PUBLIC OPINION DURING A PRESIDENTIAL CAMPAIGN: ATTITUDE CHANGE OR ENVIRONMENTAL EVOLUTION?

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ABSTRACT

This paper examines citizens' preferential choices among presidential candidates over the course of an election campaign. The objective is to explicate the sources of stability and change in these preferences. The analysis uses data from the Major Panel component of the CPS 1980 National Election Study in order to construct a spatial model of candidates and citizens. The advantage of this approach is that different components of the model can be used to represent the various types of campaign effects that may affect public opinion toward the candidates. The empirical results show that much of the variability in candidate choices is due to evolutionary changes in the electoral environment confronting the mass public, rather than individual-level attitude changes with respect to the candidates. Furthermore, that attitudinal change which does occur is strongly delimited by factors like partisan strength, interest in the campaign, and political participation. These findings have a number of important implications for prominent theories of campaign effects on mass political behavior.

This paper examines citizens' preferential choices among presidential candidates over the course of an election campaign. The "conventional wisdom" drawn from nearly fifty years of empirical research in the social sciences holds that campaigns have little, if any, effect on public opinion. If so, then there should not be much change in mass-level candidate preferences. However, it is easy to demonstrate that a substantial amount of change *does* take place, particularly when we focus on primary candidates along with the contenders in the general election. It is a more difficult task to explicate the nature of, and reasons for the observed changes. This study has exactly that objective.

The empirical results will show that much of the variability in candidate choices is due to evolutionary changes in the electoral environment confronting the mass public, rather than individual-level attitude changes with respect to the candidates. Furthermore, that attitudinal change which does occur is strongly delimited by factors like partisan strength, interest in the campaign, and political participation. These findings have a number of important implications for prominent theories of campaign effects on mass political behavior.

BACKGROUND

"A political campaign is an attempt to get information to voters that will persuade them to elect a candidate or not elect an opponent (Salmore and Salmore 1985)." This statement provides a reasonable description of the role that campaigns are *supposed* to play in American electoral politics. Whether they actually do so or not is a very different matter. Certainly, the candidates and their organizations believe that campaigns are an effective and necessary vehicle for electoral success. After all, that belief is the only way to rationalize the massive expenditures of time, energy, money, and other resources that are involved in any serious bids for major public offices. But, social scientific research often points to a very different conclusion— one that minimizes the effects of political campaigns on voters' preferences. From the earliest empirical studies of opinion change during presidential campaigns (Lazarsfeld, Berelson, and Gaudet 1948) up to recent formally-grounded spatial models of voting (Poole and Rosenthal 1984) and empirical analyses of voter choice (Finkel 1993), a common conclusion seems to emerge: Citizens' candidate preferences are largely insulated from the persuasive messages transmitted by parties and candidates during the campaigns.

Of course, the preceding interpretation has not been universally accepted. Several recent studies conclude that important changes do occur in mass political orientations as a result of campaign-related stimuli (e.g. Allsop and Weisberg 1988; Abramowitz 1987; Bartels 1985; 1988; McCann 1990; Norrander 1986; Patterson 1980). For example, Bartels (1993) argues that previous findings of minimal campaign effects were heavily contaminated by the effects of measurement error. Another analysis suggests that campaigns can be viewed as learning processes for the mass electorate (Gelman and King 1993). Both of these studies assign an important role to campaigns in the determination of mass preferences. Perhaps the most general conclusion about campaign effects is that reported by Holbrook (1996): Each presidential campaign takes place within a relatively stable environmental setting. However, campaign events can alter this equilibrium and produce visible changes in mass opinions about the candidates.

Some Limitations of Previous Research

The preceding works demonstrate convincingly that campaign effects do exist within American public opinion. But, all of these analyses are somewhat limited in several different ways. First, many of the studies focus on aggregate levels of public opinion across campaigns. This is, of course, usually due to data limitations. Nevertheless, the fact remains that few of these analyses examine temporal variability among *individual-level* candidate preferences.

Second, many of these studies limit themselves to public preferences among the two major party presidential nominees. This seems to be a rather arbitrary and artificial partitioning of the subject matter. Modern campaigns often involve intraparty competition among primary candidates before the party nominees are even selected.

A third and related limitation involves the time period under investigation: Several prominent studies focus only on the weeks between the party conventions and the general election. In so doing, they effectively ignore the fact that modern campaigns begin very early— perhaps, even before the election year, itself. There could well be important campaign-related influences on mass opinions prior to the conventions. In fact, this seems very likely, since citizens' preferences are probably less crystallized during these earlier time periods, and therefore, more susceptible to influence and change. An effective analysis of campaign effects on the electorate's candidate choices must try to overcome all of the preceding limitations and employ individual-level data that covers the full range of candidates and also spans the entire time period of the presidential campaign.

Campaign-Related Sources of Change in Citizens' Candidate Preferences

If campaign effects do exist, then they should lead to temporal changes among individuals' preferential choices among the candidates: Change occurs whenever a person expresses a preference for candidate *A* over candidate *B* at one time point, and then chooses *B* over *A* at a second time point. This kind of change could arise from either of two quite different processes. First, variability in preferences could be due to changes in the environment confronting the electorate. This would effectively alter the criteria that *everyone* uses to evaluate the candidates. In so doing, it would also lead some people to change some of their choices between pairs of candidates; that is, the evolution of the electoral environment affects the particular "mix" of factors that people bring to bear on their candidate evaluations. This first possibility is actually an example of campaign-based *priming* of voter preferences.[1]

Second, preferential choices could also result from individual-level changes in affective reactions toward particular candidates. Stated simply, individuals come to react more positively toward certain candidates, and negatively toward others, presumably as a result of information that they pick up during the campaign. Here, it is not a case of change in the stimuli confronting the electorate. Instead, it involves people changing their feelings toward a common set of stimuli— a process that will surely vary markedly from one person to the next. This second possibility is actually a version of campaign-related *attitude change* at the individual level within the mass public.

Of course, a third, and very likely, possibility is that both of the preceding processes occur simultaneously during a presidential campaign: The external environment changes and some individuals "move" independently within this evolving environmental context. The important point is that two separate and distinct sources— the external campaign environment and individual citizen attitudes— can lead to the same kinds of observed changes in preferential choices among the candidates. The analytic objective is to distinguish empirically between these two possibilities.

A SPATIAL MODEL OF CAMPAIGN EFFECTS ON PREFERENCES

Campaign effects on citizens' preferential choices can be represented by a spatial model. Let us first consider how the candidates are incorporated within this model and then proceed to the model's representation of the individual citizens. Candidates are represented as points within a space. The coordinate axes of the space correspond to the evaluative dimensions or attributes that the public uses to judge the candidates. The perpendicular projection from a candidate point onto one of the axes corresponds to the public perception of that candidate with respect to that evaluative attribute. Thus, public perceptions of the full set of candidates are represented by a matrix, **C**. This matrix has *k* rows (one for each candidate), *m* columns (one for each evaluative attribute), and entries $\mathbf{c}_{jl}$ to indicate the j^{th} candidate's position along the l^{th} evaluative dimension.

Note that the entries in **C** are fixed across the entire time period covered by a single presidential campaign. This implies that each candidate's public image is stable and unchanging during the campaign. While this may seem to be a particularly strong assumption, it is justifiable on the basis of theoretical considerations (e.g. Hinich and Pollard 1981); previous empirical analyses (Poole and Rosenthal 1984; Enelow and Hinich 1984); and also the political realities that impose pressures on candidates to maintain consistent, unchanging positions over time (e.g. Page 1978; Kessel 1988). The fixed content of the **C** matrix simply denotes that, once the public develops a perspective on a given candidate (e.g. *A* is an extremist liberal, *B* is a mainstream conservative, etc.), this image is unlikely to change over the course the current election year (although it certainly could change from one election year to the next).

Although the **C** matrix can, potentially, have any number of columns (up to the number of rows, or candidates, under consideration), the value of *m* is likely to be quite small. A considerable amount of recent research has found that traditional spatial models, in which candidates have known positions on a sizable number of policy dimensions, do not conform very closely with electoral realities. The contents of the **C** matrix are explicitly based upon citizens' perceptions, rather than any "objective" placements of the candidates on substantive attributes. Therefore, the cognitive limitations of the mass public (e.g. Herstein 1981) and the information-processing shortcuts that voters employ (e.g. Lodge, McGraw, and Stroh 1989) will probably combine to produce a candidate space with relatively few dimensions. This, in turn, has a great deal of practical utility: If *m* is a small value, it will be possible to construct a visual representation of the candidate space. Each column of **C** is shown as a coordinate axis and the rows (i.e., the candidates) are graphed as fixed points within the resultant space.

Even though the candidates' positions on the perceptual dimensions remain stationary, environmental change can be incorporated into the model by attaching salience (or "importance") weights to the dimensions. The weights vary both across dimensions and over time. As a particular judgmental criterion becomes more (or less) central to the electorate's beliefs about the candidates, the weight attached to the appropriate dimension increases (or decreases) accordingly. Geometrically, the weights have the effect of "stretching" or "shrinking" a coordinate axis; the latter effects occur when a particular dimension weight is large or small, respectively. By changing the relative lengths of the axes, the weights can also change the relative positions of the candidate points within the perceptual space. This takes place even though the candidates' specific positions along the dimensions do not change.

At time point *t*, the dimension weights are a set of *m* numerical values which are collected into the *m*-dimensional diagonal matrix, $\mathbf{W}_t$. The l^{th} diagonal entry in this matrix, $\mathbf{w}_{lt}$, shows the weight that is applied to evaluative dimension *l* at time point *t*. The fixed candidate positions and the time-specific weights are combined to form the candidate's perceptual locations at each time point as follows:

$$\mathbf{C}_t = \mathbf{C}\,\mathbf{W}_t \qquad (1)$$

Each entry in the matrix $\mathbf{C}_t$ is, therefore, equal to $\mathbf{c}_{jl}\mathbf{w}_{lt}$. This gives the public's perception of candidate *j* on evaluative dimension *l*, weighted according to the "importance" of that particular evaluative dimension at time point t in the campaign.[2] Again, the net effect of the varying dimension weights is that the relative positions of the candidate points can change within the space, from one time point to the next.

