Political Matchmakers – How do the decision rules employed by Vote Advice Application Sites influence their advice?[1]

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Abstract

Voter Advice Application (VAA) websites are an increasingly important feature of electoral campaigns, especially in established multi-party democracies. VAA's seek to enhance issue voting by showing each user how 'close' or 'similar' individuals users' stated personal issue positions with the issue positions of the parties. This paper highlights three aspects of VAA's. First, the visual presentation or advice that VAA's present to their users is critically dependent on the precise built-in Multi-Attribute-Utility-Decision (MAUD) rule to conceptualize issue voting that underlies a VAAs advices. This paper employs the logfiles of over 600,000 users of the Kieskompas.nl site during the 2010 election campaign in the Netherlands to simulate the advice that the site would have generated under alternative MAUD rules. The results show that different MAUDs result in strikingly different vote advices. Next we employ a representative multiwave panel survey of IntomartGfK among show that the simulation results hold for VAA users. Advices generated by VAAs based on different decision rules generate strikingly different advices. These advices have a huge impact on the vote.

[1] This research was funded by the Marie Curie Initial Training Network in Electoral Democracies (ITN-ELECDEM) and was part of work package 18 (New Technologies and Political Preferences: the Electoral Compass).

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1. Introduction

'Voting Advice Application' (VAA) websites are among the most significant online political innovations that have emerged to date in established democracies. Typically, VAA sites are established during electoral campaigns; they elicit information from users regarding their policy preferences, compare these to the policy positions of political parties or candidates, and issue advice to the user as to which party's policies best match the user's preferences. This advice may be presented as a simple discrete recommendation for the user to vote for a specific party, or as an explicit rank ordering of parties or a (two dimensional) visualization of parties relative to the user according to 'closeness' to the issue positions of the voter. Guidance may also be given by a graphical presentation of the position of the voter in an *n*-dimensional (usually two-dimensional) political landscape relative to the issue positions of the various parties.

In recent years, millions of voters across many countries consulted a VAA website (or, in some cases, several such sites) prior to casting their vote, especially in national legislative elections in European multiparty systems. VAA websites were pioneered in the Netherlands, where an early text version appeared just before the dawn of the internet age, in 1989, followed by the launch of the *Stemwijzer* (which roughly translates as 'Vote Pointer') website in 1998. However, VAA sites have since become internationally widespread: Walgrave *et al.* (2008) report that an expert survey of European political scientists revealed that VAA sites featured in national elections in 18 European countries. In countries where VAA sites have now featured in several elections and consistently generated high volumes of unique site visits, Walgrave *et al*. (2008) conclude that 'voting advice has become a natural part of the campaign'(p. 43). Nowhere is this more true than in the Netherlands. While the 1998 Dutch *Stemwijzer* site generated approximately 250,000 recommendations, the 2006 version generated 4.6 million, with a further 1.5 million recommendations generated by the *Kieskompas* (Electoral Compass) site (Walgrave *et al*., 2008). Ruusuvirta and Rosema's (2009) analysis of the 2006 Dutch Parliamentary Election Study (DPES) reveals that these figures do appear to have corresponded to massive usage of such sites by the Dutch population – they report that 38 per cent of voters in the DPES survey sample recalled visiting a VAA site

during the campaign. More recently, VAA sites have been developed for the non-European elections, including the 2008 US presidential elections (http://www.electoralcompass.com), the 2011 Canadian Legislative elections (www.votecompass.ca), and series of websites in 'Arab Spring' elections in Tunisia, Morocco and Egypt (see: http://www.kieskompas.nl/). VAAs have also been deployed during both sub and supra national campaigns – the 2009 European Parliament elections featured a VAA that was consulted by over a million users (euprofiler.eu), while local and waterboard elections have been developed in the Netherlands, where the concept originated in the late 1980s. Thus as VAA sites are an increasingly widespread feature of electoral politics in the Internet age.

