Norman Schofield · Gonzalo Caballero · Daniel Kselman *Editors*

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4 A Heteroscedastic Proximity Voting Model

The existing literature on assimilation and contrast has shown that reported proximity to parties is different for respondents that expect to vote for or against a party. We can go one step further and argue that a number of covariates will explain assimilation and contrast, compressing and stretching ideological distances as described in (4). Indeed, let us assume that magnification is the result of information processes that can be explicitly modeled with covariates.

As it is commonly done when estimating heteroscedastic discrete models (e.g., models in which the variance component is explained by covariates such as heteroscedastic probit models, negative binomial, etc.), we can assume that the level of magnification in ideological proximity can also be itself a function of other covariates. We can therefore use a placeholder parameter θ_{iR} in lieu of our magnification term, which will be used to assess the effect of variables that induce magnification:

$$\mathrm{U}(\mathrm{V_R}) = -\alpha \frac{(x_i - L_{iR})^2}{\exp(\theta_{iR})} + \mathbf{BZ}. \tag{5}$$

In (5) we have substituted the angular magnification estimate with the exponentiated parameter θ_{iR}, so that $\log(\theta_{iR}) \sim N(\mu_\theta, \sigma_\theta^2)$. Notice that if all covariates for the magnification equation have no effect, the $\exp(0) = 1$, and (5) will be reduced to the standard proximity model.

As in the case of a heteroscedastic choice model (Alvarez and Brehm 1995), the expression in (5) has the desirable feature of allowing us to model the variance as a linear function of a set of covariates. Yet different from a heteroscedastic model, the variance is only rescaling the ideological proximity measure. The second component of the model, **BZ**, is a vector of individual-specific controls which are unaffected by the covariates for the magnification. Since the variance applies only to distance, we label this a *heteroscedastic proximity model*.

By explicitly modeling the magnification in the ideological scale, (5) provides a means for testing arguments about which factors, both individual and systemic, shape the voter's capacity to "see clearly." In particular, this representation provides a novel way to bring in different candidate and voter attributes into the spatial model of the vote and, hence, gives us a strategy for incorporating those factors discussed in the introduction: non-proximal (directional) spatial components, candidates' valence characteristics, and voter attributions. Let's consider each of these in turn.

First, take directional effects. Directional models provide an alternative conception of how voters incorporate information on party positions. First proposed by Rabinowitz and McDonald (1989), the directional model has long been the chief rival to the proximity model from *within* the spatial modeling tradition. Like the Downsian proximity model, the directional model posits that voters obtain utility from candidates' positions on the issues. This utility is not gained by minimizing proximity but is a positive function of the candidate's distance from the voter. Specifically, when candidates are on opposite sides of the neutral point, N, directional voters prefer the candidate who advocates their side. In the context of American politics, voters select the larger from $(x_i - N)(L_{iR} - N)$ and $(x_i - N)(L_{iD} - N)$.

The explanatory power of directional models relative to the Downsian proximity model has been much contested, and with mixed results.[4] Tests of the two models, however, have compared them directly, with each component affecting voter utility directly and in additive fashion. Conclusions in favor of one or the other often hinge on how analysts measure voter utility or on which modeling assumptions are relaxed (see Lewis and King 1999). Mixed findings aside, directional and proximity effects are typically pitted against one another within the context of a mean model. Tests between rival models are thus on the order of a horse race between variables as analysts discern whether proximity of directional components carry greater weight. Our approach is different. It uses information on the extremity of where respondents place candidates as shaping the degree of angular magnification, rather than on affecting directly the choice model.

Next, consider valence. Our model of ideological lensing provides a new strategy for incorporating candidates' non-policy appeals. A great deal of recent scholarship has emphasized the importance of parties' non-positional related reputations with respect to competence, integrity, charisma, and the like (Adams et al. 2005; Clarke et al. 2009; Schofield and Sened 2006). These studies demonstrate that the inclusion of non-proximity components into the random utility model yields more complete models for understanding election outcomes and how party strategies respond to voter preferences. We build on this insight. However, rather than incorporating party valence advantages additively, we explore whether valence evaluations bias voters' perceptions of where the party is positioned in ideological space. We know from previous work that valence advantages allow parties to attain larger shares of the vote than they would as predicted solely by spatial considerations.[5] But voters' assessment of a party's location in policy space, on the one hand, and its valence (dis)advantage, on the other hand, are typically assumed to be unrelated to one another.[6] Further, the spatial modeling literature generally assumes that parties' valence advantages are identical across voters.

