model makes a simple but critical change. Rather than the party having a fixed position across voters, party position is determined by voter perception. In writing

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the utility function for the new model, we just add a subscript to party position reflecting the fact that where the party stands depends on where the voter perceives it to stand: $U_{ij} = f(-|v_i - p_{ij}|)$. Notice that in this *individually motivated model*, the logic switches from parties to voters. A party does best if each voter perceives the party at his or her own position. The proof is trivial: when $v_i = p_{ij}$, then $-|v_i - p_{ij}| = 0$. This maximizes the function and guarantees the party no worse than a tie with the voter. Since this logic applies to all voters, the party is guaranteed either victory or a tie.

Of the two models, the classic spatial formulation with fixed party locations is more interesting politically because it links voter preferences to party positions and, in turn, to government policy. A model whose equilibrium entails each voter perceiving the party at his or her own position has a certain farcical quality. The strategy a party should follow to seek the equilibrium position is difficult to describe, and the model offers no link between voter preferences and future policy. The model incorporating individual perception, however, might seem more behaviorally realistic since people are usually expected to act based on their perceptions. Nevertheless, we take it as a basic assumption that theoretical models of issue voting take on interest because of their systemic properties. In this regard, we observe that both the proximity and directional models are systemically motivated, and our simulations will be as well.

3 The Simulations

3.1 *Basic Goals*

We use the simulations to pursue two distinct and somewhat independent goals. The first is to understand the relationship between the generating models of the simulations and the parameter estimates produced by a conventional statistical method. Do the parameter estimates reasonably reflect the underlying decision model, or are the parameter estimates distorted? And if distorted, in what way? We will use the Lewis and King (2000) method because it effectively distinguishes all the relevant parameters associated with a distance-based decision rule.

The second goal is more directly substantive. Each of the simulated data sets will have a known generating model, and we can examine how the data behave when analyzed. In the case of real data, of course, the generating model is unknown. But given a set of competing generating models and a corresponding set of real data, we can reasonably ask: Which of the generated data sets behaves most like the real data? If one of the data sets does behave most like the real data, that will provide evidence that it is most likely to be the "true" generating model.[1]

3.2 *Design*

The simulations follow a two-factor design in which one factor is the model that determines party evaluation—either the proximity or the directional model—and the other is the model that determines individual perception of parties—either linear scale transformation or assimilation and contrast. Table 1 shows the design of the simulations and the four patterns that result. We will run 500 replications of each of the four patterns. Now let us consider the structure of the simulations in detail.

[1]This can be seen as a simple application of Bayes' theorem. Assuming that the competing models are equally likely and exhaustive, $\Pr(\text{model}_k|\text{data}) = \Pr(\text{data}|\text{model}_k)/\Sigma_i \Pr(\text{data}|\text{model}_i)$, where i goes from 1 to n, the number of models.

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Table 1 Basic design of the simulations

	Placement model	
Evaluation model	*Linear scale*	*Assimilation–contrast*
Proximity	Simulation 1 Linear scale Proximity	Simulation 2 Assimilation–contrast Proximity
Directional	Simulation 3 Linear scale Directional	Simulation 4 Assimilation–contrast Directional

3.3 *Voter and Party Distributions*

The first step in constructing the simulated data sets is determining the basic parameters of the voter and party distributions: How many issues? How many voters? How many parties? And, most critically, where the voters and the parties are located on the issues. This requires both decisions and assumptions. To position voters, it is common to assume some standard probability distribution, such as the multivariate normal or uniform distribution, and to decide arbitrarily on the number of voters, parties, and issues. We take a different approach here. We base the simulations directly on the location of voters and parties in the real data of the 1989 Norwegian Election Study.

Using real data as the basis for voter and party locations has substantial advantages over the more conventional distributional strategy. On most issues, voters are not located consistent with any classic distribution, and the actual distribution tends to vary considerably from issue to issue. How correlated one issue is with another also tends to vary from issue pair to issue pair. Allowing voters and parties to follow a "natural" distribution avoids these arbitrary decisions.

Norway provides an excellent case to examine since it is a reasonably typical European multiparty democracy. It has a proportional representation system of government in which parties receiving approximately 4% nationally can achieve representation in the Storting, the Norwegian parliament. Norway is a moderately fragmented political system, ranking eighth of the 16 European countries on an index of party fragmentation (Lane and Ersson 1987). Competition is lively, with control of the government very much in doubt in each of the recent elections.

In 1989, the Norwegian Election Study undertook a unique data collection in which respondents were asked to place all seven of the electorally competitive parties on a large set of issue scales.[2] Because of its unusual features, the Norwegian Study has served as a data source for a host of researchers investigating issue voting in multiparty systems (Macdonald, Listhaug, and Rabinowitz 1991; Westholm 1997, 2001; Macdonald, Rabinowitz, and Listhaug 1998, 2001; Merrill and Grofman 1999; Lewis and King 2000; Kedar 2003, 2005).[3] Thus, we simulate the various models using as a foundation the data set that has been the venue for many of the analyses shaping the issue voting debate.

[2]Respondents were asked to place the Socialist, Labor, Liberal, Center, Christian, Conservative, and Progressive parties. The set of issues included left–right, agricultural support, environmental protection, regulation of immigration, regulation of alcohol, and privatization of health care. For a full description of the variables, see Macdonald, Listhaug, and Rabinowitz (1991).

[3]For detailed analyses of the 1989 Norwegian election, see Aardal (1990) and Valen (1990).

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Relying on real voter locations in no way undermines the logic of the simulations. Although the location of each voter is taken from the Norwegian survey, the simulated voters *place* the parties and *evaluate* the parties strictly in accordance with the rules of the simulation. The fact that they begin by looking like real voters does not alter the degree to which their behavior is controlled—it just gives the simulations greater verisimilitude.

The most serious potential criticism of using real respondent data as the foundation for the simulation is that it may not be sufficiently general. This criticism is surely valid but would be equally valid for any simulation strategy. As soon as one arrives at a particular set of assumptions for defining a population of voters and parties, one is limited by those assumptions. It would, of course, be possible to add a good deal of complexity to the simulations and include voter and party locations from other countries as alternative frames or to construct several artificial distributions as a third factor in the simulations. In the end, however, the exact structure of the distributions would still limit the generalizability of the simulations. The great virtue of the strategy we employ is that it gives the simulations an empirical foundation that will allow us to compare results based on the simulated data with results based on the real data.