The weighted distance model explained above is a parsimonious but effective strategy for representing the public's candidate perceptions. For one thing, it is supported empirically. Preliminary analyses suggested that more complicated models were unnecessary, while simpler models failed to adequately reflect public views of the candidates.[3] At the same time, the idea of changing dimension weights is very consistent with prior research. Several studies have already shown that, although citizens' voting decisions are affected by a relatively fixed set of criteria, the degree of emphasis on the various factors changes markedly during a campaign (Norrander 1988; Guerrant 1990). As we will see, this model does provide a very accurate depiction of the ways that citizens view the candidates' relative positions over the course of a presidential campaign.

The second major component in the spatial model of campaign effects is comprised of the individual citizens, who are represented by a second set of points located within the same space as the candidates. For each person, his/her point coordinates along each of the axes within the space correspond to that individual's "position of maximum preference" on the respective evaluative attributes. Hence, the individual's location within the space is often called the "ideal point" for that person. The full set of ideal points at any given time point is contained in the matrix $\mathbf{V}_t$, which has n rows (one for each citizen in the dataset under consideration), m columns (one for each evaluative attribute that voters employ to think about the candidates), and entries $\mathbf{v}_{ilt}$ (for voter i's position along evaluative dimension l at time point t).

Citizens' evaluations of the candidates are determined by the relative positions of the ideal points and the candidate points, as follows:

$$\mathbf{e}_{ijt} = f\,(dist\{\mathbf{v}_{it},\ \mathbf{c}_j\mathbf{W}_t\}) \qquad (2)$$

Stated verbally, equation 2 shows that voter i's evaluation of candidate j at time t is a function of the distance between i's ideal point at time t, and j's position at t (which is, itself, determined by the candidate's fixed position along the dimensions, $\mathbf{c}_j$, and the current set of dimension weights, $\mathbf{W}_t$). The exact nature of this function will be discussed in the empirical analysis, below. Generally speaking, though, smaller distances correspond to more positive evaluations.

Note also that the dimension weights are not applied to the voters' ideal points. This is because the weights only affect the composition of the external environment— that is, the candidates' positions. In contrast, individual citizens are free to weight the dimensions in any idiosyncratic manner. Similarly, the locations of the ideal points, themselves, could change over time. For both of these reasons, the ideal points are indexed by time (the "t" in the subscript for $\mathbf{V}_t$) even though the candidates' positions along the dimensions are not.

The full spatial model of campaign effects contains three distinct sets of parameters: The **C** matrix, the set of $\mathbf{W}_t$ matrices (one for each available time point, $t = 1, 2, \ldots, T$), and the set of matrices containing voter ideal points, $\mathbf{V}_t$ (once again, allowing for the possibility of different ideal points at different time points). Given appropriate data, these parameters can all be estimated empirically, using a two-step approach. The first step estimates **C** and the set of $\mathbf{W}_t$ matrices. At any time point, t, the weighted Euclidean model represents the squared distance between any two candidates' points (say, j and p) as follows:

$$distance^2 \{\mathbf{c}_j, \mathbf{c}_p\} = \sum_{l=1}^{m} \mathbf{w}_{lt}^2 (\mathbf{c}_{jl} - \mathbf{c}_{pl})^2 \qquad (3)$$

Substantively, the distance obtained from equation 3 should correspond to the dissimilarity that the public perceives to exist between candidates j and p. If empirical data can be obtained on these perceptual dissimilarities for all pairs of candidates, at all available time points during the campaign, then the elements of **C** and the various $\mathbf{W}_t$ matrices can be estimated, using weighted multidimensional scaling, or WMDS (e.g., Davison 1983; Young and Hamer 1987).[4]

Once the candidate points and the weights are obtained, the citizens' ideal points can be estimated using a strategy called external unfolding (e.g., Carroll 1972; Young and Hamer 1987). Here, the candidate locations at any time point are regarded as fixed, and ideal point locations are found such that individual preferences are inversely related to the distances between ideal points and candidate points. Specifically, the more voter i prefers candidate j, the smaller the distance between i's ideal point and the current location of candidate *j*'s point among the weighted axes of the space. This procedure is carried out independently, for each separate voter in the data under consideration. Furthermore, the estimation procedure can be adapted to allow for the possibility that the ideal points, themselves, move during the course of the campaign. If such movements do occur, it will signal individual-level attitude change with respect to the candidates and therefore constitute strong evidence for the presence of campaign effects in mass political attitudes. The two-step approach (i.e. find the candidate points and dimension weights, and then find the citizens' ideal points) used in the estimation procedure is sometimes called "successive unfolding" (Rodgers andYoung 1981; Brannick and Hahn 1985).

The spatial model proposed here is a particularly useful strategy for examining public opinion during a presidential election campaign. First, the candidate locations and the weights are determined empirically, so they should represent accurately the "perceptual map" that citizens bring to bear on presidential candidates. Second, the spatial model easily incorporates the full field of candidates, rather than limiting the investigation to only the two major party nominees. Third, the model embeds individual citizens into the same geometric configuration as the candidates, and thereby represents preferences distinctly from perceptions. Fourth, the spatial model provides a parsimonious representation of change over time; stated simply, as public perceptions of, and preferences for the candidates change, the points will "move" within the space, in corresponding ways. The fifth, closely related, advantage of the spatial model is that it allows us to differentiate between environmental and individual-level sources of change in citizens' preferential choices. If campaign effects are environmental in nature, then the dimension weights (and hence, the relative candidate positions) should change over time. If campaign effects are manifested within citizens' attitudes, then the ideal points should move from one time period to the next. And of course, it is very likely that both of these kinds of changes will occur together. The next section discusses the empirical data that will be used to operationalize this spatial model.

MEASURING INDIVIDUAL PREFERENCES AND PERCEPTIONS

Any empirical study of individual-level opinion change must rely on repeated measures, obtained from the same set of people. For this reason, the data employed in this analysis are taken from the Major Panel Component of the CPS 1980 National Election Study. Although it is perhaps somewhat dated, this is the only time that the NES collected panel information from survey respondents over the entire election year. Furthermore, the 1980 election is a particularly interesting context in which to examine campaign effects, for at least two reasons. First, there was real competition among both Democratic and Republican candidates for their respective party nominations. Thus, the electorate really was confronted with a wide range of candidate choices. Second, the candidate with the overall lead in public preferences apparently changed from Carter to Reagan during the period from January to November, 1980. Thus, we can be reasonably certain that there are some kinds of campaign effects to be examined in the first place.

Within the 1980 NES Major Panel Study, a representative cross-section of the American electorate was interviewed at four time points. In the three pre-election panel waves (January, June, and September), the survey respondents were asked to evaluate a series of presidential and vice-presidential candidates on the familiar feeling thermometer scales; higher values on these scales indicate more positive attitudes toward the respective candidates. The analysis will focus on the ratings given to eleven candidates: Carter, Reagan, Anderson, Kennedy, Connally, Ford, Baker, Dole, Brown, Mondale, and Bush. [5]For most of these candidates, feeling thermometer responses were obtained in all three panel waves. The exceptions are Anderson (who was not included in the first wave) and Dole (who was dropped from the third wave). In any event, the number of candidates, *k*, is eleven, and the number of time points, *T*, is is three.

The basic input data are the respondents' thermometer evaluations of the candidates. These are collected into three matrices, designated $\mathbf{E}_1$ through $\mathbf{E}_3$ for the successive waves of the Panel Study. Each matrix, $\mathbf{E}_t$, has 615 rows (one for each survey respondent with enough nonmissing data to be included in the analysis),[6] 11 columns (one for each candidate), and entries $\mathbf{e}_{ijt}$ (for respondent *i*'s evaluation of candidate *j* at time *t*). The two missing candidates— Anderson at *t*=1 and Dole at *t*=3— are incorporated into the appropriate $\mathbf{E}_t$'s as columns of missing values.

Preferential choices are indicated by the relative values of the thermometer ratings within each row. That is, if $\mathbf{e}_{ijt} > \mathbf{e}_{ipt}$, then voter *i* prefers candidate *j* over candidate *p* at time *t*. And, if $\mathbf{e}_{ijt} > \mathbf{e}_{ipt}$ but $\mathbf{e}_{ij,t+1} < \mathbf{e}_{ip,t+1}$, then a temporal change has occurred in this person's preferential choice between these two candidates. Empirically, a substantial amount of this kind of change does occur over the three waves of the panel. From January to June, 35% of the total preferential choices (i.e., across candidate pairs and across respondents) change, while the comparable figure is 33% for the time period from June to September. Thus, the empirical data immediately contradict the admittedly simplistic assertion that *nothing* happens to public opinion during a presidential campaign.

Within the spatial model, the entries in the $\mathbf{E}_t$ matrices are interpreted as empirical reflections of the distances between voters' ideal points and the candidates' points. But, the WMDS phase of the analysis requires a matrix of perceived proximities among the candidates for each time point, $\mathbf{D}_t$, where the entries (say, $\mathbf{d}_{ijt}$) represent the public's perceived dissimilarity between candidate *i* and candidate *j*, at time point *t*. Fortunately, these matrices can be obtained, using the line-of-sight (LOS) measure of interobject dissimilarity (Rabinowitz 1976; Jacoby 1993). The LOS measure is based upon the geometric consequences of the distance interpretation of citizens' candidate evaluations. It employs the feeling thermometer responses to produce a rank-ordering of the distances between all pairs of candidate points; the rankings then form the entries in the $\mathbf{D}_t$ matrix. The LOS procedure is applied separately to the thermometer ratings obtained from the NES respondents in January, June, and September, respectively. Thus, each $\mathbf{D}_t$ matrix is separate from the others, and the information can be used to examine stability and change in candidate perceptions over the course of the campaign. It is also important to emphasize that the entries in the LOS-obtained dissimilarities matrices are based upon the full set of thermometer responses obtained at each time point, rather than any single respondents' ratings. This is important because it enables us to separate public perceptions of the candidates from individual preferences among the different candidates— a vital distinction for purposes of this analysis.

In summary, the LOS approach to measuring inter-candidate dissimilarity is fully appropriate for the assumptions of the spatial model (e.g. Rabinowitz 1973; 1976; Jacoby 1991; Brady and Bartels 1993).