We relax these assumptions. We model the degree of bias in voter assessments of party positions as a function of the voter's perception of the party's valence appeals. We maintain that if a voter i views the image of a party R as proximally closer to her than R's actual location, then the degree of magnification, M, should decrease. With reference to (4), this makes it likely that $(x_i - L^*_{iR})^2 > (x_i - L_{iR})^2$. To the extent that reputational considerations are built on familiarity, this claim finds support in work on voter choice out of the behavioral tradition which shows that voters dislike

[4]Recent research, however, has used experimental designs to get around previous measurement problems and finds stronger support for the proximity view (Tomz and van Houweling 2008; Lacy and Paolino 2010). We take this as instructive evidence for using direction extremity to modify ideological lensing arising from proximity models, rather than the other way around.

[5]See especially Adams et al.'s (2005) unified model; also see Wittman (1983), Groseclose (2001), Calvo and Hellwig (2011).

[6]Something of an exception is Sanders et al. (2011) who model valence as a function of voter-party issue proximity, thus positing that spatial effects shape utility indirectly, through valence characteristics.

uncertainty and resist supporting parties they know little about (even if they share the party's policy preferences).[7] Parties who voters view as being more competent, trustworthy, charismatic, and the like, should receive a biased evaluation by the voter in positional terms (that is, the distance between x_i and L_{iR} is small). Lastly, the heteroscedastic proximity model provides a way to model how the effect of voter perceptions of candidate location on the vote is altered by the individual's acquisition of information about politics. As noted above, there exists a large and generally uncontested literature highlighting the dearth of Americans' objective knowledge about political institutions and affairs (Converse 1964; Delli Carpini and Keeter 1996). More contested among scholars is whether such information discrepancies matter for voter choice and, by extension, election outcomes. Perhaps not surprisingly, researchers have sought out different pathways through which information effects are present (Gomez and Wilson 2001; Zaller 2004). Using our heteroscedastic proximity model, we examine whether exposure to information about politics matters for voter choice by sharpening, or "clarifying," the influence of ideological distance.

With this information, the heteroscedastic proximity model is as shown in (5) with desirable feature of allowing us to model the variance, θ_{iR}, specified as a linear function of policy extremism, valence, and political information, expressed as

$$\theta_{iR} = \gamma_1 D_{iR} + \gamma_2 T_{iR} + \gamma_3 I_i. \tag{6}$$

In (6), D_{iR} represents voter i's perception of the extremity of R's policy preferences, T_{iR} is i's assessment of R's non-positional qualities, or valence characteristics, I_i represents i's exposure to political information, and the γs are parameters to be estimated. The directional effect, D_{iR}, is scored 1 if the voter places the candidate as more extreme but on the same side of the neutral point as herself, and 0 otherwise. Valence, T_{iR}, is coded $+1$ if the respondent likes anything about the presidential candidate's party, -1 if she dislikes anything about the party, and 0 otherwise.[8] The political information variable, I_i, is a subjective measure of how much attention the respondent pays to news about government and politics.[9] Finally, note that we control for the respondent's partisan dispositions using the standard ANES seven-point scale for party identification. This is entered into the specification in (5) as part of **BZ**, the vector of controls.

We estimate a set of heteroscedastic proximity models—one each for U.S. presidential elections in 1980, 1996, and 2008—using the Markov Chain Monte

[7] See, among others, Alvarez (1997) and Bartels (1996). Enelow and Hinich's (1981) formal model yields consistent predictions.

[8] Specifically, the American National Election Studies surveys ask respondents to identify whether there is anything they like about the Democratic and Republican Parties. This is followed by an item asking whether there is anything they dislike about the two main parties. With responses to these two binary choice items, we construct a three-point scale scored -1 dislike only, 0 for neither like nor dislike, or both like and dislike, and $+1$ for like only.

[9] The measure is coded 1 = "don't pay much attention," 2 = "pay some attention," 3 = "pay a great deal of attention."

Table 1 Heteroscedastic proximity models. Source: American National Election Studies

	1	2	3	4	5	6
	1980	1980	1996	1996	2008	2008
Choice Model						
Ideological Distance	–0.068	–0.067	–0.065	–0.190	–0.056	–0.039
	(0.746)	(0.018)***	(0.302)	(0.033)***	(0.060)	(0.010)***
Party Identification	0.029	0.040	0.071	0.094	0.096	0.099
	(0.009)**	(0.009)***	(0.008)***	(0.009)***	(0.008)***	(0.011)***
Constant	–0.290		–0.750		–0.594	
	(10.973)		(4.656)		(1.080)	
Ideological Variance Model						
Directional Effect		–0.811		–0.398		–0.028
		(0.171)***		(0.118)**		(0.198)
Party Valence		0.747		0.698		1.252
		(0.092)***		(0.101)***		(0.132)***
Attention to News		–0.088		0.078		–0.210
		(0.099)		(0.046)$^{+}$		(0.067)**
LogLik	–1102.1	–998.7	–1389.2	–1075.8	–1717.4	–753.1
N	1838	1736	2570	2076	3064	1418

