TESS Proposal: Spatial Models of Voting using Two Issues and in Multidimensional Space

Donald Moratz

Dam85

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I. Introduction

Understanding voter's underlying preference system for candidate analysis in issue spaces is fundamental for the field of political science. It is crucial that researchers understand how people distinguish between candidates and why they vote as they do. Questions regarding identifying the importance of party, non-issue concerns, and even predictions as to how parties will locate themselves all depend upon assumptions around spatial models. While many attempts- Tomz and Van Houweling cite over 50 articles- have been made to understand the issue, there are two core difficulties preventing easy analysis; the endogeneity of candidate position in real world, observational data, and the frequently indistinguishable predictions of the models (Tomz and Van Houweling, 2008).

In an attempt to mediate between the three most commonly supported spatial models- proximity, directional, and discounting- I propose an experiment whereby clear distinctions are made between the predictions of the models as to isolate the frequency of their use. This is an extension of the work done by Tomz and Van Houweling, with two key differences. First and most importantly, this experiment will use two issues rather than one. An explanation as to why this is critical will be given in a subsequent section. Secondly, the findings will be tested in a multidimensional setting to see if changing dimensionality of the space influences voter choice. This second test is also necessary as it is unclear from the literature how many issues voters truly consider (Gigerenzer and Gaissmaier, 2011). This proposal will be laid out in the following way: an initial, quick rundown of the three models, followed by a summary and critique of the work of Tomz and Van Houweling, and concluded by the proposal for a new experiment.

II. The Three Models- a Brief Overview

The three models most commonly used to explain a voter's relationship with issue positions

are the proximity, directional, and discounting models.[1] The proximity model- proposed by Downs in 1957- suggests that voter utility is a loss function, which is minimized as candidate issue positions approach those of the voter themselves. The model predicts that voters will always choose the candidate closest to them in the issue space, and provides no considerations for a neutral point. To account for the lack of a reference point in the proximity model, Grofman proposed his discounting model in 1985. This model proposes that voters value policy aligning with their values- similar to the proximity model- however, Grofman argues that voters consider the status quo in making this analysis. By including the status quo, voters do not just determine where candidate's stated preferences lie in the issue space, but additionally a reasonable expectation of where their ultimate policy implementation lies. Voters have expectations about the strength of the status quo, and the difficulty of moving policy away from it, and the more pessimistic they are, the higher they discount candidate's issue preferences. In this model, voter utility is maximized when their expectation of policy is aligned with their own issue preferences (Grofman, 1985).

The final model is the directional model, proposed by Rabinowitz and MacDonald in 1989.[2] The directional model only moderately accounts for the status quo, but rather emphasizes the neutral point. The key component of the directional model is that voters do not have distinct policy preferences, but rather have vague ideas of the direction in which they would like policy to go. As a result, voter's choice will be framed around the neutral point- they will strictly prefer candidates on their side of the neutral point. Additionally, there preference will be for more intense candidates, because intensity is a signal for commitment (Rabinowitz and MacDonald, 1989).

III. The Tomz and Van Houweling Experiment

[1] For a full discussion of the history of the models, one should read Downs, 1957, Enelow and Hinich, 1984, Davis, Hinich, and Ordeshook 1980, Grofman, 1985, Grofman 2004 and Rabinowitz and MacDonald, 1989. This list is non-exhaustive and covers merely the core model proposals rather than a full range of their criticisms.
[2] For an alternative formulation of the model, see Matthews, 1979.

As Tomz and Van Houweling note in their 2008 experimental study of spatial models of voting, studying the issue is almost impossible with observational data. As a result, they conducted a carefully defined survey experiment in an effort to isolate each of the models- one of the first attempts at experimentally identifying spatial models. They attack the issue of identical predictions by clearly delineating so-called "sandwich" conditions, which provide distinct predictions from each of the models. These sandwich conditions can most succinctly be summarized in Table 2.[3] They use a single, salient issue with nondescript candidates to isolate a single spatial model. While they find strong support for the proximity model, there are issues with some of their approaches that need to be addressed.