3.4 *Models of Party Evaluation*

The first factor distinguishing the simulations is the model that determines the evaluation of the parties based on issues. This is either the proximity or the directional model. The exact mathematical form of each model appears in Appendix A.

3.4.1 Proximity Model

In the proximity model, voters like parties whose issue positions are close to their own and dislike those whose positions are far away.[4] Because there are a variety of distance functions, there are a variety of ways to implement the proximity model. In Appendix A, we operationalize the proximity model using squared Euclidian distance, the quadratic form of the model. This is consistent with the classic Davis, Hinich, and Ordeshook (1970) presentation of the model as well as the logic underlying the Lewis and King (2000) method.[5]

3.4.2 Directional Model

In the directional model, voters like parties that agree with them on the issues and dislike parties that disagree with them. Each issue is conceived as having two sides and a neutral center. A voter's response to a party on any given issue is based on the simple product of the voter and party positions. The product is positive when the voter and party are on the same side of the issue and negative when they are on opposite sides. The magnitude of the product increases as the voter and party take more intense positions. Parties that exceed an overall intensity threshold are penalized. Thus, voters in directional theory are stimulated to support (or oppose) parties that provide intense cues, whereas parties are constrained in their overall intensity by the need to appear responsible. Mathematically, the sum of the set

[4]This intuitively attractive view of issue-based evaluation has been criticized as demanding too much information from voters (e.g., Stokes 1963; Rabinowitz and Macdonald 1989).

[5]To check the sensitivity of the results to the form of the proximity function, we replicated all simulations and analyses using a city-block metric. The form of the metric does not influence the results we report in any substantively meaningful way.

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of products is frequently labeled the *scalar product*, and the region of the space that is free of penalty is called the *region of responsibility*.[6]

3.5 *Models of Party Placement*

The second factor distinguishing the simulations is the model of party placement. Two theories that explain the different placement of parties on issues have received considerable attention in the literature. One theory is based on the view that individuals have different interpretations of the issue scales and the other that individuals adjust their perceptions to conform more closely with their evaluations.

3.5.1 Linear Scale Transformation

Several scholars have advanced the idea that the issue scales are sufficiently ambiguous that respondents are likely to interpret them differently, leading to different placements of a given party even when respondents perceive the party identically (Achen 1975; Aldrich and McKelvey 1977; Hinich and Pollard 1981; Enelow and Hinich 1984; Krosnick 1990; Hinich and Munger 1994; King et al. 2003).[7] The most direct application of this idea is the model of Aldrich and McKelvey (1977) in which each individual linearly transposes the scale to fit his or her own interpretation of it. Some respondents might shift the scale to the right (or left), sliding all the parties in that direction. Some respondents see the endpoints as very far apart and thus place all the parties toward the center; still others see the endpoints as less remote and place the parties more distally, stretching the scale out. The critical idea underlying the linear scale transformation model is that all individuals share a common view of each party's position on each issue but differ in terms of how they interpret the scale on which the parties are placed.

In the simulations, the single common scale is established based on the mean location of each party on each issue scale. We then estimate for each respondent in the survey a shift parameter and an expansion/contraction parameter on each issue (so long as the respondent placed at least five of the seven parties on the issue). The simulated voters are then assigned their party placements based on these estimates.

The estimating equations appear in the top section of Appendix B. All estimation is done using ordinary least squares with the restriction that the expansion/contraction coefficient be greater than or equal to 0. This restriction is imposed to avoid scale reversals that would put parties of the left on the right and vice versa.

With 1702 respondents and six issues and seven parties, this procedure requires the estimation of over 20,000 parameters and over 70,000 party placements. An important caveat in this regard is that we are able to estimate these parameters in Norway because most respondents placed all seven parties on an issue, and seven parties provide reasonable information for estimating two parameters. In countries with fewer parties, the estimates could quickly become trivial as the number of parties approached the number of parameters to be estimated.

[6]The threshold component of directional theory has been criticized by some scholars (e.g., Iversen 1994; Westholm 1997) but is consistent with the qualitative distinction between party types common in the comparative literature (e.g., Lipset and Rokkan 1967; Sartori 1976). In the United States, the fate of candidates such as Goldwater in 1964 and McGovern in 1972 seem also to suggest a threshold effect.

[7]Each of the issue scales goes from 1 to 10 with labels at the endpoints. The environment question, for example, is worded as follows: "Value 1 denotes the wish to give much more priority to the protection of the environment, even if it leads to a considerably lower living standard for everyone, including yourself. Value 10 denotes the position that protection of the environment should not go so far that it hurts our standard of living. Where would you place yourself on this scale? Where would you place the various parties on such a scale?"

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3.5.2 Assimilation and Contrast

From the earliest studies of elections (e.g., Berelson, Lazarsfeld, and McPhee 1954; Campbell et al. 1960), scholars have recognized that voters tend to misperceive candidate and party positions to fit their political preferences. Even on an issue as partisan and well publicized as the Taft-Hartley Act was in 1948, respondents were remarkably inclined to say whichever party they favored was on their side of the issue (Berelson, Lazarsfeld, and McPhee 1954). The 1968 American National Election Study was the first national survey explicitly to ask respondents to place parties and candidates on issue scales. In analyzing those placements, Page and Brody (1972) found a clear tendency for people who liked a party to view the party as closer to their own position than the party's actual position warranted (assimilation) and for people who disliked a party to perceive the party as farther away (contrast). This result has been replicated in the United States and several other countries using a variety of methodological approaches (e.g., Kinder 1978; Granberg and Holmberg 1988; Visser 1994; Merrill, Grofman, and Adams 2001).[8]

To estimate the degree of assimilation and contrast, we follow the basic approach established by Markus and Converse (1979). The equations we use appear in the bottom portion of Appendix B. The degree of assimilation or contrast is a function of the product of the distance of the respondent from the party's "true" (mean perceived) position and the respondent's affect for the party. In general, the assimilation component of the model is intuitively appealing since respondents are expected to draw parties toward themselves more if the parties are far away than if they are already close. The contrast component of the model has been criticized for implying little change in perception when an individual is close to the true position of a party yet dislikes the party (Judd, Kenny, and Krosnick 1983; Macdonald and Rabinowitz 1997). No alternative formulation, however, has gained acceptance. Therefore, we simply distinguish the effects by estimating separate assimilation and contrast parameters and make no effort to correct for the almost certain underestimation of the degree of contrast. With six issues and seven parties, there are 42 base location estimates (the α terms), 42 assimilation coefficients, 42 contrast coefficients, and 42 error terms, for a total of 168 parameters.[9]

The logic of assimilation and contrast hinges on the idea that perception is conditioned by evaluation. The causal logic is also consistent with the fact that evaluation is a normal human process—people regularly evaluate parties and candidates—whereas the placement of parties on issue scales is a task imposed on subjects by researchers. Typically, respondents have already formed their evaluations of the parties before they are asked to place them.