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{+}p < 0.1$, two-tailed tests
Cells report coefficients and standard errors from estimating heteroscedastic proximity model described in the text

Carlo (MCMC) engine in WinBUGS (Spiegelhalter et al. 2003). We estimate two equations—one for the choice model and the other for the variance component. The choice model is further split between the vector of exogenous controls (party identification), **BZ**, and the ideological distance component, $(x_i - L_{iR})^2$.

Table 1 presents the model results: the choice model includes the estimated effect of ideological distance on the likelihood the respondent selects the candidate. The choice-specific coefficients for partisanship are positively signed and precisely estimated in each case. Our interest, however, lies with the results for ideological distance. Here, we observe differences in the effect of positional proximity in models that do model the variance as a function of ideological extremity, valence, and information (Models 2, 4, 6) and those that do not (Models 1, 3, 5). When the variance model is left unspecified, parameter estimates on *Ideological Distance*, while negatively signed, are imprecisely estimated. However, when we do specify the variance, these estimates in the choice model attain statistical significance. This finding holds across the 1980, 1996, and 2008 elections. The remaining covariates pertaining to directional, valence, and information effects are specified to account for *variations* about the voter's decision with respect to ideological proximity. We consider each in turn.

4.1 Explaining the Effect of Candidate Extremity on Proximity Voting

First consider the influence of directional effects. The heteroscedastic specification implies that the ideological space is stretched so that candidates' distance to voters differs as they move to the extreme or to the center of the ideological space. A positively signed coefficient on the directional term would indicate ideological distance matters less when that when the candidate is more extreme than the voter, and on the same side of N, than otherwise. A negative sign, on the other hand, means that the penalty attached to the non-proximal candidates is greater. That is, while the proximity model attaches a penalty to candidate R when L_{iR} is far from x_i, the magnitude of that penalty is greater if $\gamma_1 < 0$. Table 1 shows that this is in fact the case for the 1980 and 1996 elections. In these cases, voters who viewed the candidate as more extreme than themselves put greater (negative) weight on ideological distance than voters who did not. In terms of ideological lensing, the directional effect *stretches* the distance between the voter and the candidates. This story does not apply, however, to the 2008 election. In this case, γ_1 is indistinguishable from zero, meaning that extremely placed candidates receive no penalty on policy terms.

These results suggest that in 1980, a typical voter i was less and less likely to support Ronald Reagan or Jimmy Carter for president as a function of how extreme he viewed the particular candidate's ideology to be. In 1980 the large and precisely estimated coefficient on *Directional Effect* indicates that she assigns a relatively heavy penalty on extreme position-taking candidates. The same story applies to 1996. The negatively signed coefficient on the directional term in the variance equation implies that proximity voters punished the candidates, Bob Dole and Bill Clinton, for taking what they perceived as extreme positions. However, the "extremity penalty" confronting Dole and Clinton in 1996 was less than that facing Reagan and Carter in 1980, as evinced by the relative sizes of the coefficients. And by 2008, this penalty had altogether disappeared: taking extreme positions (on the preferred side of the neutral point) had no adverse effect on proximity voting. We can infer from this result that the candidates in 2008, John McCain and Barack Obama, did not suffer from coming across as either too conservative or too liberal or conservative the way their predecessors did.

4.2 Explaining the Effect of Valence on Proximity Voting

Next consider valence effects. Unlike the directional effect, coefficients estimated for the valence parameters are consistent across elections: in 1980, 1996, and 2008, the estimate on *Party Valence* is positively signed and statistically significant. In terms of the heteroscedastic model, this means that as valence increases, the voter's perceived ideological distance, $(x_i - L_{iR})^2$, shrinks. Put differently, as the distance between the voter's preferred policy location and that of the party increases, higher valence makes the distance smaller and the disutility smaller. As a party's valence advantage goes up, the effect of ideological distance on the vote becomes smaller. In the extreme, if valence is sufficiently high, a voter will perceive that the candidate