Once the candidate point configuration is obtained from the WMDS analysis, each individual respondent's set of feeling thermometer ratings will be used again, to locate his/her ideal point within the space. The details of this procedure will be discussed below. For now, it is only important to mention that each ideal point will be located so that the person's thermometer ratings are, to the greatest extent possible, proportional to the distances between the ideal point and each of the candidate points. And again, the points will be permitted to "move" over time within the space, in order to test for the existence of attitude change across the presidential campaign.

EMPIRICAL RESULTS

The weighted Euclidean model is fitted to the dissimilarities data, using a least-squares approach. In other words, the WMDS algorithm provides the best-fitting set of weighted interpoint distances for the public's perceived proximities between the candidates.[7] For the 1980 Major Panel data, a two-dimensional solution is appropriate. The overall fit of the point configuration to the data is very good: The squared correlation between the scaled distances and the input dissimilarities is 0.81.[8] Furthermore, the scaling solution shows a high degree of statistical stability; in other words, the locations of the candidate points are definitely *not* due to sampling fluctuations (see Appendix A for further details). Even more important, the scaled results are immediately interpretable in substantive terms.

The Candidate Space

The empirical configuration of candidate points is shown in Figure 1. Once again, this represents the perceptual map that the electorate brings to bear on the presidential contenders— the evaluative criteria that people actually use to distinguish between them. And, therefore, the point configuration provides an empirical estimate of the external political environment confronting the voters.

The general partisan character of this perceived political environment is immediately apparent. The points representing Democratic candidates are arrayed vertically within the right side of the space, while

Republican candidate points are scattered throughout the center and left side. Thus, the American electorate clearly distinguishes between candidates on the basis of their partisan affiliations. Of course, this is hardly a surprising result, given both the importance of party identification for understanding voter behavior (e.g. Campbell, Converse, Miller, and Stokes 1960; Miller and Shanks 1996) and the fact that partisan background is often the one real piece of hard information that people possess about a given candidate.

While partisanship serves to divide the candidates into two disjoint sets, there is still further variability in the point locations that requires explication. Fortunately, this does not seem to be a very difficult task. The horizontal axis in Figure 1 clearly corresponds to an ideological dimension, with liberal candidates (e.g., Kennedy and Brown) located toward the right side of the space, and conservatives (e.g. Connally and Dole) located toward the left. Furthermore, these ideological distinctions help to account for intraparty variability in the placements of the candidate points along the horizontal axis. That is, the more conservative Republican candidates (again, Dole and Connally) are placed at more extreme locations than the mainstream candidates (Reagan, Baker, Bush, and Ford). Similarly, Mondale and Carter are located closer to the horizontal center than their more liberal Democratic counterparts, Kennedy and Brown.

One could, perhaps, argue about the "objective" accuracy of the candidate point locations. For example, Reagan seems to be placed closer to the center than he should be, given his overtly conservative orientations. And, on the other side, the differences between the relatively moderate Carter and the more openly liberal Kennedy and/or Brown seem to be underestimated. The explanation for these seeming anomalies is the fact that the candidate space is based upon voters' *beliefs* about the candidates, rather than any "objective" qualities that they may possess. The placement of the candidate points is actually quite consistent with many interpretations of the 1980 election campaign: Thus, a major component of Reagan's strategy was to convince the electorate that he was *not* an extremist. The relatively centrist location of the Reagan point within the perceptual space verifies his success in doing so. At the same time, the relatively minor ideological differences among the Democratic candidates may reflect the Repulicans' success in blaming *all* Democrats for the economic woes and other problems affecting the country in 1980.

It is easy to demonstrate the strong degree to which the candidate point positions correspond to public perceptions, using some available external evidence. Respondents in the 1980 NES Panel Study placed ten of the candidates on a seven-point liberal-conservative scale; these survey responses are entirely separate from the items used to construct the space. and yet, the correlation between the mean candidate placements and the point projections onto the horizontal axis is quite large, at 0.80. This confirms that the candidate's spatial locations coincide very closely with the public's perceptions of their ideological positions.

The vertical axis in Figure 1 is also substantively interpretable, although not quite as unambiguously as the ideology dimension. Generally speaking, the variations that exist in this direction seem to correspond to some kind of "credibility" or "electability" judgments. At the higher end of this continuum (i.e. toward the top of the figure) are located the nominees from both parties, Reagan, Bush, Carter, and Mondale. At the other extreme, toward the bottom, we find the candidates that had no realistic chance of winning either their respective parties' nominations or the general election, itself; these include Brown, Anderson, Dole, Kennedy, and Connally. Accordingly, this dimension seems to tap the degree to which voters regard the candidates as realistic contenders in the 1980 election.

Dimensions similar to the vertical axis have appeared in most other empirical spatial analyses of the 1980 election (Enelow and Hinich 1984; Poole and Rosenthal 1984). However, it is often interpreted somewhat differently, as a more general "valence" dimension or measure of the candidate's personal characteristics. Obviously, the latter do contribute to a candidate's credibility. But, the array of candidate points along the vertical axis really does not coincide with their levels of personal appeal. For example, Gerald Ford was evaluated extremely positively by the 1980 electorate, but his point is only located at the center of the vertical axis. Similarly, the location of the Anderson point is problematic if the vertical axis represents personal appeal. The 1980 Panel respondents' views of Anderson's personal qualities (e.g., was he "knowledgeable," "dishonest," and so on?) were closely comparable to those given to Carter and Reagan. But again, Anderson is located at a position far away from those major party candidates along the vertical direction. Therefore, credibility or electability seems a more appropriate interpretation for this dimension.

The preceding interpretation is also supported by external evidence. The 1980 NES Panel respondents were asked which candidates they believed had any chance of receiving each party's nomination. The proportions who chose each of the candidates can be used as a measure (admittedly, an imperfect one) of candidate credibility. Its correlation with the point projections onto the vertical axis is very acceptable, at 0.62. Thus, an important component of public perceptions in 1980 apparently focused on judgments of each candidate's chances of success in the electoral arena.

Time-Specific Dimension Weights

Figure 2 provides a graphical display of the salience weights applied to the dimensions at each time point. The dimensions in the figure are identical to those in the candidate space. Hence, the horizontal axis corresponds to ideology, while the vertical axis represents candidate credibility and/or electability. There is a single vector for each wave of the Panel Study, and each one's orientation (relative to the axes) shows the weights that are specific to that time point. The smaller the angle between a vector and an axis, the greater the importance of that evaluative dimension, at that time point.

The results in Figure 2 show a clear pattern among the dimension weights, which change a great deal across the 1980 election year. At the first time point (January, 1980), the vertical axis receives a weight that is just slightly larger than that allocated to the horizontal axis. Overall, at this early stage in the campaign, the ideology and credibility dimensions contribute about equally to public perceptions of the candidates. But, this changes markedly over time. The emphasis on ideology increases quite a bit from January through September, while the credibility dimension drops sharply in importance over the same time period. By September, the ideology dimension clearly dominates the public's perception of the candidates, with more than twice the salience of the credibility/electability dimension. These results definitely confirm that the "mix" of features in the electoral environment facing the public at the end of the presidential campaign is quite different from that which existed at the beginning of the election year.

The differences in the orientations of the vectors are statistically significant (see Appendix A). And, the observed variability in the dimension weights conforms to patterns reported by other researchers. For example, Miller and Shanks (1982; 1996) show that perceptions of the candidates' issue positions polarized sharply, beginning in the middle stages of the 1980 campaign. Poole and Rosenthal (1984) also found that a liberal-conservative policy dimension dominated the spatial locations of the candidates late in the 1980 campaign. Both of these results are fully consistent with the increasing weight on the ideology dimension shown in Figure 2. Turning the the credibility dimension, both Bartels (1988) and Abramowitz (1987) report that public expectations about candidates strongly influence voters' choices during the early parts of a campaign, followed by a decline in the magnitude this effect at later points in the election year. Of course, such findings coincide with the steadily decreasing weights on the credibility dimension found in the present analysis.

What determines the weights attached to the respective dimensions? With only three time points, it is probably impossible to formulate a definitive answer to this question. But, there is one negative conclusion that can be drawn: The variations in the weights are definitely not due to media-based priming of public perceptions. Preliminary analyses unambiguously demonstrated that the amount of media coverage devoted to candidate characteristics, and that on policy issues were both completely unrelated to the values of the dimension weights.[9] Therefore, the mass media's emphasis on certain kinds of stories does *not* translate directly into the evaluative criteria that people bring to bear on the candidates.

An alternative explanation for the dimension weights is simply the number of active candidates at each of the three time points. Of course, this number decreased steadily from January through September 1980, and this corresponds precisely to the declining salience of the credibility dimension in the WMDS results. Early in the 1980 campaign, questions about the candidates' personal abilities and characteristics were widespread: Was Reagan too extreme a conservative to be president? Was Kennedy responsible enough? Did Bush really have enough support among moderates? Did Carter deal competently with the economy and the Iranian hostage crisis? All of these kinds of questions focus squarely on the candidates' competence and credibility levels. Furthermore, the mere existence of several potential candidates during the early stages of the campaign would force voters to examine the individuals involved more closely. But, as the campaign progressed, the fields narrowed, and questions about the individual candidates faded behind more long-standing differences based upon ideological and partisan considerations. This corresponds perfectly to the increase in the weights attached to the ideology dimension. Once again, it is important to emphasize that this interpretation is far more speculative than conclusive. Nevertheless, the weights placed on the evaluative criteria that people bring to bear on presidential candidates is definitely related to the size of the active candidate "pool" at each time point during the campaign..

PERCEPTUAL CHANGE AND INDIVIDUAL PREFERENCES

The WMDS analysis reported in the previous section shows that perceptual change within the 1980 electorate can be represented by a straightforward spatial model, in which the candidates occupy fixed positions, while the saliences or weights attached to the respective dimensions change over time. But, the question remains: Can this variability in the external environment account for temporal changes in the candidate *preferences* articulated by individual citizens? In order to address this question, we must examine the locations of the citizens' ideal points, relative to the candidate points.

Recall that the environmental- and individual-level explanations of campaign effects have different implications for the components of the spatial model. If the varying dimension weights, by themselves, produce changes in preferential choices, then the individual ideal points should remain at fixed locations over the course of the presidential campaign. On the other hand, if real attitude change occurs during the election year, then the ideal points would move within the space, independently of the changes in the dimension weights. For obvious reasons, these two alternatives will be called the "stationary ideal point" (SIP) and "moving ideal point" (MIP) models, respectively. And, since each person's ideal point is completely independent of any others, both models could easily be appropriate for different subsets of the 1980 electorate.