A caveat is in order before leaving this section. We do not presume to argue that either the linear scale or the assimilation and contrast models is "correct" in some generic sense. The explicit critique we introduce of the contrast formulation should make that clear. Nevertheless, the models of scale transformation and assimilation and contrast that we use are consistent with how these phenomena have been broached in the literature and they provide a means to estimate the parameters of the simulation in a well defined way that preserves a clear link to the behavior of real data. Despite underestimating some effects,

[8]The view that individuals distort information to conform to prior preferences is not reserved to scholars analyzing candidate and party placements on issues. The ideas of assimilation and contrast are associated with Heider's (1946, 1958) balance theory, Festinger's (1957) cognitive dissonance theory, and Kunda's (1990) theory of motivated reasoning. Over the last half century, social psychology has provided consistent support for the view that cognition is distorted to fit existing preferences and world views.

[9]The parameter estimates are available on the *Political Analysis* Web site.

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the simulations should be both more realistic and less arbitrary than ones less firmly tied to an empirical base.

3.6 *Evaluation Equations*

Consistent with the logic of the other components of the simulation, the equations used to produce evaluations are based on comparable equations estimated directly from the 1989 Norwegian Election Study. The equations appear in Appendix C. The coefficients in the linear scale simulations are based on analyses that use perceived position to locate the parties, whereas those in the assimilation and contrast simulations use mean party placements. The coefficients in Simulation 1, for example, duplicate those recovered from the Norwegian data when party evaluation is predicted by the squared distance between the respondent's position and the respondent's perception of the party's position on each issue. In the assimilation and contrast case (Simulation 2), mean party placements are used instead of individual perceptions. In the directional simulations, the directional model simply replaces the proximity model in defining the independent variables.

With the evaluation equations established, the simulations should be fully replicable.[10] In considering the simulation structure, it is important to appreciate that the parameters in each phase of the simulations are based on empirical estimates rather than arbitrarily determined. This applies to both the perception models and the evaluation models, so the simulations should have high verisimilitude.

4 Analyzing the Simulation Data

The simulations create four artificial worlds: one world in which citizens transform the issue scales and make their decisions according to the proximity model (linear scale proximity), a second world in which citizens follow the proximity model but assimilate and contrast their party placements (assimilation contrast proximity), a third world in which citizens transform the issue scales and use the directional model to make their decisions (linear scale directional), and a fourth world in which citizens follow the directional model but assimilate and contrast their perceptions (assimilation contrast directional). In each world, 1702 subjects place the seven political parties on the set of six issues and evaluate each of the parties. We replicate each simulation 500 times. To analyze these data, we will use the Lewis and King (2000) method. Before reporting the analysis, it is useful to review the method briefly.

4.1 *Lewis and King Method*

The Lewis and King method is motivated by the fact that the squared Euclidean distance between a voter and a party can be decomposed into three components: the sum of the products of the voter and party positions, often called the *scalar product*; the squared distance of the voter from the center of the issue space, which we call the *voter extremity*; and the squared distance of the party from the center of the issue space, which we call the *party extremity*. Below, we show a direct decomposition of the squared Euclidean model followed by the Lewis and King formulation:

$$-\text{Squared Euclidean} = -\sum_{k=1}^{n_{\text{issues}}} b_k(v_{ik}-p_{jk})^2 = -\sum_{k=1}^{n_{\text{issues}}} [-b_k 2 v_{ik} p_{jk} + b_k v_{ik}^2 + b_k p_{jk}^2]. \qquad (1)$$

[10]The STATA code is available on the *Political Analysis* Web site.

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$$\text{Lewis and King} = \sum_{k=1}^{n_{\text{issues}}} [b_{sp,k}(2v_{ik}p_{ijk}) + b_{v,k}(-v_{ik}^2) + b_{p,k}(-p_{ijk}^2)]. \quad (2)$$

Notice that there are two differences between the Lewis and King formulation and the direct expansion of the squared Euclidean proximity model. The first and most obvious is that a separate parameter is estimated for each of the three components of the model: b_{sp}, b_v, and b_p. The second is that party location is determined by each individual voter's perception: p_{ijk} instead of p_{jk}. Thus, parties do not have fixed positions in the Lewis and King model. In light of our earlier distinction, the Lewis and King model is individually motivated, whereas the simulations are systemically motivated.[11]

In order to consider all possibilities, our analyses will incorporate both fixed and individual placements of the parties. The use of individual placements is consistent with the linear scale perception model, whereas the use of mean placements is consistent with the assimilation and contrast models. In analyzing the simulated data, we want to pretend that we are investigating real data and do not know how the data were generated. For real data, we would not know whether voters used linear scale perception or assimilation and contrast, and, of course, we would not know whether they based their evaluations on proximity or directional considerations.

Given the close link between the Lewis and King model and squared Euclidean distance, it follows directly that if voters use proximity logic in evaluating parties, the three parameters of the model will be approximately equal: $b_{sp} \approx b_v \approx b_p$. The Lewis and King model is also consistent with directional theory when no party in the system lies outside the region of responsibility. Then $b_{sp} > 0$ and $b_v \approx b_p \approx 0$. When a party is located outside the region, however, the statistical model is misspecified because it fails to take into account the penalty. Although the exact effects are unknown, we would expect the party extremity coefficients to be greater than 0: $b_p > 0$. In the Norwegian case, two of the seven parties are thought to lie outside the region of responsibility: the Progressive Party and the Socialist Left (Macdonald, Listhaug, and Rabinowitz 1991). Consistent with the theoretical model, a penalty is imposed on each of these parties in the directional simulations (see Appendix C).

5 Results

The simulated data are analyzed in three ways. First, we consider the evaluations of all seven parties using individual placements of the parties on the issues. Second, we repeat the same analysis, but this time locating the parties at their mean placements. Third, we base the analysis on just the five parties within the region of responsibility using individual placements. This is to observe how the simulated directional data behave when there are no party penalties to influence evaluation. For completeness, we perform the same analysis on the proximity data as well. It is impossible to use mean (fixed) placements with six issues

[11] Allowing for estimates with both fixed and individual placements is consistent with the design of the simulations. In the case of linear scale transformation, the use of individual placements is consistent with a systemic approach because the underlying party location is fixed and individuals only manipulate the issue scales. In the case of assimilation and contrast, however, the use of individual placements is strictly inappropriate because the placements are influenced by the voter's evaluation of the party and thus introduce endogeneity.