There are three core problems with the Tomz and Van Houweling experiment which further experimentation needs to tackle more rigorously. The first and third relate to their use of a single issue position, while the second relates to the order in which they ask their questions. First is an issue of identification. In using only one issue, they can- at best- only isolate a single spatial model. In practical terms, this means that they have gained little information from any survey respondent who chooses the candidate unrelated to the isolated model. Because of this, it is feasible that a significant number (in their experiment, over 60%) of the survey respondents will provide no distinguishing information.[4] This is compounded by the second issue- the order in which they ask the questions. While they attempt to avoid priming respondents to vote via the discounting model by asking about their perception of the status quo last, this means there is an even higher chance of failing to gain accurate information. Consider Figure 2, identical to that found in the original paper: as can be seen by comparing scenario IV and scenario II: an attempt to isolate the discounting model has at best a fifty percent chance of isolating anything at all. This means that

[3] See Appendix Table 1A for their version of the isolation
[4] See Appendix for discussion around sample rejection rate

practically, if they attempt to isolate the three in equal measures, they almost certainly under identify discounting. The final issue is related to the dimensionality of their project. By only asking along a single issue position, not only do they struggle to provide precise estimates of individuals voting, they also fail to consider how voters will move in multidimensional spaces, such as those presented in the real world.

IV. The Proposal

I hope to rectify the shortcomings of the Tomz and Van Houweling experiment by extending the model into two-dimensional space. This serves two purposes with regards to extension. First, I will present respondents with the original survey questions- in the same order- which can be seen in the Survey Section, questions 1-3. I will use the original issue position- healthcare- as it is still a salient issue today. I will then follow up with a second set of survey questions regarding a new issue-gun control- with a slightly different order. As can be seen in Example 1, careful placement of candidate locations means that so long as voters do not identify at the neutral point, or the boundaries, it is almost always possible to isolate either proximity voting or directional voting, depending on the location of the status quo. My method will exploit this fact by using the first issue to isolate one of these two models using a matching algorithm, with the second question being used to split the un-isolated models, if possible. [5]

To do this, the second survey set will first ask the respondent to identify their belief about the status quo before asking them to choose between two new candidates. While I recognize this may prime the discounting model, Tomz and Van Houweling found that it is significantly less common than the proximity model, so the effect should theoretically not be large. Furthermore, by this point in the experiment, the respondent should already be thinking about politics, and if

[5] Even if voter location renders this impossible, the model will still be able to be extended into the multidimensional space to see if the initial prediction is still valid.

discounting is their underlying model, further priming should have no effect. However, by asking them to locate the status quo first, I dramatically increase the chances that I can isolate a new model in the second question. By providing the possibility of dual isolation, it will be easier to clarify if respondents are using one primary system. Of course, considerations will have to be given to the possibility of respondents using multiple systems. This issue, as well as determining whether multidimensionality changes the question, will be addressed in the third survey question set. This single question will map an additional two new candidates on a cartesian coordinate system along with the voters previously identified preferences and their identified status quo. Example 1 in the appendix provides a visual depiction. This method should ensure that I can identify individuals primary spatial model, while allowing for the possibility that voters use multiple models to some varying degrees.

V. Conclusion

Understanding which spatial models voters use to distinguish between candidates on issue positions is a key factor in building utility curves for elections. This is in turn fundamental for predicting how political parties will operate. Previous attempts to understand which of the three spatial models are most common- proximity, directional or discounting- have relied primarily on observational data. As Lewis and King note though, because the predictions the models offer are frequently similar, attempts to distinguish them become "theoretical debates about which statistical assumption is right (Lewis and King, 2000)." Attempting to address this shortcoming, Tomz and Van Houweling designed an experiment to isolate the models using survey responses. While their work was an excellent start, their use of a single issue position means that more clarity is needed. By studying voter's choices using multiple issues and in a multidimensional space, I hope to shed more light on a widely debated topic.