Testing for Movement in the Ideal Points

External unfolding is employed to test the fit of the SIP and MIP models to the NES respondents' candidate evaluations. This means that the ideal points are treated as unknowns, to be estimated, while the previously-derived, weighted candidate configurations (one for each time point) are treated as known constants. In order to do so, it is first necessary to specify the preference function that relates ideal point locations to candidate point locations. Basically, increasing preference is modeled as decreasing distance between an ideal point and a candidate point. This is no problem on the horizontal axis, since voters presumably have their own personal ideological placements that they can compare to the candidates' positions.

However, recall that the vertical dimension represents candidate credibility/electability. Presumably, citizens want "their" candidates to be as credible and/or electable as possible, without limit. It is nonsensical to posit an amount of credibility/electability that is optimal, but not maximal. If this is the case, then the larger the candidate's coordinate along this axis, the more that candidate is preferred by all voters. Geometrically, all ideal points would be located at positive infinity along this axis (because more credibility is always better), so it is not necessary to estimate their individual positions.

The stationary ideal point (SIP) model can be represented by the following equation:

$$\mathbf{e}_{ijt} = \beta_{0i} + \beta_{1i} (\mathbf{v}_{i1} - \mathbf{c}_{j1}\, \mathbf{w}_{1t})^2 + \beta_{2i}\, \mathbf{c}_{j2}\, \mathbf{w}_{2t} + \mathbf{u}_{ijt} \quad (4)$$

As explained earlier, $\mathbf{e}_{ijt}$ is citizen *i*'s evaluation of candidate *j* at time *t*, while $\mathbf{c}_{j1}\ \mathbf{w}_{1t}$ and $\mathbf{c}_{j2}\ \mathbf{w}_{2t}$ are candidate *j*'s coordinates along the two dimensions of the perceptual space, weighted appropriately for time point *t*. The preceding quantities are all known, from either the observed data, or the results of the WMDS analysis. The $\mathbf{v}_{i1}$ is the currently-unknown ideal point coordinate for person *i* along the first dimension; note that there is no *t* subscript, signifying that this location is fixed across the campaign. The three coefficients on the right-hand side of equation 4, β_{0i}, β_{1i}, and β_{2i}, represent a set of measurement parameters. In effect, they measure the ways that person *i* "translates" his/her own relative position within the space into an empirical response on the feeling thermometers. Finally, $\mathbf{u}_{ijt}$ is a disturbance term, representing all of the influences on the *i*'s thermometer rating that are not contained within the spatial model. A sizable component of the disturbance is likely to be measurement error within the thermometer scores. Therefore, it is appropriate to treat this term as random noise.

The moving ideal point (MIP) model is tested using the following equation:

$$\mathbf{e}_{ijt} = \beta_{0i} + \beta_{1i} ([\mathbf{v}_{i1} + \alpha_{i2}\, \mathbf{t}_2 + \alpha_{i3}\, \mathbf{t}_3] \text{-}\ \mathbf{c}_{j1}\, \mathbf{w}_{1t})^2 + \beta_{2i}\, \mathbf{c}_{j2}\, \mathbf{w}_{2t} + \mathbf{u}_{ijt} \qquad (5)$$

Equation 5 is a straightforward generalization of equation 4. The only new additions are two terms on the right-hand side, $\alpha_{i2}\ \mathbf{t}_2$ and $\alpha_{i3}\ \mathbf{t}_3$. The two $\mathbf{t}_t$ terms are dummy variables; $\mathbf{t}_2$ is zero for all evaluations obtained from the first and third time points, and set to one for evaluations from the second time point. Similarly, $\mathbf{t}_2$ is set to zero for evaluations from the first two time points, and takes on a value of one for evaluations in the third time point. α_{i2} and α_{i3} are coefficients to be estimated; together, they allow the ideal point coordinate on the first axis to vary over time: For thermometer responses in the January panel wave, both $\mathbf{t}_2$ and $\mathbf{t}_3$ are zero; so *i*'s location on the first axis reduces to $\mathbf{v}_{i1}$. In the June panel wave, $\mathbf{t}_2$ is set to one, and the ideal point coordinate for *i* is estimated by the sum, $\mathbf{v}_{i1} + \alpha_{i2}$. Similarly, the September estimated ideal point coordinate is $\mathbf{v}_{i1} + \alpha_{i3}$. In this manner, the MIP model allows the position of *i*'s ideal point to change, independently of the varying time-specific weights applied to the candidate coordinates.

The unknown coefficients and point coordinates in equations 4 and 5 are estimated separately for each respondent in the 1980 NES Major Panel Study dataset. This is accomplished using a variant of a regression-based procedure originally developed by Carroll (1972). The details are presented in Appendix B. For present purposes, we are less interested in the specific parameter estimates than in the fit of the two equations to each person's preferences. For person *i*, if equation 5 generates a larger R^2 than equation 4, then it would indicate that the ideal point does change locations over the three panel waves. If equation 5 does *not* fit the data any more closely than equation 4, then a single ideal point location is sufficient; we would conclude that any changes in preferential choices are due only to the varying weights along the dimensions.

Note that equation 4 is fully-nested within equation 5. Accordingly, the "raw" R^2 value for the MIP model will always be larger than that for the SIP model and comparisons between the two should only be made using R^2 values that have been adjusted for degrees of freedom. At the same time, the nested nature of the two equations means that we can perform a statistical analysis of model fit for each NES respondent. In other words, for individual *i*'s thermometer ratings, is the sum of squares explained by the MIP model sufficiently larger than the sum of squares explained by the SIP model to represent a meaningful improvement in goodness of fit? Or, can the differences merely be attributed to random errors? A standard *F* test can be used for this purpose (the details are given in Appendix B). Speaking loosely, this test determines whether the increase in the R^2 (moving from the SIP to the MIP model) is statistically significant or not.

The results from this part of the analysis are summarized in Table 1 and Figure 3. The table shows various summary statistics pertaining to the fit of the SIP and MIP models. Reading from the left, the first two columns give information about the individual-level adjusted R^2 values for the respective models, while the third column gives the same information on the difference between the two adjusted fit statistics. The most important feature of these results is that the values are larger for the MIP model than for the SIP model; the mean adjusted R^2_{MIP} is 0.541 and the mean adjusted R^2_{SIP} is 0.219, a difference of 0.321. This shows that the model which allows ideal points to vary over time fits the data more closely than that which posits fixed ideal points. Of course, there is a substantial amount of variability in the degree of fit from one individual respondent to the next. The R^2_{SIP} values range from a low of -0.110 through a high of 0.861, with a standard deviation of 0.134. The R^2_{MIP} values vary between 0.261 and 0.926, with a standard deviation of 0.201.

Let us next consider the statistical significance of the difference between the two models. The fourth column of Table 1 shows the observed probability value obtained from the *F* test comparing the fit of the MIP and SIP models. Smaller values of this probability support a conclusion that rejects the null hypothesis of identical fits across the two models. Here, the mean probability value is quite large, at 0.454; superficially, this suggests that the MIP model is not really a better representation of the preference data, once sampling variability and degrees of freedom are taken into account. However, this negative conclusion must be qualified by two other features from the table. First, the standard deviation of the probability values is very large, at 0.319; thus, there is a great deal of variability in the significance level from one person to the next. And, the median probability is substantially lower than the mean, at 0.403. This indicates that the distribution of these individual-level probability values is skewed in a positive direction. The implication is that there are many respondents with small probability values (therefore, with greater support for the MIP model) and a few respondents with unusually large probability values (which implicitly provide support for the SIP model). Consider a slightly different way of interpreting these data: The usual probability level for rejecting a null hypothesis is 0.05. In this dataset, 8.60% of the respondents exhibit probability levels below this value. These are the people for whom the MIP model provides a more accurate representation of candidate preferences than the SIP model.

Some telling graphical evidence about the comparison of the two models is given in Figure 3. The first panel of the figure simply plots each respondent's R^2_{SIP} value on the horizontal axis, and his/her R^2_{MIP} on the vertical axis. The second panel again plots the R^2_{SIP} on the horizontal axis. But, the vertical axis shows the difference between the two fit statistics for each person. The first panel presents the basic information about model fit, but the second panel is probably more useful for visual examination of the *improvement* in fit obtained by moving to the MIP representation, from the SIP model.

In either case, the results are clearcut. The improvement in fit provided by the MIP model is, itself, strongly and inversely related to the original value of R^2_{SIP}; in fact, the bivariate correlation between the R^2_{SIP} values and the (R^2_{MIP} - R^2_{SIP}) values is -0.780. The MIP model cannot produce a worse fit than the SIP model under any circumstances (again, because they are nested models). But, among people for whom the SIP model does not provide an accurate representation of candidate evaluations (i.e., low R^2_{SIP} values), there is a substantial number of individuals whose thermometer ratings can be better accomodated by the MIP model; these are represented by the data points plotted in the upper left corners of Figures 3A and 3B. On the other hand, there are also many people for whom the SIP model does provide an accurate fit to their evaluations. In these cases, the MIP model does not contribute any improvement; the data points for such individuals are plotted in the upper right corner of Figure 3A and the lower right corner of Figure 3B.

The overall conclusion to be drawn from the analysis of the two ideal point models is that the electorate is an extremely heterogeneous body with respect to their behavior during a presidential election campaign. For some people, variability in candidate evaluations can be explained by changes that occur in the external political environment; their own political stance remains fixed over that same time period. For others, however, there does seem to be some additional movement in the location of the ideal point, relative to the positions of the candidates within the electoral environment. Thus, campaign effects involve both environmental and individual-level phenomena.

Testing Individual-Level Sources of Ideal Point Movements

We have just established that some ideal points do seem to move during the presidential campaign. But, is this movement substantively important? Does it represent genuine changes in individual political orientations? Or is it simply meaningless fluctuations, due to stochastic factors, or measurement error in the feeling thermometer responses? If the former explanation is correct, then the ideal point movements should be random and virtually unpredictable. If the latter explanation holds, then previous research points to a number of factors that should be related to attitude change during an election campaign.