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and five parties, so there is no comparable analysis using mean party locations with the five parties.[12]

5.1 *Parameter Estimates*

Table 2 displays the results of predicting party evaluation based on issues for each of the simulations. It also replicates the results of the Norwegian Election Study that appeared in Lewis and King (2000). At the moment, let us focus exclusively on the simulation results on the left side of the table.

The table entries are unstandardized ordinary least squares (OLS) coefficients obtained by regressing party evaluation on the three components of squared Euclidean distance. The coefficients displayed in the table are the average values across the 500 replications of each simulation.

The first set of results belongs to the linear scale proximity model with the analysis based on individual placements. Here we see that the three b-coefficients are equal. Comparing the values of the coefficients to the actual generating parameters shown at the bottom of the table, we find that the recovery is virtually perfect. This is not surprising as the analysis is consistent with the way the data were generated—individual placements determine party locations in the linear scale model. When mean placements are used instead, the estimates are somewhat distorted. Still the average coefficients conform well to the proximity model.

When perceptions are formed through assimilation and contrast, the coefficients of the proximity model are no longer equal. The distortion occurs because the analytic model assumes the independent variables are exogenous when in fact the individual placements are influenced by the respondent's evaluation of the party. The analysis based on the means is better in this case.[13]

Continuing across the top row of the table, we come to the directional models. In the seven-party analyses, neither of the directional models matches the assumptions of the method because two of the parties are penalized. As we suspected, including parties with penalties in the analysis produces significant party extremity coefficients. This is true for both the linear scale and the assimilation and contrast models. Nevertheless, the scalar product and voter extremity coefficients seem reasonable in each case.

We can remove the confounding effects of the penalty by restricting the analysis of the directional simulations to the parties within the region of responsibility. With five parties, the recovery is flawless in the linear scale directional simulation. This is the one instance in which the analytic method is well matched to the data generation process in a directional simulation. With no party penalties influencing evaluation and with linear scale perception, the results are exactly as Lewis and King suggest: $b_{sp} > 0$ and $b_v \approx b_p \approx 0$. With assimilation and contrast, however, the coefficients are seriously distorted. In the directional simulation, five of the six party extremity coefficients are statistically significant

[12]Estimation of the $b_{p,k}$ coefficients is logically impossible (because of perfect collinearity) when the number of issues exceeds the number of parties; even when the number of parties exceeds the number of issues, estimates are generally unstable because of the high degree of collinearity that is present. In addition, fixed party locations foreclose the use of party dummy variables to account for idiosyncratic characteristics of parties that might affect their evaluation. Lewis and King (2000, p. 28) document these problems when they discuss the method. This does not mean, however, that estimation of the other parameters is impossible. In fact, it is quite fine to include dummy variables for $N - 1$ parties and to estimate the scalar product and the voter extremity parameter when each party is located at a single fixed position.

[13]The use of the means does not provide a precise match because the "true" values used in the simulation are not entirely replicated when the mean party placements are calculated with the simulated data. Still the fit is reasonably close.

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Table 2 Predicting party evaluation based on issues: full sets of coefficients from the simulated and Norwegian data[a]

	Linear scale proximity			*Assimilation–contrast proximity*			*Linear scale directional*			*Assimilation–contrast directional*			*Actual Norwegian data*		
Issue	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p
Individual placements used to locate parties—7 parties															
Left–right	*0.44*	*0.44*	*0.44*	0.42	0.42	0.29	0.62	−0.03[b]	0.15	0.58	−0.10	0.26	0.64	−0.15	0.32
Agriculture	*0.19*	*0.19*	*0.19*	0.23	0.21	0.13	0.22	0.00[n]	0.07[c]	0.23	0.02[b]	0.14	0.22	−0.03[b]	0.28
Environment	*0.20*	*0.20*	*0.20*	0.24	0.15	0.09	0.25	−0.02[b]	0.02[b]	0.26	0.04[b]	0.10	0.23	0.04[b]	0.13
Immigration	*0.08*	*0.08*	*0.08*[c]	0.15	0.11	0.19	0.18	−0.00[b]	0.29	0.25	−0.01[b]	0.17	0.16	−0.10	0.29
Alcohol	*0.19*	*0.19*	*0.19*	0.22	0.19	0.11	0.23	−0.00[b]	0.04[b]	0.21	0.01[b]	0.09	0.24	−0.08[c]	0.28
Health	*0.18*	*0.18*	*0.18*	0.23	0.18	0.13	0.23	−0.02[b]	0.06[c]	0.26	−0.00[b]	0.11	0.23	0.04[b]	−0.23
Average coefficient	*0.21*	*0.21*	*0.21*	0.25	0.21	0.16	0.29	0.01	0.11	0.30	−0.01	0.15	0.29	−0.05	0.18
(average SE)	*(0.02)*	*(0.03)*	*(0.04)*	(0.01)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)	(0.01)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)
Adjusted *R*-square	0.32			0.36			0.34			0.40			0.44		
Mean placements used to locate parties—7 parties															
Left–right	0.56	0.61	0.46	*0.58*	*0.60*	*0.52*	0.74	0.13[c]	−0.16[b]	0.82	0.00[b]	0.04[b]	0.90	0.02[b]	−0.46
Agriculture	0.20	0.19	0.16[b]	*0.23*	*0.23*	*0.18*	0.23	−0.02[b]	0.17[c]	0.23	0.00[b]	0.11[b]	0.25	−0.03[b]	−0.17[c]
Environment	0.18	0.20	0.04[b]	*0.13*	*0.12*	*0.09*[b]	0.24	−0.05[b]	0.15[b]	0.20	−0.00[b]	0.16[b]	0.18	0.01[b]	−0.26[c]
Immigration	0.18	0.06	0.36[b]	*0.14*	*0.14*	*0.23*[b]	0.26	−0.03[b]	0.42[c]	0.35	0.00[b]	0.74	0.35	0.02[b]	2.78
Alcohol	0.19	0.19	0.13[b]	*0.22*	*0.22*	*0.18*	0.24	−0.00[b]	−0.12[b]	0.22	−0.00[b]	0.08[b]	0.29	−0.09	−0.31
Health	0.20	0.22	0.13[b]	*0.20*	*0.20*	*0.13*[b]	0.26	0.01[b]	0.17[c]	0.23	−0.00[b]	0.09[b]	0.25	0.11	−1.47
Average coefficient	0.25	0.25	0.21	*0.25*	*0.25*	*0.22*	0.32	0.01	0.20	0.34	−0.00	0.20	0.37	0.01	0.02
(average SE)	(0.02)	(0.03)	(0.12)	*(0.02)*	*(0.03)*	*(0.13)*	(0.02)	(0.03)	(0.12)	(0.02)	(0.03)	(0.13)	(0.02)	(0.03)	(0.11)
Adjusted *R*-square	0.27			0.26			0.31			0.31			0.36		