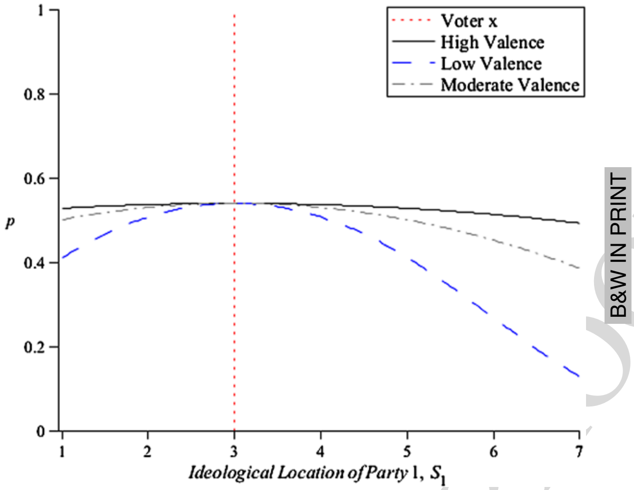

Fig. 2 The effect of party valence in the heteroscedastic proximity model. Notes: Figure displays the probability voter i intends to vote for a candidate as the candidate moves in policy space. Voter i is located at 3 on the 1–7 ideology scale. The other candidate (not shown) is located at position 5. The figure indicates how the candidate's position as perceived by i (*horizontal axis*) and i's perceived valence of the candidate's party (*solid and dashed lines*) affect the probability i supports the candidate. Simulated probabilities are based on parameter estimates from Table 1 Model 6 for the 2008 U.S. presidential election

is "right next to her," irrespective of the policy proposed, and the utility of spatial proximity voting will remain constant. In effect, *as a candidate's valence advantage approaches its maximum, he becomes spatially closer to each and every voter in the population*.

Figure 2 illustrates this effect for a moderately liberal voter (located at 3 on 1–7 scale) using parameter estimates from Model 6 in Table 1 for the 2008 election. If the candidate is also located at 3, then i prefers the candidate with equally high probability (∼0.63) regardless of its valence level.[10] But as the candidate moves away from i's preferred location, it loses less utility if it is deemed to have high valence (solid line) than if it has low valence (dashed line). Notice that this interpretation shows that the effect of high valence is to "drown out" spatial proximity as a determinant of voting. By contrast, as valence declines, the effect of spatial proximity becomes more pronounced.

The intuition is straightforward and surprising: voters will perceive low valence parties as ideological and high valence parties as pragmatic, irrespective of their actual policy location. In other words, voters who attach high valence marks to their party will see them close to themselves and pragmatic, while parties with low valence will appear further removed and much more ideological. Again, this trait remains constant in all model results.

[10]In this illustration, the other candidate in the two-candidate race is placed at 5 on the 1–7 scale.

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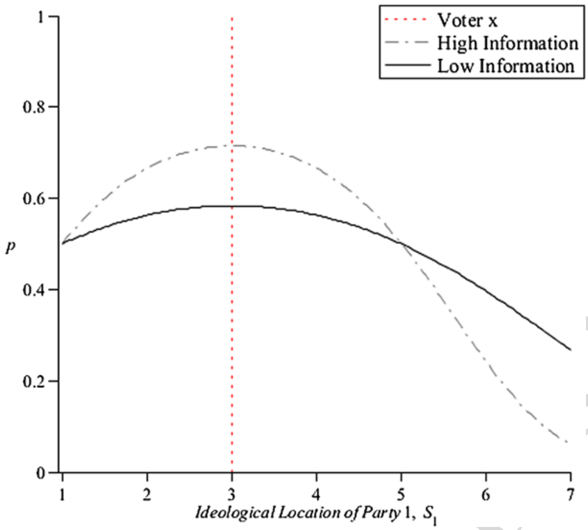

Fig. 3 The effect of information (attention to news) in the heteroscedastic proximity model. Notes: Figure displays the probability voter i intends to vote for a candidate as the candidate moves in policy space. Voter i is located at 3 on the 1–7 ideology scale. The other candidate (not shown) is located at position 5. The figure indicates how the candidate's position as perceived by i (*horizontal axis*) and i's level of attention to news (*solid and dashed lines*) affect the probability i supports the candidate. Simulated probabilities are based on parameter estimates from Table 1 Model 6 for the 2008 U.S. presidential election