This part of the analysis uses a multiple regression model. The dependent variable is the difference in the individual adjusted R^2 values for the MIP and SIP models, respectively. Again, this variable gauges the degree to which a person's candidate evaluations are more consistent with a moving, rather than a stable ideal point, across the three time points. Temporally stable ideal points correspond to small differences in the adjusted R^2 values. Conversely, temporal movement in ideal points should generate larger differences between adjusted R^2_{MIP} and adjusted R^2_{SIP}.

There are four independent variables: (1) Level of interest/information about politics and the campaign, which measures psychological involvement in the campaign process; (2) political participation, which measures a person's overt involvement; (3) education, measuring individual cognitive capacities for dealing with the information stream generated by a presidential campaign; and (4) strength of party identification, which measures a person's attachment to a salient political reference group. It is important to emphasize that these variables have been selected from a much longer list of possible independent variables. A variety of other potential factors were tested and found to have no additional impact whatsoever on ideal point movements. Also, regression diagnostics of preliminary models indicated that the information variable should be squared, in order to correct for an initially-nonlinear relationship.

Table 2 shows the parameter estimates obtained from the regression analysis. The leftmost column gives the OLS coefficients and standard errors, while standardized coefficients are shown in the right column. Overall, the equation accounts for a relatively small, but nevertheless statistically significant amount of the variance in the dependent variable; the R^2 value is 0.118. While this low explanatory power is somewhat bothersome, it is not really unusual compared to other analyses of public opinion data.

The more important aspect of Table 2 is the consistent set of findings for the independent variables. All of the coefficients are statistically significant, with negative signs. And, such results are perfectly consistent with theories of attitude change and mass political behavior. The variable with the strongest impact is political information, which shows a standardized coefficient of -0.188; this shows that more informed individuals are less likely to move during the campaign. Furthermore, the quadratic specification for this variable implies that this trend toward positional stability is especially pronounced among the most knowledgeable strata of the electorate. The standardized coefficients for political participation and for education are both somewhat smaller, at -0.122 and -0.098, respectively. Taken together, these results mirror the vast amount of research that has been conducted over the past fifty years showing that greater integration into the political world generally coincides with lowered susceptibility to attitude change and fluctuations in political orientations (e.g., see Zaller 1992 or Sniderman, Brody, and Tetlock 1991) for summaries of this literature).

Finally, the standardized coefficient for strength of party identification (-0.124) shows that stronger attachments to political parties are accompanied by more stationary ideal point locations. This, in turn, verifies once again the important stabilizing role of partisan reference groups; they effectively "insulate" their adherents from appeals emanating within the external political environment (e.g. Converse 1969; Miller 1976; Shively 1980).

Returning to the question posed at the beginning of this section, are the observed movements in the ideal points substantively important? The empirical results suggest that they are, because the differences in fit between the MIP and SIP models are consistently related to a set of individual-level political characteristics. The changes are definitely not the result of mere "noise" in the feeling thermometer ratings. So, I would argue that it is reasonable to characterize them as campaign effects on individual political orientations. However, it is important to emphasize that these kinds of effects are not distributed uniformly throughout the electorate: Instead, they are concentrated among the segments of the public that are most detached from the political world.

CONCLUSIONS

This study has employed a spatial model to examine variability in citizens' preferential choices among presidential candidates over the course of the 1980 election year. The results can be briefly summarized as follows: The electorate's perceptions of the candidates were based upon two evaluative dimensions. While the dimensions themselves remained fixed across the three time points, the weights attached to the dimensions varied markedly. The variability in the dimension weights also changed the distances from the candidate points to the citizens' ideal points in the spatial model. These changes were responsible for some of the variability in expressed preferential choices. But, there were some people whose ideal points also moved, independently of the varying dimension weights, producing further temporal change in their candidate preferences. These results have several important implications for the study of mass political behavior during election campaigns.

First, the two-dimensional candidate space provides an empirical representation of the electoral environment confronting the mass public. The stable candidate locations are a manifestation of the equilibrium that dominates this environment over the course of any single campaign. Holbrook (1996) has recently argued that any changes to this environment are likely to be relatively minor and temporary in nature. The results presented here provide only partial support for this argument. On the one hand, the overall structure of the electoral environment that exists at the beginning of the campaign is quite similar to the one the remains on election day. However, the differences between them are definitely "directional" in nature and relatively permanent in their consequences. Over the course of the campaign, the salience of ideological distinctions among the candidates steadily increases, while their credibility becomes a less prominent component of the electorate's general perceptions. My explanation— admittedly tentative in nature— is that this process is due to the nature of American electoral institutions and practices; specifically, the steady winnowing of the candidate field over the course of the presidential election year. Thus, I would argue that there is a predictable dynamic underlying the structure of political environment that confronts voters during an election campaign.[10]

Second, this analysis provides useful insights about public opinion during a presidential campaign. The results presented here definitely contradict any "minimal effects" model in which citizens are effectively insulated from external, campaign-based influences. And, they help disentangle the various possible sources of change in candidate preferences. For much of the electorate, temporal variability in candidate choice is a relatively passive process. Individuals maintain stable perceptions of the candidates and stable personal positions with respect to the evaluative criteria employed to judge political stimuli. However, the relative saliences of these criteria vary across the campaign. Therefore, some people change their minds about some of the candidates simply due to the fact that certain factors become more important in their decision-making, while other criteria become increasingly irrelevant over the course of the campaign. Accordingly, a sizable component of campaign effects seems to be composed of priming influences on voter decisions. Furthermore, it is important to emphasize that this priming seems to be a product of the campaign environment, itself. Attempts to link either media content or individual media exposure to variability in preferences produced no results whatsoever.

Of course, priming effects do not tell the whole story about campaign-related changes in candidate choice. And, this leads to the third important implication of this study. There is a relatively small, but still nontrivial segment of the 1980 electorate whose ideal points really did seem to move during the campaign. This signals changes in opinions about the candidates, occurring separately from and in addition to the environmental changes discussed above. But, these individual-level changes are not distributed throughout the entire electorate. Instead, they are concentrated most heavily among those people who are least interested, involved, or active in political matters. This nonrandom distribution of campaign-based attitude change—

sometimes called the “Berelson paradox” (Granberg and Holmberg 1990)— has been noticed since the very earliest empirical studies of electoral behavior (e.g. Lazarsfeld, Berelson, and Gaudet 1948; Berelson, Lazarsfeld, and McPhee 1954). It suggests that the people who are most responsive to the effects of an election campaign are those who are least capable of making effective use of any new information they may receive (MacKuen 1984). If this is the case, then there are major negative consequences for the viability of democratic political systems, such as the potential for “the rule by the worst of the many (Kelley 1983).” The questionable quality of campaign-related attitude change seems to be one empirical finding that is extremely robust, standing up to replication across widely separated time periods, different research strategies, and varying political contexts. Therefore, it is probably fortunate that this kind of attitude change seems to be confined to a relatively small number of people within the electorate.

In conclusion, this study has examined the public's candidate preferences during the 1980 election year. The empirical results show that campaign-effects in public opinion are largely (but not completely) a matter of environmentally-based *priming* and attendant changes in decision-making criteria rather than active *persuasion* leading to individual-level attitude changes. These results address directly several major questions that have arisen within the scholarly study of mass political behavior and they provide important insights about the ways the public responds to the political world.

APPENDIX A:

STATISTICAL INFERENCE AND WEIGHTED MULTIDIMENSIONAL SCALING

Multidimensional scaling strategies are usually used for data analysis purposes, rather than for statistical inference. In other words, the MDS estimates of the interpoint distances in the scaled space reflect dissimilarity values in the observed data, alone; they generally do not provide any information about sampling variability. Therefore, it is usually impossible to make systematic and reliable generalizations from the empirical MDS results to some broader population. This is a serious problem for the present study, because the objective is to draw conclusions about the 1980 electorate, based upon observations within the 1980 NES Panel Study sample.

In order to alleviate this problem, I will employ a bootstrapping approach to estimate sampling variability in the WMDS results. The specific procedure is composed of several separate steps. First, observations are sampled with replacement from each the input data matrices for the separate panel waves, $\mathbf{E}_1$, $\mathbf{E}_2$, and $\mathbf{E}_3$. This produces a "bootstrap replication" of the input data, designated as $\{\mathbf{E}_1*, \mathbf{E}_2*, \mathbf{E}_3*\}_1$. The subscript outside the brackets indicates that this is the first such bootstrap replication. The resampling process is repeated a large number of times (50, in this case) to produce many bootstrap replications of the original data. These are represented as $\{\mathbf{E}_1*, \mathbf{E}_2*, \mathbf{E}_3*\}_1$, $\{\mathbf{E}_1*, \mathbf{E}_2*, \mathbf{E}_3*\}_2$, ... $\{\mathbf{E}_1*, \mathbf{E}_2*, \mathbf{E}_3*\}_j$, ... $\{\mathbf{E}_1*, \mathbf{E}_2*, \mathbf{E}_3*\}_{50}$.

The entire WMDS analysis is carried out for each of the 50 bootstrap replications. That is, for each $\{\mathbf{E}_1*, \mathbf{E}_2*, \mathbf{E}_3*\}_j$, the LOS procedure is applied to the three panel waves, producing bootstrap replications of the dissimilarities, $\{\mathbf{D}_1*, \mathbf{D}_2*, \mathbf{D}_3*\}_j$. The latter are used as input matrices for the WMDS estimation procedure, generating bootstrap replications of the general candidate point configuration ($\mathbf{X}_j*$) and the wave-specific dimension weights, $\{\mathbf{W}_1*, \mathbf{W}_2*, \mathbf{W}_3*\}_j$. In other words, there are 50 completely independent sets of WMDS estimates for the spatial model.

As in any bootstrapping procedure, the differences across the bootstrap replications are used to gauge the sampling variability in the model parameter estimates. But, the WMDS model contains two distinct kinds of spatial information: The candidate points, in which differences are represented as distances; and the dimension weights, in which differences are represented as angles between vectors. The strategy for assessing sampling variation differs across these two kinds of information. Let us consider each one, in turn.