Continued

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Table 2 (continued)

	Linear scale proximity			*Assimilation–contrast proximity*			*Linear scale directional*			*Assimilation–contrast directional*			*Actual Norwegian data*		
Issue	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p
Individual placements used to locate parties—5 parties															
Left–right	*0.44*	*0.44*	*0.44*	0.46	0.42	0.26	*0.64*	*−0.00*[b]	*0.00*[b]	0.58	−0.06[b]	0.21	0.73	−0.06[b]	0.14
Agriculture	*0.19*	*0.19*	*0.19*	0.23	0.23	0.11	*0.20*	*0.00*[b]	*−0.00*[b]	0.23	0.04[b]	0.11	0.25	0.04[b]	0.20
Environment	*0.20*	*0.20*	*0.20*	0.30	0.19	0.06	*0.24*	*−0.00*[b]	*−0.00*[b]	0.31	0.08	0.09	0.20	0.08[c]	0.19
Immigration	*0.08*	*0.08*	*0.08*	0.23	0.09	0.05[b]	*0.22*	*0.00*[b]	*−0.00*[b]	0.28	−0.00[b]	0.04[b]	0.14	0.05[b]	0.09[b]
Alcohol	*0.19*	*0.19*	*0.19*	0.22	0.19	0.07	*0.22*	*−0.00*[b]	*0.00*[b]	0.22	0.02[b]	0.06[b]	0.27	−0.09	0.21
Health	*0.18*	*0.18*	*0.18*	0.27	0.20	0.08	*0.24*	*0.00*[b]	*0.00*[b]	0.29	0.02[b]	0.06[c]	0.25	0.07[c]	−0.32
Average coefficient	*0.21*	*0.21*	*0.21*	0.29	0.22	0.11	*0.29*	*0.00*	*0.00*	0.31	0.02	0.09	0.31	0.02	0.08
(average SE)	*(0.03)*	*(0.04)*	*(0.06)*	(0.02)	(0.03)	(0.03)	*(0.03)*	*(0.04)*	*(0.06)*	(0.03)	(0.03)	(0.03)	(0.02)	(0.04)	(0.04)
Adjusted R-square	0.18			0.29			0.19			0.29			0.36		
The generating coefficients in each simulation															
Left–right	0.44	0.44	0.44	0.60	0.60	0.60	0.64	0.00	0.00?	0.85	0.00	0.00?			
Agriculture	0.19	0.19	0.19	0.23	0.23	0.23	0.20	0.00	0.00?	0.23	0.00	0.00?			
Environment	0.20	0.20	0.20	0.12	0.12	0.12	0.24	0.00	0.00?	0.20	0.00	0.00?			
Immigration	0.08	0.08	0.08	0.14	0.14	0.14	0.22	0.00	0.00?	0.36	0.00	0.00?			
Alcohol	0.19	0.19	0.19	0.22	0.22	0.22	0.22	0.00	0.00?	0.24	0.00	0.00?			
Health	0.18	0.18	0.18	0.20	0.20	0.20	0.24	0.00	0.00?	0.22	0.00	0.00?			
Average coefficient	0.21	0.21	0.21	0.25	0.25	0.25	0.29	0.00	0.00?	0.35	0.00	0.00?			

Note. Entries are unstandardized OLS coefficients obtained by regressing party evaluation on the three components of squared Euclidean distance (see text and Lewis and King 2000). The coefficients displayed are the average values across 500 replications of each simulation. Italicized entries indicate that the simulation model that generated the data closely matches the assumptions of the Lewis and King statistical method used to analyze the data.

[a]All unmarked coefficients are significant at the .01 level.

[b]Not significant at the .05 level.

[c]Significant at the .05 level, but not at the .01 level.

0.00? unknown in seven party simulations, and 0.00 in five party simulations.

despite the fact that the distance of the party from the center of the issue space played no role whatsoever in determining party evaluation in the directional simulation. These party effects can only be artifacts produced by the assimilation and contrast of party placements.

5.1.1 Inferential Errors

We have italicized the four analyses in which the assumptions of the Lewis and King method are consistent with the data generation in the simulations. As we have seen, the coefficients recovered in these analyses are perfect or near perfect. But what happens when the assumptions of the analytical method do not match the generating model and the estimates are distorted? Can we still discern how the voters were making their decisions?

Researchers often use one of two approaches to infer the model underlying the data in studies of issue voting (see Lewis and King 2000). One approach focuses on the scalar product and the *voter extremity* coefficient, whereas the other relies on the scalar product and the *party extremity* coefficient. Let us see how each would work with the simulations.

Across all 12 analyses, comparing the average scalar product to the average *voter extremity* would always produce the correct inference. It would suggest a proximity interpretation whenever the data were generated by the proximity model and a directional interpretation whenever the directional model generated the data. Indeed, in most instances, the average b_{sp} is about equal to b_v in the proximity simulations and b_{sp} is much greater than b_v in the directional simulations.

The serious distortions—from the standpoint of identifying the correct model—are associated with the *party extremity* coefficient. In the assimilation and contrast simulations, notice how difficult it would be to tell the proximity model and the directional model apart based on the party extremity and the scalar product. In the seven-party analyses, the somewhat large party extremity coefficients in the directional simulations might be a consequence of party penalties. Quite surprising, however, are the rather low party extremity coefficients in the proximity simulations. In generating the proximity evaluations, the three coefficients were exactly equal.

The party extremity coefficients are better behaved in the analyses using mean party placements. The directional coefficients are hard to assess because of the party penalties, but on the proximity side, on average, the party extremity coefficients are quite close to both the scalar product and voter extremity coefficients. They do, however, have high standard errors.