4.3 Attention to News and Ideological Distance

Finally, consider information effects, captured in our models as attention to political news. Many researchers have sought to ascertain the influence of political information on an individual's voting behavior. We examine what effect, if any, information acquisition has on ideological lensing. The same logic applies as above: a positive coefficient on the information variable in the variance component implies that ideological distance is *compressed*, or that ideology matters for voter utility among informed individuals. A negative coefficient, on the other hand, implies that the politically informed are more likely to use ideological proximity to inform their vote—in this case, information *stretches* distance. Results show that our information measure, *Attention to News*, does not exert the same general effect across the three elections. In the 1980 and 1996 polls, attention to news had no biasing effect on *Ideological Distance*. In 2008, however, the coefficient on *Attention to News* is precisely estimated and negatively signed. This means that *among those located proximally close* to a candidate (say Barack Obama), the utility of voting for Obama was greater as information levels increased. This utility, however declines rapidly among the informed as the candidate moves away from the voter, i.e., as $(x_i - L_{iR})^2$ increases. Among the less informed ideology matters less: the gains from proximally located candidates are lower but so are the losses incurred by moving further away on the ideological continuum. Figure 3 illustrates this dynamic, again using parameter estimates from the 2008 election. We again set $x_i = 3$.

Taken together, the results of these heteroscedastic proximity models provide insights into American presidential politics. Voters in the United States do select candidates to the office of president based policy (ideological) considerations. The voter's view of the candidates' policy positions, however, is highly biased, particularly but not exclusively among those at self-identify at the extreme positions on the liberal-conservative scale (see Fig. 1). And once we model the "shape" of this lensing effect, ideological distance becomes a stronger predictor of voter utility (Table 1). Yet perhaps of greatest interest to students of American politics come from when we model the lensing effects via the heteroscedastic proximity model of voter utility. Comparing the voter's calculus in the 1980, 1996, and 2008 elections, we uncover a mix of continuity and change. Not surprisingly, partisanship and ideology matter, and do so consistently. Candidates' non-positional valence appeals, with respect to competence, integrity, and the like, also matter across elections—yet we provide a novel means for showing how valence blunts the proximity effect.

5 Concluding Remarks

The assumptions undergirding spatial models of voting are by now familiar: 1) voters *know* their preferred polices; 2) voters *know* the revealed policy preferences of candidates; and 3) voter preferences are transitive and single-peaked. Employing a novel *heteroscedastic proximity model*, we are able to relax these assumptions. In particular, we allow voters to use different metrics when measuring their relative proximity to parties. Furthermore, we show that information effects *stretch* and *compress* the policy space in systematic ways. While we have not been the first to acknowledge this perceptual bias in the voters' perceptions, our work offers a more cogent and theoretically informed way (a) to measure ideological lensing and (b) to correct for it.

By allowing spatial distances to vary in response to changes in information, our *heteroscedastic proximity* approach is able to explain attenuation biases in current proximity models of voting. Drawing on insights from physics, this research sheds new light on the problems of—and offer solutions to—ideological lensing in elections. Borrowing from lens models in optics, we assume that individuals observe the image of a party located in the ideological space rather than the actual location of a party.

In this chapter, we applied the heteroscedastic proximity model to three presidential elections in the United States. As a means to correct for—or make adjustments to—ideological aberration, we model the level of angular magnification in proximity voting via a trio of non-proximity covariates. Our model of magnification includes a directional component, a valence component, and an information component. Using this *heteroscedastic* proximity model, we show that the directional component and the information component both vary across electoral contests. Regarding direction, our three-period analysis shows that the penalty of candidates' taking extreme positions as declined over time. Indeed, the size of the coefficient on the directional effect, D_{iR}, is half as great in 1996 as in 1980, and by 2008 is essentially zero. This trend suggests that while presidential candidates used to be penalized by taking extreme positions on the issues, such penalties have declined with time. This tendency comports with a general sentiment that American politics has become polarized and that such polarization is electorally sustainable (McCarty et al. 2005). As for political information, our results imply that in earlier periods, access to information had no effect in terms of enhancing (stretching) or blunting (compressing) the effects of voter and candidate policy positions. However, in the recent 2008 election, proximity voting was stronger among the more politically informed. Both of these changes comport with common characterizations of the changing, increasingly volatile nature of presidential politics in the United States.

Future work on elections in the U.S. and elsewhere should might extend and improve upon the framework we have provided. For example, extrapolating from current trends, it might be the case that the heteroscedastic proximity model applied to the 2012 U.S. election would yield a positive coefficient on the directional parameter, indicating that proximity voting is *greater* among those perceiving candidates as more extreme. Future work might also distinguish among different sources of political information. Are viewers of more politically charged news outlets like Fox News or MSNBC more likely to vote on the basis of ideological proximity than those receiving information from other sources? In short, our contribution has provided a tool for systematically comparing these effects across elections and, in turn, a means for deepening our understanding about how voters decide.

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