Confidence Regions for the Candidate Points

Sampling variation in the candidate configuration can be assessed by constructing confidence regions around the WMDS point estimates. These regions are two-dimensional generalizations of the familiar confidence interval for a single sample statistic. In effect, the confidence regions are a heuristic device for assessing the reliability of the WMDS results. More formally, each region is a closed set of point estimates that contains the "true," but unknown, point location (i.e., that which would be obtained if the data were obtained from the population, rather than a sample) with a given degree of probability (0.95 in this case).

The regions are obtained using a procedure originally laid out by Weinberg, Carroll, and Cohen (1984). For each of the eleven candidate points, the bootstrap replications are used to create the variance-covariance matrix for the coordinate values. This matrix is used solve for the boundary points of an ellipse that is centered at the original WMDS point location for the candidate. The size of the confidence ellipse is determined by the number of bootstrap replications (more replications decrease the size) and the desired confidence level (larger intervals have a greater probability of containing the population point location). Full details about the construction of the confidence regions are available from the author.

Figure A1 shows the 95% confidence regions for the candidate points. Three features stand out in the figure. First, the regions tend to be quite small, relative to the overall space. Second, the regions are quite distinct from each other; there is very little overlap between them. Third, the major axes of the confidence ellipses are more vertical than horizontal in orientation. These results show that the electorate maintained fairly well-developed perceptions about the candidate field confronting them in the 1980 presidential campaign, and that they were able to make reliable distinctions between separate candidates. Public beliefs seem to have crystallized with respect to the candidates' ideological positions; hence the horizontal axes of the ellipses tend to be fairly narrow. There was much more uncertainty about the candidates' viabilities as realistic contenders for the presidency; this "stretched" the ellipses in the vertical direction.

There are some exceptions to the preceding conclusions: The confidence ellipse for Jerry Brown is large, compared to the others. There is also quite a bit of overlap between the ellipses for Carter and Mondale, along with a much smaller intersection between the regions for Reagan and Baker. And, the ellipses for Connally and Dole are "tilted" in the horizontal direction more than the others. But, these features all seem quite reasonable: Brown's unusual status as an "outsider" candidate within the Democratic party undoubtedly fueled public uncertainty about his personal abilities. This, in turn, increases the size of the confidence region. Carter and Mondale were incumbents as well as the clear leaders of the Democratic ticket. Similarly, Reagan's status as a leading presidential contestant, and Baker's position as Senate Minority Leader apparently placed them in close proximity to each other, at least from the public's perspective. These perceptual similarities generate the intersections between their respective confidence regions. And finally, both had Connally and Dole had visible reputations as conservatives, but the public appeared to be uncertain about their precise ideological positions. This seems very reasonable, since these men were relatively unfamiliar, at least as presidential candidates. Thus, even the exceptions to the more general patterns make a great deal of sense in substantive terms. To summarize, public perceptions of the differences between the candidates, as revealed by the weighted multidimensional scaling analysis, are "statistically significant."

Sampling Variability in the Weight Vectors

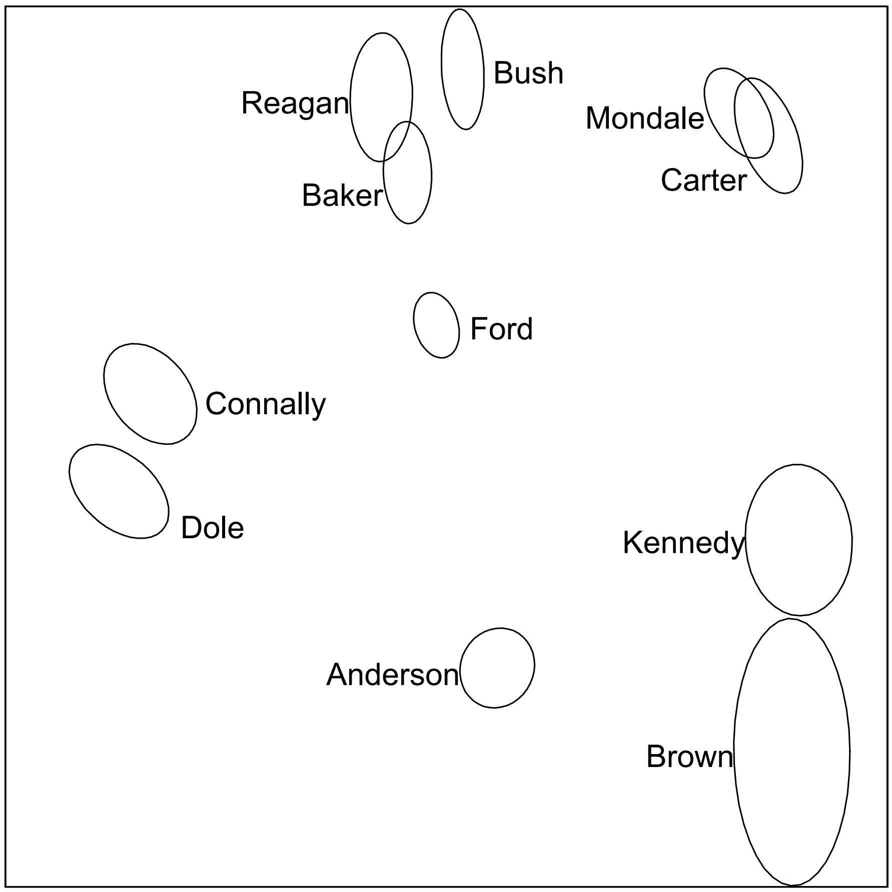
The substantive question is whether the differences in the orientations of the weight vectors for the three time points (i.e., those shown in Figure 2) are meaningful or merely the result of sampling fluctuations. The bootstrap resampling procedure generates a total of 150 weight vectors. These are naturally divided into three subgroups, corresponding to the respective Panel waves. From an analytical perspective, the question is whether the within-subgroup variability in vector orientations is small, relative to the between-group variation. If so, then sampling variability (which is gauged by differences in the bootstrap replicated vector orientations within each Panel wave) is probably *not* the source of the observed differences in the orientations of the original WMDS weight vectors.

A procedure called the "analysis of angular variation" or ANAVA is ideally suited for this kind of situation. ANAVA is analogous to the more common analysis of variance (or ANOVA). However, it examines angular separation across sets of vectors instead of variability in data values around group means (Mardia 1972; Schiffman, Reynolds, Young 1981). For present purposes, the important feature of the ANAVA strategy is that it provides an F statistic that can be used to assess the probability that empirical differences across sets of vector orientations are due to sampling error.

Table A1 contains the ANAVA results comparing the weight vector orientations across the three waves of the Panel Study. The contents of the table are interpreted just like an ANOVA table. The total sum of squared angular deviations about the overall mean vector (from the bootstrap replications) is shown on the bottom line. This is broken down into two additive components: The within-group sum of squared angular deviations (about the mean of the bootstrap replications for each Panel wave), and the between-group sum of squared angular deviations. All of these sums of squares can be divided by their respective degrees of freedom to obtain mean squared deviations. And, the between-groups mean can be divided by the within-groups mean, to produce a test statistic. The latter can be compared against the F distribution, for the null hypothesis of stable vector orientations (in which case, the between- and within-group mean squares should be equal) and appropriate degrees of freedom. Complete details of the ANAVA calculations can be obtained from the author.

The results in the table show that the between-group mean squares is much larger than the within-group mean squares. The empirical F statistic is an enormous 89.62. The observed probability value for this result is, effectively, zero. Thus, it is extremely unlikely that the observed set of dimension weight vectors would be obtained if the “true” dimension weights were constant across the three waves of the Panel Study. Stated more informally, the differences in the vector orientations are definitely “statistically significant” at any reasonable level of precision.

Figure A1: 95% Confidence Regions for Candidate Points Obtained from Weighted Multidimensional Scaling Analysis of Perceived Dissimilarities Among 1980 Presidential Candidates.



Source: Calculations based upon 50 bootstrap replications of the WMDS analysis. Data are from the 1980 CPS National Election Study, Major Panel Component. Full details about calculations are available from the author.

Table A1: Analysis of Angular Variation Table for Weight Vectors Obtained from WMDS Analysis.

Source	Sum of Squared Angular Deviations	Degrees of Freedom	Mean Squared Deviations	F
Between Groups:	1.134	2	0.567	89.622
Within Groups:	0.930	147	0.006	
Total:	2.064	149		

Note: The "groups" mentioned in the table are the three waves of the 1980 Panel Study.

Source: Calculations based upon 50 bootstrap replications of data from the 1980 CPS National Election Study, Major Panel Component. Full details of the analysis are available from the author.

APPENDIX B

ESTIMATING THE PARAMETERS OF THE STATIONARY IDEAL POINT AND MOVING IDEAL POINT MODELS

First, consider the stationary ideal point (SIP) model. As shown in the text (Equation 4), this model can be represented as follows:

$$\boldsymbol{e_{ijt} = \beta_{0i} + \beta_{1i}(v_{i1} - c_{jl}w_{lt})^2 + \beta_{2i}c_{j2}w_{2t} + u_{ijt}} \quad \text{(B1)}$$

The objective is to estimate *i's* location along the first dimension, v_{i1}. It will also be necessary to estimate the coefficients on the right-hand side of A1, β_{0i}, β_{1i}, and β_{0i}. The only other unknown term in equation A1 is u_{ijt}, which will be treated as a random disturbance. In order to simplify the following presentation somewhat, let us replace $c_{j1}\, w_{1t}$ and $c_{j2}\, w_{2t}$ with c_{j1t} and c_{j2t}, respectively. The first step is to expand the squared term in the right-hand side of A1, as follows:

$$e_{ijt} = \beta_{0i} + \beta_{1i}(v_{i1}^2 - 2v_{i1}c_{jlt} + c_{j1t}^2) + \beta_{2i}c_{j2t} + u_{ijt} \quad \text{(B2)}$$

Distribute the β_{1i} coefficient and rearrange the right-hand side terms in B2, as follows:

$$e_{ijt} = \beta_{0i} + \beta_{1i}(v_{i1}^2) + \beta_{1i}v_{i1}(-2c_{jlt}) + \beta_{1i}(c_{j1t}^2) + \beta_{2i}c_{j2t} + u_{ijt} \quad \text{(B3)}$$

Use ordinary least squares to estimate the coefficients of the following equation:

$$e_{ijt} = \beta_{0i}^* + \beta_{1i}^*X_1^* + \beta_{2i}^*X_2^* + \beta_{3i}^*X_3^* + u_{ijt} \quad \text{(B4)}$$

The unknown coefficients on the right-hand side of equation B4 are defined as follows:

$$\beta_{0i}^* = \beta_{0i} + \beta_{1i}v_{i1}^2$$

$$\beta_{1i}^* = \beta_{1i}v_{i1}$$

$$\beta_{2i}^* = \beta_{1i}$$

$$\beta_{3i}^* = \beta_{2i}$$

And, the observed variables on the right-hand side of equation B4 are defined as follows:

$$X_1^* = -2c_{ijt}$$

$$X_2^* = c_{ijt}^2$$

$$X_3^* = c_{j2t}$$

The ideal point coordinate for *i* along the first axis is then obtained by:

$$v_{i1} = \beta_{1i}^*/\beta_{2i}^* \quad \text{(B5)}$$

The R^2 for this equation shows the goodness of fit for the stationary ideal points model, so it is therefore designated R^2_{SIP}.