The five-party analyses are especially revealing because they remove the confounding influence of parties outside the region of responsibility in directional theory. Again, notice the coefficients associated with the assimilation and contrast models. If the focus is on the scalar product and party extremity, the proximity and directional models are simply indistinguishable: $b_{sp} = 0.29$ and $b_p = 0.11$ versus $b_{sp} = 0.31$ and $b_p = 0.09$. Although each set of evaluations was generated exactly in line with a pure model type and no party penalties are now in play, the results based on the scalar product and party extremity look like they come from a mixed proximity-directional model. Yet, this seemingly obvious conclusion would be wrong, and badly wrong, in each case.

We have learned some valuable lessons. We cannot expect the coefficients of a proximity model to be equal if voters rationalize their perceptions. We cannot expect $b_p = 0$ in directional models if penalized parties are included in the analysis. Even restricting the analysis to parties within the region, we cannot expect $b_p = 0$ in the presence of assimilation and contrast. And, perhaps most striking, the results from entirely opposing models can look the same if one focuses on the party extremity and the scalar product.

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5.2 *Analyzing the Norwegian Data*

Now that we have analyzed the data from our four artificial worlds, we are ready to turn to the real world. The data come from the Norwegian Election Study of 1989. Lewis and King analyzed these data in their article of 2000, and we have reproduced their results at the far right of Table 2.[14] Let us quickly review the actual findings.

With seven parties using individual placements, the average coefficients are $b_{sp} \approx 0.29$, $b_v \approx -0.05$, and $b_p \approx 0.18$—a large scalar product, a small voter extremity, and a medium party extremity. Recall that Lewis and King were expecting $b_{sp} \approx b_v \approx b_p$ for the proximity model and $b_{sp} > 0$ and $b_v \approx b_p \approx 0$ for the directional model. Thus, the results were a muddle.

With seven parties using mean placements, the average coefficients look decidedly directional with values of 0.31, 0.01, and 0.02. But the average party extremity coefficient of 0.02 masks the fact that some of the individual coefficients have strange and significant values. The five-party analysis returns average coefficients of 0.31, 0.02, and 0.08. Although these appear more directional than proximity, there are still significant party extremity effects that cannot be explained by parties outside the region of responsibility.

Lewis and King presented the results as a puzzle that could not be solved with the data at hand. In the end, the authors concluded that the findings were too ambiguous to support either model.

5.3 *Insights from the Simulations*

So: Do the Norwegian results resemble those of any of our four simulated data sets? To facilitate comparison, Table 3 displays just the average coefficients from the simulations and the Norwegian data.

It is immediately apparent that the proximity model could not have generated the Norwegian evaluations. Even allowing for the most generous of confidence intervals, the very small voter extremity coefficients (b_v) could not have come from proximity generated data. From a statistical standpoint, if the proximity model accounted for party evaluation, the probability of obtaining the Norwegian results would be effectively 0.

The evidence is less clear-cut between the linear scale and assimilation and contrast models of party placement, but the tie is readily broken when we look at the five parties within the region of responsibility. Here the linear scale coefficients (b_v and b_p) are consistently close to 0, whereas the assimilation and contrast coefficients are not—and the Norwegian coefficients are not. Thus, the results from the assimilation and contrast simulations provide a better match. To answer the question—which of the four simulated data sets most closely corresponds to the behavior of the real data?—it is the data set generated using directional theory for evaluations and assimilation and contrast for perceptions.

This is true based on the average coefficients in Table 3 and also true based on the full set of coefficients in Table 2 above. Going coefficient by coefficient and calculating the squared difference between the simulation coefficients and the coefficients from the Norwegian data, the results are always more favorable to the assimilation and contrast directional model. The values are displayed in Table 4. The differences are dramatic when the voter extremity coefficients are in play, and the pattern continues to hold even when they are not.

The ambiguity Lewis and King found based on their criteria for interpretation is resolved when we compare the Norwegian results to those of the simulated data.

[14]The information in Table 2 is identical to that reported in Lewis and King (2000) or consistent with reports in the footnotes when the results were not directly shown. We have computed the average coefficients.

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Table 3 Average coefficients from both the simulated and Norwegian data

	Linear scale proximity			*Assimilation–contrast proximity*			*Linear scale directional*			*Assimilation–contrast directional*			*Actual Norwegian data*		
	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p	b_{sp}	b_v	b_p
Individual placements used to locate parties—7 parties															
Average coefficient	*0.21*	*0.21*	*0.21*	0.25	0.21	0.16	0.29	0.01	0.11	0.30	−0.01	0.15	0.29	−0.05	0.18
(average SE)	*(0.02)*	*(0.03)*	*(0.04)*	(0.01)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)	(0.01)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)
Mean placements used to locate parties—7 parties															
Average coefficient	0.25	0.25	0.21	*0.25*	*0.25*	*0.22*	0.32	0.01	0.20	0.34	−0.00	0.20	0.37	0.01	0.02
(average SE)	(0.02)	(0.03)	(0.12)	*(0.02)*	*(0.03)*	*(0.13)*	(0.02)	(0.03)	(0.12)	(0.02)	(0.03)	(0.13)	(0.02)	(0.03)	(0.11)
Individual placements used to locate parties—5 parties															
Average coefficient	*0.21*	*0.21*	*0.21*	0.29	0.22	0.11	*0.29*	*0.00*	*0.00*	0.31	0.02	0.09	0.31	0.02	0.08
(average SE)	*(0.03)*	*(0.04)*	*(0.06)*	(0.02)	(0.03)	(0.03)	*(0.03)*	*(0.04)*	*(0.06)*	(0.03)	(0.03)	(0.03)	(0.02)	(0.04)	(0.04)

Table 4 Sum of squared differences between coefficients estimated using the simulated data and the Norwegian data[a]

Basis for calculation	*Linear scale proximity*	*Assimilation–contrast proximity*	*Linear scale directional*	*Assimilation–contrast directional*
Individual placements used to locate parties—7 parties				
b_{sp}, b_v, and b_p	0.85	0.77	0.27	0.23
b_{sp} and b_p only	0.32	0.26	0.23	0.21
Mean placements used to locate parties—7 parties				
b_{sp}, b_v, and b_p	10.34	11.20	8.75	7.29
b_{sp} and b_p only	9.81	10.66	8.71	7.26
Individual placements used to locate parties—5 parties				
b_{sp}, b_v, and b_p	0.82	0.69	0.30	0.27
b_{sp} and b_p only	0.44	0.31	0.27	0.25

[a]The lower the value of the sum, the closer the correspondence.

The evidence suggests that citizens in Norway evaluate political parties in very much the same way as citizens in our fourth artificial world—they follow directional theory and assimilate and contrast perceptions.