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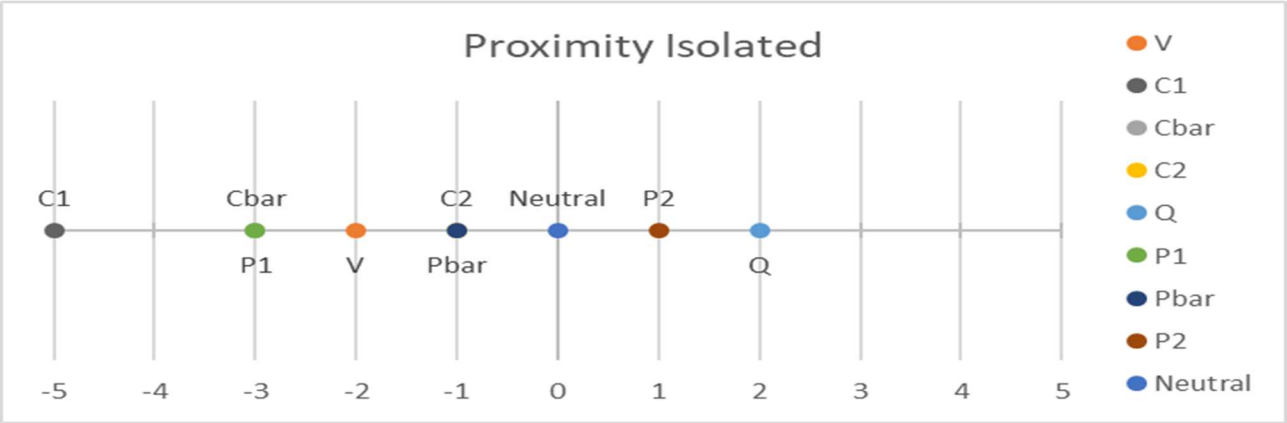
Example 1

Number lines and graphs, with labels. Please note that candidate average, policy predictions, and policy averages will be excluded in actual survey

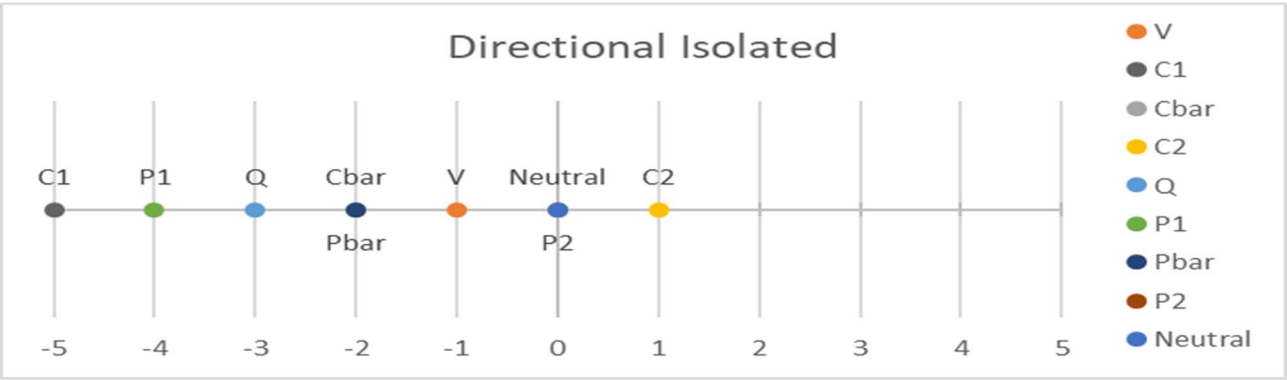
Number line from Issue One, theoretical respondent:



In this example, the proximity model is isolated and the models make the following predictions:

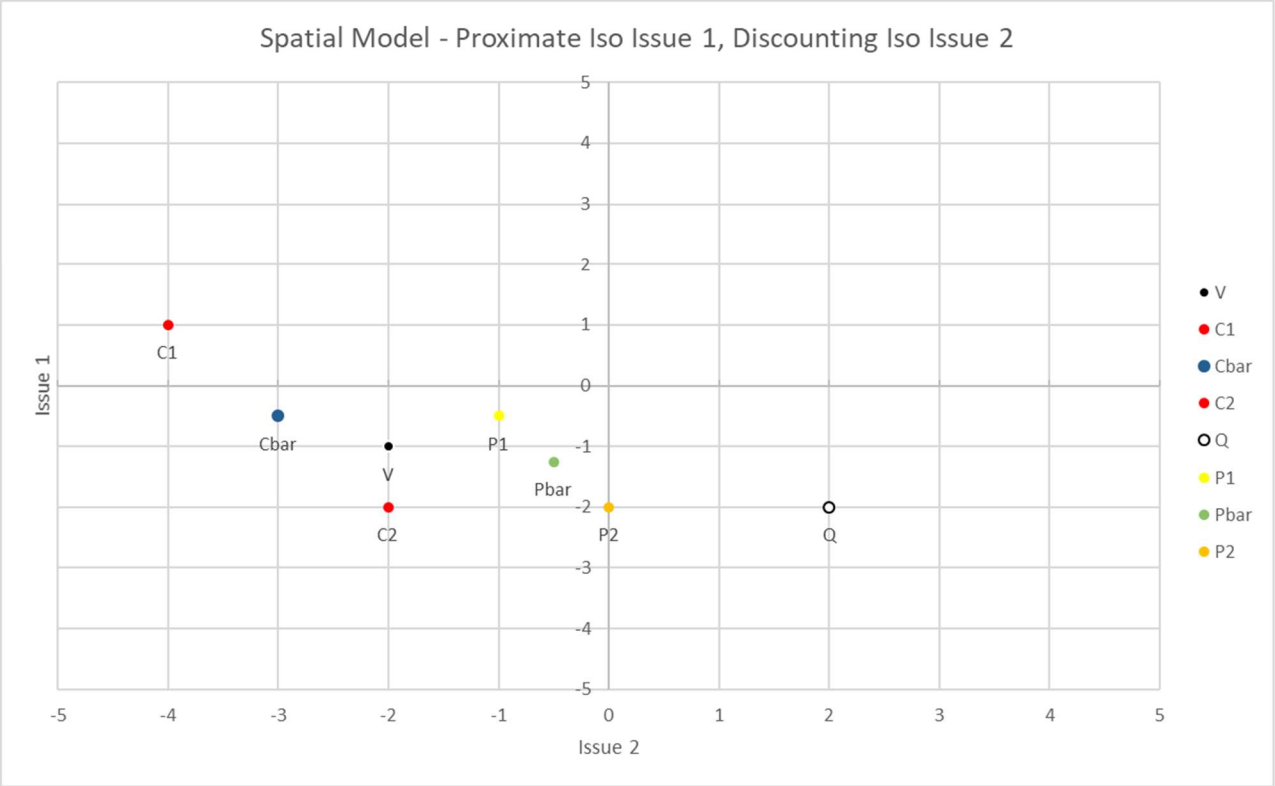
Prediction	Proximity	Directional	Discounting
Vote Choice	c2	c1	c1

Number Line from Issue Two, theoretical respondent:



Prediction	Proximity	Directional	Discounting
Vote Choice	c2	c1	c2

Under the assumption that voter has chosen Candidate 2 in both models, they are presented with the following model:



With the models making the following predictions on vote choice:

Prediction	Issue 1	Issue 2
Proximity	c2	c2
Directional	c1	c2
Discounting	c1	c1

If the respondent again chooses Candidate 2, proximity is strictly confirmed across these two issue positions. Note that the candidates in the multidimensional system have different positions than in either of the first two position systems. Additionally, while candidate notation is consistent in this example, in the actual survey candidates will be labeled A-F to provide further distinction rather than just 1 and 2.