The parameters of the moving ideal point model are obtained through a similar, though lengthier derivation. From equation 5 in the text, this model is represented by:

$$e_{ijt} = \beta_{0i} + \beta_{1i}([v_{i1} + \alpha_2 t_2 + \alpha_3 t_3] - c_{j1t})^2 + \beta_{2i} c_{j2t} + u_{ijt} \tag{B6}$$

The entire term within parentheses on the right-hand side is expanded as follows:

$$\begin{aligned} e_{ijt} = \beta_{0i} + \beta_{1i}(&v_{i1}^2 + 2\alpha_2 t_2 v_{i1} + 2\alpha_3 t_3 v_{i1} + \\ &-2 v_{i1} c_{j1t} + \alpha_2^2 t_2^2 + 2\alpha_2 \alpha_3 t_2 t_3 + 2\alpha_2 t_2 c_{j1t} + \\ &\alpha_3^2 t_3^2 + 2\alpha_3 t_3 c_{j1t} + c_{j1t}^2) + \beta_{2i} c_{j2t} + u_{ijt} \end{aligned} \tag{B7}$$

Note that t_2 and t_3 can never both be equal to one at the same time, so the $2\alpha_2\alpha_3 t_2 t_3$ term (the third one in the second row) drops out of the right-hand side of equation B7. Distributing the β_{1i} and rearranging produces the following:

$$\begin{aligned} e_{ijt} = \beta_{0i} + \beta_{1i} v_{i1}^2 + \beta_{1i}\alpha_{2i} v_{i1}(2t_2) + \beta_{1i}\alpha_{3i} v_{i1}(2t_3) + \\ \beta_{1i} v_{i1}(-2c_{j1t}) + \beta_{1i}\alpha_{2i}^2(t_2^2) + \beta_{1i}\alpha_{2i}(2t_2 c_{j1t}) + \beta_{1i}\alpha_{3i}^2(t_3^2) + \\ \beta_{1i}\alpha_{3i}(2t_3 c_{j1t}) + \beta_{1i}(c_{j1t}^2) + \beta_{2i} c_{j2t} + u_{ijt} \end{aligned} \tag{B8}$$

At this point, ordinary least squares can be used to estimate the coefficients of the following equation:

$$\begin{aligned} e_{ijt} = \beta^*_{0i} + \beta^*_{1i} X^*_1 + \beta^*_{2i} X^*_2 + \beta^*_{3i} X^*_3 + \\ \beta^*_{4i} X^*_4 + \beta^*_{5i} X^*_5 + \beta^*_{6i} X^*_6 + \beta^*_{7i} X^*_7 + u_{ijt} \end{aligned} \tag{B9}$$

In equation B9, the unknown coefficients are defined as follows:

$$\beta^*_{0i} = \beta_{0i} + \beta_{1i} v_{i1}^2$$

$$\beta^*_{1i} = 2\beta_{1i}\alpha_{2i} v_{i1} + \beta_{1i}\alpha_{2i}^2$$

$$\beta^*_{2i} = 2\beta_{1i}\alpha_{3i} v_{i1} + \beta_{1i}\alpha_{3i}^2$$

$$\beta^*_{3i} = \beta_{1i} v_{i1}$$

$$\beta^*_{4i} = \beta_{1i}\alpha_{2i}$$

$$\beta^*_{5i} = \beta_{1i}\alpha_{3i}$$

$$\beta^*_{6i} = \beta_{1i}$$

$$\beta^*_{7i} = \beta_{2i}$$

The known variables on the right-hand side of equation B9 are defined as follows:

$$X^*_1 = t_2$$

$$X^*_2 = t_3$$

$$X^*_3 = -2c_{j1t}$$

$$X^*_4 = 2t_2c_{j1t}$$

$$X^*_5 = 2t_3c_{j1t}$$

$$X^*_6 = c^2_{j1t}$$

$$X^*_7 = c_{j2t}$$

The OLS estimates from equation B9 can be used to calculate the parameters of the moving ideal point model as follows:

$$v_{i1} = \beta^*_{3i}/\beta^*_{6i} \tag{B10}$$

$$\alpha_{2i} = \beta^*_{4i}/\beta^*_{6i} \tag{B11}$$

$$\alpha_{3i} = \beta^*_{5i}/\beta^*_{6i} \tag{B12}$$

Next, let us consider the *F* test for comparing the fit of the stationary and moving ideal point models. The R^2 from the regression in equation B4 measures the goodness of fit for the stationary ideal point model, R^2_{SIP}. Note that the regression degrees of freedom for this model is 4 (the number of parameters estimated in equation B4). The R^2 value from the regression in equation B9 measures the goodness of fit for the moving ideal points model, R^2_{MIP}. Here, the regression degrees of freedom is 8, the total number of parameters estimated in equation B9. The difference in the regression degrees of freedom across the two models is, therefore, 4. The residual degrees of freedom for the moving ideal points model is 23; this is the total number of thermometer ratings per respondent, minus the number of parameters estimated in the moving ideal point model. This information can be used to construct the following test statistic:

$$F = \frac{(R^2_{MIP} - R^2_{SIP})/4}{(1 - R^2_{MIP})/23} \tag{B13}$$

The value of this test statistic can be compared against the quantiles of the *F* distribution with 4 and 23 degrees of freedom in order to evaluate the significance of the R^2 change, moving from the SIP model to the MIP model.

NOTES

1. The term "Priming" refers to attempts to manipulate the decision-making criteria that people employ when they choose between political stimuli (e.g., Iyengar and Kinder 1987). Priming is usually conceived as a media effect on public opinion. Here, it is viewed more broadly as any variability in the external environment which impinges on the ways that individuals express their preferences among presidential candidates.

2. A spatial model with a diagnonal weight matrix, like that expressed in equation 1, is usually called the "weighted Euclidean model." Again, this representation allows the relative importance of the dimensions to change, but the dimensions, themselves, remain stable across the different time points under investigation. If $\mathbf{W}_t$ contains certain patterns of nonzero entries in the off-diagonal cells, then the weights rotate, as well as alter the relative lengths of, the dimensions. This is called the "general Euclidean model." In substantive terms, the general Euclidean model corresponds to a situation where the judgmental dimensions undergo qualitative changes from one time point to the next.

3. When the general Euclidean model is fitted to the data employed in this study, the estimates of the off-diagonal entries in $\mathbf{W}_t$ are always very close to zero; thus, it effectively devolves to the weighted Euclidean model. On the other hand, the simple Euclidean model (i.e., with no differential weighting of the dimensions) does not fit the data as well as the weighted model. Full details about these alternative analyses are available from the author.

4. The weighted Euclidean model is often called "the INDSCAL model" and MDS studies based that employ this spatial model are called "INDSCAL analyses." Both of these terms come from the first computer program that was developed for estimating the weighted Euclidean model (Carroll and Chang 1970). Following Young (1984; 1987), I prefer to use the more generic terms "weighted Euclidean model" and "weighted multidimensional scaling." This latter usage emphasizes the distinction between the spatial model and general analytic strategy on the one hand, and the specific software employed to calculate the parameter estimates on the other.

5. The 1980 NES Panel Study included feeling thermometers for several other political figures. Philip Crane was included in the first two waves, but he was only received nonmissing thermometer scores from a tiny subset of the respondents: 5.26% in the first wave and 6.25% in the second wave. Similarly, a feeling thermometer for Patrick Lucey was included in the third wave, but he only received nonmissing scores from 7.74% of the respondents. George McGivern, George Wallace, and Richard Nixon all had feeling thermometers, but none of them were contenders for the presidency in 1980.

6. The analysis includes respondents with nonmissing thermometer evaluations for at least half of the candidates. Respondents who recognized, but didn't know enough about a candidate to give a thermometer rating were scored as 50. Failure to recognize a candidate, refusals, panel dropouts, and other "not ascertained" responses are all regarded as missing data.

7. The input dissimilarities are assumed to be ordinal-level data. Therefore, it is really more appropriate to say that the scaled distances are fitted to an optimal monotonic transformation of the perceived proximities. In practical terms, the measurement level of the input data makes very little difference. A replication of this analysis, assuming interval-level proximities, produces virtually identical results. The scaling analysis is carried out using PROC MDS in SAS. Once again, nearly identical results are obtained using the other major software packages for WMDS (ALSCAL and SINDSCAL).

8. In this context, the R^2 between the distances and the data values is actually a conservative measure of model fit. Since the input data are assumed to be ordinal-level, the appropriate comparison is between the rank-orders of the data values and the scaled distances. An alternative measure, Kruskal's Stress_1,

does measure the degree of monotonic fit; its value for the present scaling solution is 0.23. However, this coefficient is a *badness*-of-fit statistic (increasing values correspond to worse scaling solutions), so it is difficult to interpret.

9. Robinson and Sheehan (1983) show that the amount of media coverage devoted to the candidates personal characteristics remained fairly stable while the coverage of issues decreased slightly from January through September 1980. These trends are completely different from the changes in the dimension weights that occur over the three waves of the study.

10. This also appears to be a recurrent pattern in American politics, rather than an idiosyncratic feature of the 1980 presidential election. Analysis of the 1984 NES Rolling Cross-Section Study reveals that similar trends occur over the course of the 1984 campaign, as well.