Naturally, one must be cautious in interpreting these findings. We developed four specific models, and the comparisons we make are among these four. Of course, there could be other models. What makes these four especially compelling, however, is that they represent both the directional and proximity models of issue voting and the two major models of party placement.

7 Discussion

Social scientists have long recognized that individuals rationalize perceptions. To avoid the endogeneity bias rationalization creates, researchers generally use fixed (mean or median) party or candidate placements (e.g., Iversen 1994; Alvarez and Nagler 1995, 1998; Alvarez 1997; Abramson, Aldrich, and Rohde 2006; Adams, Merrill, and Grofman 2005). That tactic is strongly supported by the simulations. If mean placements were used when, in fact, the generating model was based on individual placements, the estimates were occasionally off the mark but, on average, reasonably well behaved. The real problems arose when rationalized individual placements were used. Then the estimates were markedly distorted and, on average, substantially off target.

If there is widespread agreement in the research community that voters assimilate and contrast perception, why then do some researchers use individual placements? The first answer is that it is intuitively appealing to researchers who have an individual-level perspective. Their reasoning is that if this is where a party is perceived to stand by an individual, then that is how it must be incorporated in the analysis. The fact that where a party is perceived to stand might be a function of evaluation is simply assumed away or sometimes the researcher even acknowledges the potential endogeneity but argues that the effects will not be problematic (e.g., Westholm 2001; Kedar 2005). The estimates from the simulations, however, suggest that the effects are problematic—the parameters are distorted and not in intuitively obvious ways.

There are two other, more statistically motivated reasons for the use of individual perceptions. The first is that it allows estimation in some cases where model identification

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would be difficult or impossible if parties were located at fixed positions. For example, to estimate the Lewis and King model with fixed locations, there must be more parties than issues, and no party dummies can be included in the model. If either condition is violated, party extremity parameters cannot be estimated.

Let us now make a simple but important point. If parameters are not identified using fixed party positions, how does the introduction of individual perceptions identify the model? Clearly it is the *within*-party variation that provides the necessary information, not the variation *across* parties. A researcher may intend to ask: Does a party taking a more moderate position on an issue receive higher evaluations than a party taking a more extreme position? But, in fact, that researcher will be asking: Does a person who places Party X at a more moderate position like Party X more than a person who places Party X at a more extreme location? This within-party interpretation is not generally the goal when exploring the impact of party issue strategy on electoral outcomes. And even this narrower, within-party interpretation is compromised when perceptions are rationalized.

A final motivation for using individual perceptions is that the ability to explain evaluation or vote is enhanced when perceived positions are used to locate parties or candidates (e.g., Grynaviski and Corrigan 2006). In every analysis we performed, a good deal more variance was explained when we used individual rather than mean placements—and the increase was fairly dramatic in the assimilation and contrast simulations. Critically, that dramatic increase in explanatory power was a direct result of the endogeneity of individual perceptions. The estimated parameters were substantially different from those of the known generating models, whereas the analyses with lower fit values came much closer to recovering the actual coefficients. More important than apparent information gain is getting the model right.

If individuals in the real world did not rationalize perceptions, these results would have methodological interest but no substantive consequences. The evidence, however, from both the simulations and the wider scientific literature suggests that people do rationalize perceptions. This motivates a strong caveat against the use of individual placements in analyses of issue voting.

8 Conclusion

When Lewis and King (2000) compared directional and proximity theory, they concluded that the empirical findings were ambiguous. Based on one set of assumptions, the evidence favored directional theory; based on another set of assumptions, the evidence favored proximity theory. Inherent in the controversy was the question of how voters perceive parties and candidates on issues. But considering models of voter perception concurrently with models of party evaluation was simply a task that no standard statistical method could confront.

We broached this problem by using a simulation strategy to construct sets of artificial data with fully known generating models that could be meaningfully compared to real data. Critical to our analytic strategy was estimating the potentially arbitrary parameters of the simulation model from the actual data set of interest. This insured that the simulations had a high degree of realism and facilitated the comparison of the simulated data to the real data.

In essence, we created four artificial worlds that could then be compared to a real world. Of the four simulated data sets, the one that behaved most like the empirically collected data was the one in which voters evaluated parties directionally and rationalized perceptions. The ambiguity found by Lewis and King (2000) was entirely resolved when the voting model and perceptual model were considered simultaneously.

An offshoot of the simulation work is a strong caveat against the use of individually perceived party and candidate placements in voting models. In the simulations,

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serious inferential problems arose when party extremity coefficients were estimated using individual placements in the assimilation and contrast models. This occurred in both the directional and proximity cases. Simply put, the known generating parameters were systematically misestimated when the data were analyzed using a conventional statistical approach. Given the widespread evidence that voters rationalize placements, the direct use of perceptual data will almost surely lead to incorrect inference.

As political scientists deal with increasingly complex models, it will become increasingly difficult to deploy statistical methods that match the underlying assumptions of the theoretical models. When a researcher cannot confidently apply a statistical method, then simulating data and analyzing it along with the real data provides a valuable approach. If a set of competing models can be simulated in a highly verisimilar way, as we have done here, then there is a meaningful basis for empirical testing. Such high verisimilitude simulations strike us as a useful strategy for tackling problems that are theoretically well described but difficult to analyze statistically.

Appendix A: Mathematical Form of the Two Theoretical Models of Party Evaluation

Directional Model

Mathematically, the directional model is expressed as:

$$U_{ij}^{\text{dir}} \approx \sum_{k=1}^{n_{\text{issues}}} \beta_k (v_{ik} p_{jk}) - \text{penalty}_{ij},$$

where U_{ij} is the utility of party j for voter i, β_k is the importance of issue k in the election, v_{ik} is the centered position of voter i on issue k, p_{jk} is the centered position of party j on issue k, and penalty_{ij} is the penalty applied in directional theory to a party j by voter i if party j is located beyond the boundary of the region of responsibility. $\text{Penalty}_{ij} = 0$ when $\sum(p_{jk})^2 \leq r^2$ and $\text{penalty}_{ij} > 0$ when $\sum(p_{jk})^2 > r^2$, where $r > 0$ is a system-specific constant. Note: The centered position is computed as the deviation of the position from the center scale position. So, for example, on an issue scale that runs from 1 through 10, the center value is 5.5 and the centered values go from -4.5 to $+4.5$.

Proximity Model

Mathematically, the proximity model can be expressed in a variety of ways. Consistent with Lewis and King (2000), we use the quadratic form of the model:

$$U_{ij}^{\text{quadprox}} \approx -\sum_{k=1}^{n_{issue}} \beta_k (v_{ik} - p_{jk})^2,$$

where the notation is consistent with the directional model above.