Survey Questions:

Instructions:

Please answer each question honestly to the best of your ability. There is no time limit, so take as long as you would like to consider each question before deciding.[6]

Question 1:[7]

There is much concern about the rapid rise in medical and hospital costs. Some people feel there should be a government insurance plan which would cover all medical and hospital expenses for everyone. Suppose these people are at one end of a scale, at point -5. Others feel that all medical expenses should be paid by individuals through private insurance plans like Blue Cross or other company paid plans. Suppose these people are at the other end, at point +5. And, of course, other people have opinions somewhere in between, at points -4, -3, -2, -1, 0, +1, +2, +3, or +4. Where would you place yourself on this scale?

Insert number line from -5 to +5, with a choice option at each integer

Question 2:

Many political candidates have opinions about this same issue. Some candidates feel there should be a government insurance plan which would cover all medical and hospital expenses for everyone. Other candidates feel that all medical expenses should be paid by individuals through private insurance plans like Blue Cross or other company paid plans. And, of course, other candidates have opinions somewhere in between.
Here are the opinions of two candidates, whose names will remain confidential.

Insert number line from -5 to +5, with candidate A and candidate B clearly marked

On this particular issue, do you prefer to vote for candidate A or candidate B?

Question 3:

If you were to describe your opinion on the current status quo of this issue in the United States, which number would you choose?

Insert number line from -5 to +5, with a choice option at each integer

[6] The question of a time-limit should be addressed- respondents should be encouraged to take their time, as in a real election cycle, people usually have months to decide. Furthermore, removing time constraints will hopefully increase accuracy

[7] Question 1 and 2 are taken directly from Tomz and Van Houweling

Question 4:

There is significant concern about the rapid rise of mass shootings in the United States. Some people feel that more should be done to eliminate access to firearms. Suppose these people are at one end of a scale, at point -5. Others feel that access to firearms should be increased as the presence of guns acts as a deterrent. Suppose these people are at the other end, at point +5. And, of course, other people have opinions somewhere in between at points -4, -3, -2, -1, 0, +1, +2, +3, or +4. Where would you place yourself on this scale?

Insert number line from -5 to +5, with a choice option at each integer

Question 5:

If you were to describe your opinion on the current status quo of this issue in the United States, which number would you choose?

Insert number line from -5 to +5, with a choice option at each integer

Question 6:

Many political candidates have opinions about this same issue. Some candidates feel the government should eliminate access to firearms. Others feel that firearm restrictions should be relaxed to increase access for the population. And, of course, other candidates have opinions somewhere in between.
Here are the opinions of two candidates, whose names will remain confidential.

Insert number line from -5 to +5, with candidate C and candidate D clearly marked

On this particular issue, do you prefer to vote for candidate C or candidate D?

Question 7:

In the below graph, healthcare has been placed on the x-axis, while gun control has been placed on the y-axis. For your convenience, we have marked your choices, as well as your beliefs about the status quo here. Consider two new candidates, E and F who take the positions marked on the graph.