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Table 1: Summary Statistics for Goodness-of-Fit Measures Obtained from External Unfolding Analyses of the Stationary and Moving Ideal Points Models.

	Goodness of Fit for Stationary Ideal Point Model (R^2_{SIP})	Goodness of Fit for Moving Ideal Point Model (R^2_{MIP})	Difference in Fit Across the Two Models (R^2_{MIP} - R^2_{SIP})	Observed Probability Value (from *F* Test)
Sample Mean	0.219	0.541	0.321	0.454
Sample Median	0.179	0.527	0.308	0.403
Standard Deviation	0.201	0.134	0.112	0.319
Minimum Value	-0.110	0.261	0.064	0.000
Maximum Value	0.861	0.926	0.808	1.000

Note: Number of observations is 616.

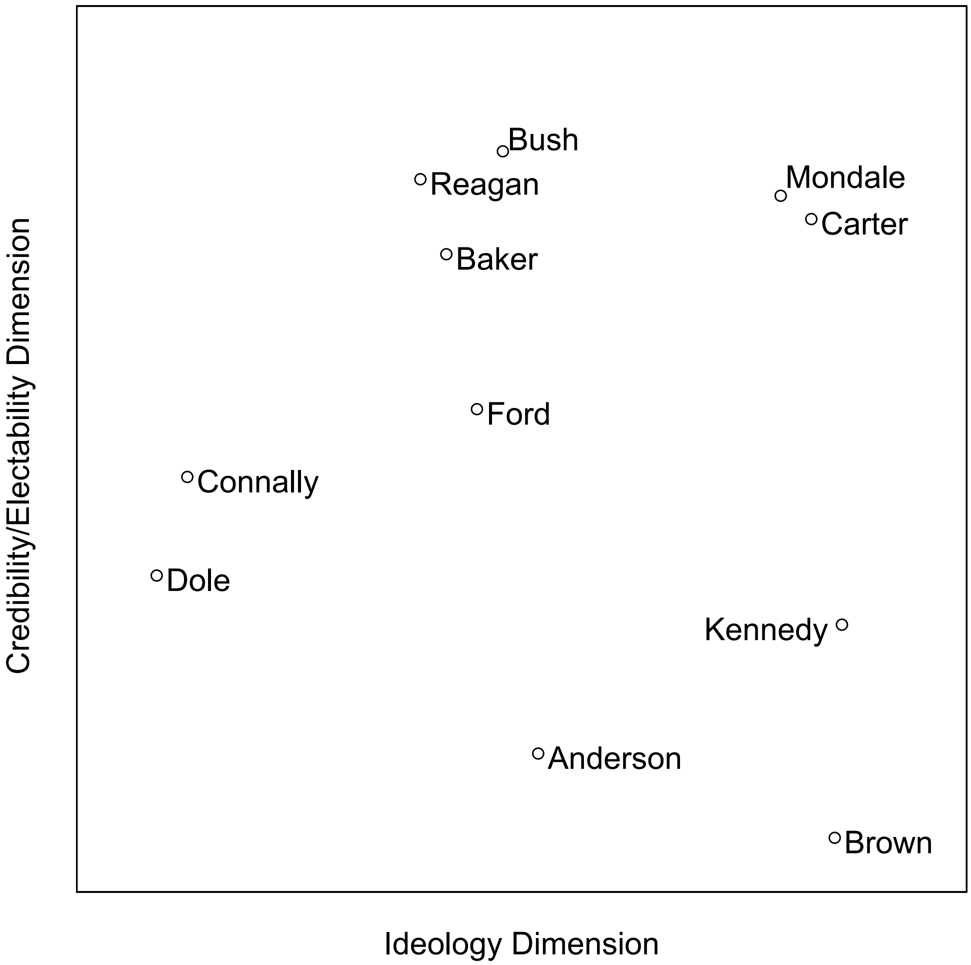
Source: External unfolding analyses of the stationary and moving ideal points models, applied to the feeling thermometer ratings from the 1980 NES Major Panel Study.

Table 2: Factors Influencing Ideal Point Movements.

	OLS Regression Coefficients (Standard Errors in Parentheses)	Standardized Coefficients
Level of political interest and information (squared)	-0.005 (0.001)	-0.188
Political Participation	-0.013 (0.004)	-0.122
Level of Education	-0.005 (0.002)	-0.098
Strength of Party Identification	-0.015 (-0.005)	-0.124
Intercept	0.427	
R^2	0.118	
Number of Observations	615	

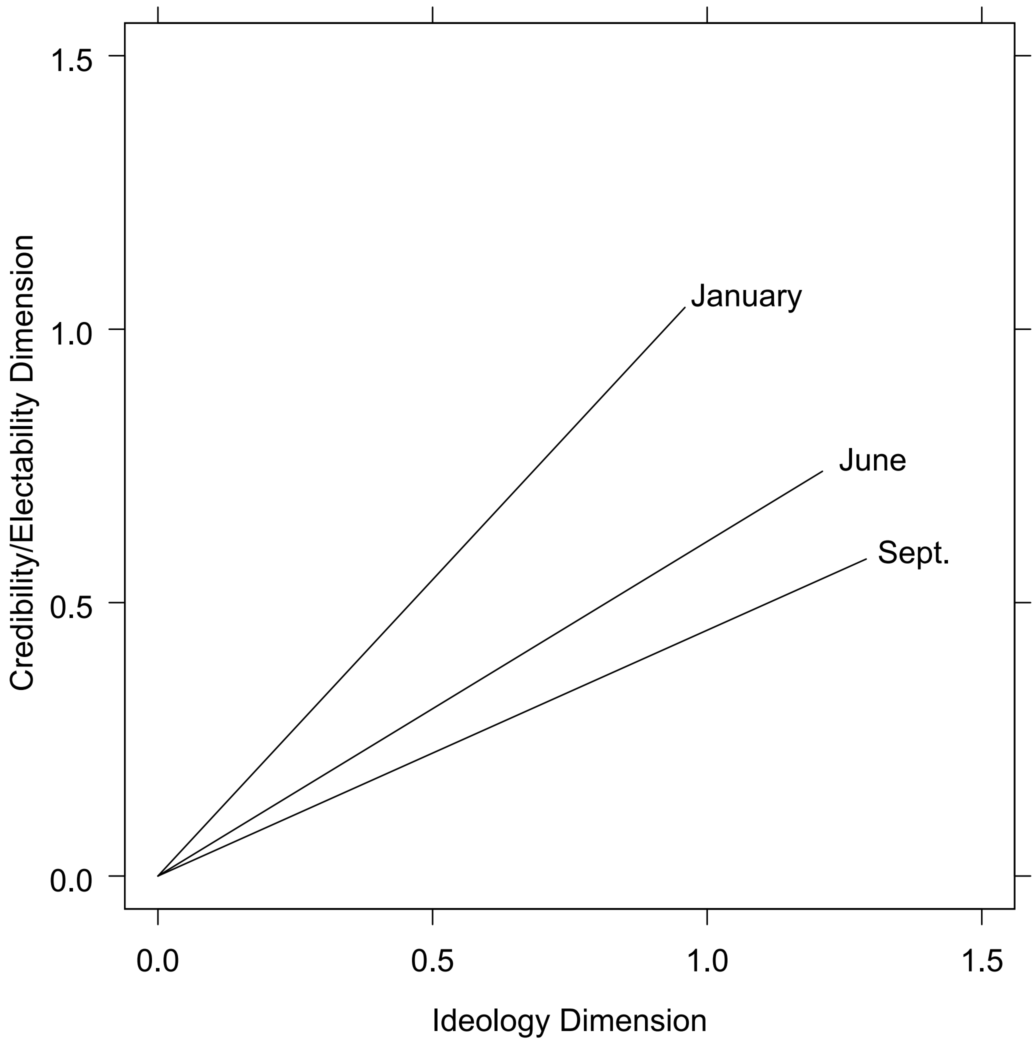
Source: 1980 NES Major Panel Study.

Figure 1: Two-Dimensional Configuration of 1980 Candidates.



Source: Weighted multidimensional scaling analysis of data from the CPS 1980 National Election Study, Major Panel Component.

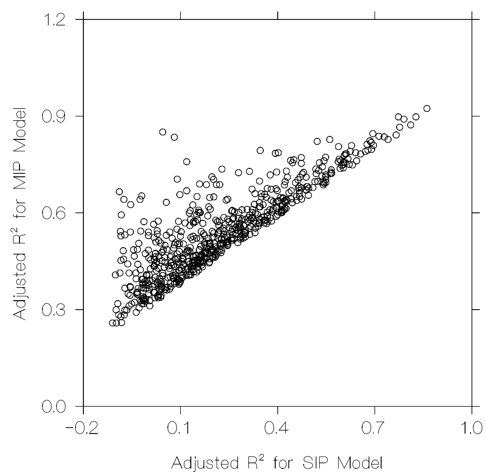
Figure 2: Plot of Dimension Weight Coefficients for 1980 Candidate Space.



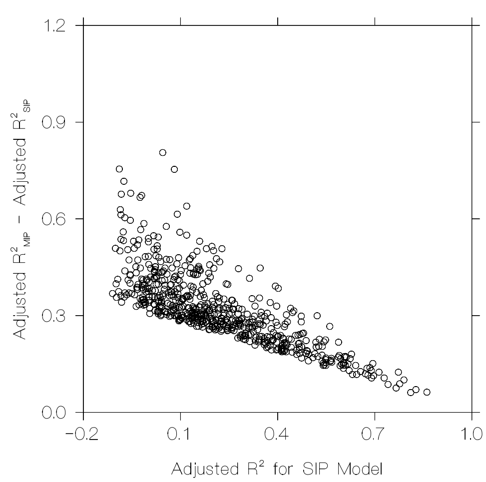
Source: Weighted multidimensional scaling analysis of data from the CPS 1980 National Election Study, Major Panel Component.

Figure 3: Graphical Displays Showing Goodness-of-Fit for Stationary Ideal Point and Moving Ideal Point Models.

A. Plot of Adjusted R^2 Values for the Two Models



B. Difference Between Adjusted R^2 Value, Plotted Against R^2_{SIP}



Source: External unfolding analyses of feeling thermometer responses from the 1980 NES Major Panel Study.