Appendix B: Estimating Equations for the Linear Scale Transformation and Assimilation and Contrast Models

Linear Scale Transformation Estimating Equation

$$p_{ijk} = \alpha_{ik} + \beta_{ik} \bar{p}_{.jk} + \mu_{ijk},$$

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where p_{ijk} refers to voter i's perception of party j's position on issue k, $\bar{p}_{.jk}$ refers to the mean perception of party j on issue k across voters, α_{ik} and β_{ik} ($\beta_{ik} \geq 0$) are issue- and respondent-specific parameters, and μ_{ijk} represents random error.

Note that one equation of this nature is estimated for each respondent on each issue that the respondent has placed five or more parties. All estimation is done using OLS with the restriction that $\beta_{ik} \geq 0$, in order to preserve scale order. The predicted perceptions ($\hat{p}_{ijk}$) are then established as the ''real'' perceptions of the simulated respondents. Because there is a unique set of coefficients for each respondent with sufficient data, space considerations prevent their inclusion in the paper. They are available in the replication data set on the *Political Analysis* Web site.

Assimilation and Contrast Estimating Equation

$$p_{ijk} = \alpha_{jk} + \beta_{\text{assim}_{jk}}(v_{ik} - \bar{p}_{.jk}) \times \text{posaffect}_{ij} + \beta_{\text{contrast}_{jk}}(v_{ik} - \bar{p}_{.jk}) \times \text{negaffect}_{ij} + \mu_{ijk},$$

where α, β_{assim}, and β_{contrast} are issue- and party-specific parameters, and posaffect and negaffect represent the degree of positive or negative affect the respondent feels toward the party. To determine posaffect and negaffect, the rating scales are centered by subtracting 50 from the ratings so that a 0 value indicates that the respondent is neither favorable nor unfavorable to the party. If the centered value is 0 or above, posaffect is equal to that value; if it is less than 0, then posaffect is set equal to 0. If the centered value is less than 0, then negaffect equals that value; otherwise, negaffect is set equal to 0. The remaining terms are defined as in the linear scale perception model above.

The estimated coefficients $\hat{\beta}_{\text{assim}_{jk}}$, $\hat{\beta}_{\text{contrast}_{jk}}$, and the $\hat{\mu}_{ijk}$ magnitude of the error are all used in the simulation phase construction of assimilated and contrasted perceptions. The full set of estimated coefficients appears in the replication data set on the *Political Analysis* Web site.

Appendix C: Equations for Generating Party Evaluations and Assimilated and Contrasted Party Placements

Linear Scale

Simulation 1. Linear Scale Proximity Evaluation

$$\begin{aligned}\text{LinSimEval}_{ij}^{\text{squared Euclidean}} = 66.1 - [&0.44(\text{lfrt}_i - \text{lfrt}_{ij})^2 + 0.19(\text{agric}_i - \text{agric}_{ij})^2 \\ &+ 0.20(\text{envir}_i - \text{envir}_{ij})^2 + 0.08(\text{immig}_i - \text{immig}_{ij})^2 \\ &+ 0.18(\text{medic}_i - \text{medic}_{ij})^2 + 0.19(\text{alcoh}_i - \text{alcoh}_{ij})^2] \\ &+ \mu_{ij},\end{aligned}$$

where lfrt_i represents the position of subject i on the left–right issue, lfrt_{ij} represents subject i's perception of party j's position on left–right (these are the estimated perceptions), and each of the remaining issues is similarly defined. The issue scales are ''centered,'' so they range from -4.5 to $+4.5$. μ_{ij} is random normal with a mean of 0 and an SD of 19.6.

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Simulation 2. Linear Scale Directional Evaluation

$$\begin{aligned}\text{LinSimEval}_{ij}^{\text{directional}} = 50 &+ 1.27\text{lfrt}_i \times \text{lfrt}_{ij} + 0.39\text{agric}_i \times \text{agric}_{ij} + 0.49\text{envir}_i \\ &\times \text{envir}_{ij} + 0.43\text{immig}_i \times \text{immig}_{ij} + 0.47\text{medic}_i \times \text{medic}_{ij} \\ &+ 0.45\text{alcoh}_i \times \text{alcoh}_{ij} - 3.18\text{penalty}_j + \mu_{ij},\end{aligned}$$

where all the terms common to the proximity simulation equation above are identically defined. The penalty has a value of 0 for all parties except the Socialist Left and the Progressives, which have penalty values of 1.541 and 3.931, respectively. The penalty structure replicates Macdonald, Listhaug, and Rabinowitz (1991).

Simulation 3. Assimilation–Contrast Proximity Evaluation

$$\begin{aligned}\text{A}-\text{C}:\text{SimEval}_{ij}^{\text{squared Euclidean}} = 65.0 &- [0.60(\text{lfrt}_i - \overline{\text{lfrt}}_j)^2 + 0.23(\text{agric}_i - \overline{\text{agric}}_j)^2 \\ &+ 0.12(\text{envir}_i - \overline{\text{envir}}_j)^2 + 0.14(\text{immig}_i - \overline{\text{immig}}_j)^2 \\ &+ 0.21(\text{medic}_i - \overline{\text{medic}}_j)^2 + 0.22(\text{alcoh}_i - \overline{\text{alcoh}}_j)^2] \\ &+ \mu_{ij},\end{aligned}$$

where $\overline{\text{lfrt}}_j$ refers to the mean position of party j based on the actual election study, and μ_{ij} has a mean of 0 and an SD of 20.5. All other notation is identical to that in the linear scale equations above.

Simulation 4. Assimilation–Contrast Directional Evaluation

$$\begin{aligned}\text{A}-\text{C}:\text{SimEval}_{ij}^{\text{directional}} = 50 &+ 1.71\text{lfrt}_i \times \overline{\text{lfrt}}_j + 0.46\text{agric}_i \times \overline{\text{agric}}_j + 0.40\text{envir}_i \\ &\times \overline{\text{envir}}_j + 0.72\text{immig}_i \times \overline{\text{immig}}_j + 0.48\text{medic}_i \times \overline{\text{medic}}_j \\ &+ 0.44\text{alcoh}_i \times \overline{\text{alcoh}}_j - 3.67\text{penalty}_j + \mu_{ij},\end{aligned}$$

where all terms common to the proximity equation above are defined identically, and the penalty is defined as in the linear scale directional equation.

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