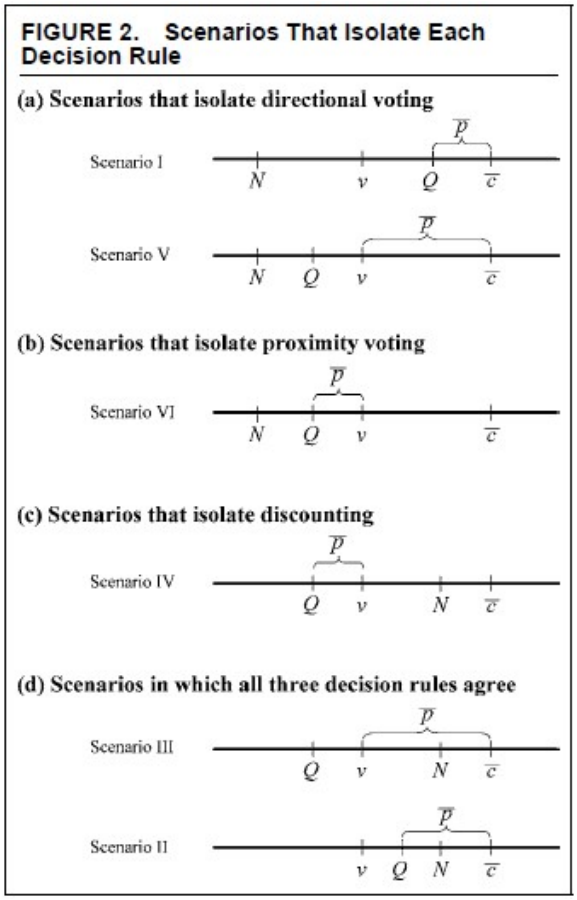
Insert cartesian coordinate system, scale -5 through +5 on both y and x axes. Clearly marked are status quo, voter preference, and two candidate positions, E and F

Based on their positions on these two issues, do you prefer to vote for candidate E or candidate F?

Tables

Table 1	
Variable Description	Variable
Voter Position	v
Candidate 1 Position	c_1
Candidate 2 Position	c_2
Candidate Midpoint	$\bar{c}$
Candidate 1 Policy Position	p_1
Candidate 2 Policy Position	p_2
Candidate Midpoint	$\bar{p}$
Neutral Position	N
Status Quo	Q

Table 2		
Sandwich Conditions		
$\bar{p}$<>v<>$\bar{c}$	$\bar{c}$>v>N	Isolated
Yes	Yes	Proximity
No	Yes	Directional
Yes	No	Discounting
No	No	None



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[8] This table is an exact replica of the table from Tomz and Van Houweling. To preserve integrity, the Table is unchanged and is referred to in this paper as Figure 2

Appendix

Table 1.A

TABLE 1. Predicted Choices in Six Scenarios

Scenario	Arrangement of Candidates, Voter, Neutral Point and Status Quo	Weight Discounters Put on Status Quo	Implied Sandwich Conditions: Voter Is Between Candidate Midpoint and Policy Midpoint	Implied Sandwich Conditions: Voter Is Between Candidate Midpoint and Neutral Point	Predicted Choice (c_1 versus c_2): Proximity Theory	Predicted Choice (c_1 versus c_2): Discounting Theory	Predicted Choice (c_1 versus c_2): Directional Theory
I	$N < v < \bar{c}$ and $v \leq Q$	Any: $\alpha \in (0, 1)$	No	Yes	c_1	c_1	c_2
II	$v < \bar{c}$, N and $v \leq Q$	Any: $\alpha \in (0, 1)$	No	No	c_1	c_1	c_1
III	$Q < v < \bar{c}$, N	Low: $\alpha < \alpha^*$	No	No	c_1	c_1	c_1
IV	$Q < v < \bar{c}$, N	High: $\alpha > \alpha^*$	Yes	No	c_1	c_2	c_1
V	N, $Q < v < \bar{c}$	Low: $\alpha < \alpha^*$	No	Yes	c_1	c_1	c_2
VI	N, $Q < v < \bar{c}$	High: $\alpha > \alpha^*$	Yes	Yes	c_1	c_2	c_2

Note: $\alpha^* = (v - \bar{c})/(Q - \bar{c})$.

[9]

[9] Duplicated from Tomz and Van Houweling

Discussion on Avoiding Sample Issues:

Consider that by eliminating the boundaries and the neutral point, 27.3% of potential responses are eliminated. Indeed, in their paper they note 68.5% of respondents were dropped. 52.8% were dropped because of location along the boundary or at the null, and a further 15.7% (or 33.2% of remaining respondents) were dropped because they offered unclear predictions. In comparison, my proposal should offer predictions for 92.6% of possible responses.