In a context of weakened partisan socialisation (Dalton and Wattenburg, 2002), the presence in electorates of a growing number of voters who change party preferences between elections (Dalton and Gray 2003; Franklin 1992; 2003), and a seemingly ever more fragmented and complex media environment across a range of established democracies, the popularity and impact of such sites is not entirely surprising. They purport to simplify the intricate and often contradictory statements and signals given to the public by political parties/candidates into an easily understandable representation of the party political 'policy space' and to allow users to examine where their own preferences place them relative to the parties competing in that space. Such sites also have a certain entertainment value; and some of their popularity is undoubtedly due to the suspense that they can produce as users wait to see which party they most closely resemble.

There is a nascent body of research seeking to measure the impact of VAA sites on users' voting behaviour; thus far, this research has tended to conclude that the advice provided by VAA sites is consequential in terms of voting behaviour, although existing research differs with regard to the scale and nature of this influence, as well as how such influence is best-measured (Marschall and Schmidt, 2010; Kleinnijenhuis and van Hoof, 2008; Walgrave *et al*., 2008, Wall *et al*., 2012). While research on this topic is far from definitive, there does appear to be strong evidence that at least some voters take the advice that they receive online seriously, and Wall *et al*. (2012) found evidence that voters were more likely to vote for a party recommended during a VAA site than for a non-recommended party *ceteris paribus*.

This research points to the substantive significance of VAAs as a research topic for political scientists – they are both widely consumed and at least somewhat influential.

Proponents of VAA sites argue that they have the potential to improve the quality of democratic participation by making it easier for voters to become informed about the policy positions of political parties on salient issues. A core element in many theoretical and empirical treatments of voting behaviour in modern representative democracies is that voters base their decisions at least partially on an assessment of the likely policy actions that parties will undertake in the future. Indeed, the 'mandate' model of political representation sees this type of consideration on the part of voters as a key source of legitimisation for the exercise of political power in a representative democracy (Budge and Hofferbert 1990). Given the costs of analysing parties policy outputs, as well as the noted tendency for parties to 'talk past' each other, seeking to emphasize those issues that they 'own' rather than staking a clear stance on all issues, voters have strong incentives to seek informational shortcuts that allow them to estimate which parties are most likely to act in accordance with their preferences. While, under the classical Downsian (1957) conception, voters were able to use positions on the 'left-right' scale to perform this shortcut, VAA sites potentially allow voters to compare their positions to the main parties on a wide range of issues to their own preferences.

According to this conceptualisation, VAA sites represent a public good; a free source of positional information on the main parties/candidates, condensed into an easy-to-understand and, indeed, entertaining online format. However, VAA sites also have trenchant critics, who have argued that they unrealistically simplify complex political issues (Hooge and Teepe, 2007). For such critics, VAA sites are, at best, incapable of providing reliable advice and, at worst, politically pernicious devices, which provide biased advice; systematically favoring certain parties over others.

However, as Walgrave *et al*. point out:

'in sharp contrast to their amazing popularity, to the pertinent questions about VAA outputs, and to the fierce political debate in some countries, the *scientific* debate about VAAs has hardly commenced' (2009: 1162).

Specifically, Walgrave *et al.* argue that claims regarding the validity and reliability of VAA sites' voting advice have received surprisingly little attention from political scientists. This article seeks to address this lacuna in the literature. Building on the approach adopted by Walgrave *et al*. (2009); we simulate the effects of alternative methodologies on the type of output that a VAA site would generate. Walgrave *et al*. focused their attention on the impact of statement selection (that is, the specific policy statements that are used to measure voter and party opinions) on the aggregate voting advice produced by a VAA site. This research also focuses on the reliability and quality of the vote advice issued by VAAs. However, we examine the importance of methodological assumptions concerning the nature of the issue space within which voters and parties may be located, and the manner in which 'closeness' or 'utility' of parties for voters can be inferred. Specifically, the first research question addressed by this article is as follows: *what is the impact of the decision rules incorporated in party advice website upon the advice that they present to users*?

Regardless of the manner in which party and voter policy preferences are measured, and regardless of the specific issue statements that are used to characterise the policy conflicts that characterise the political debate in a given election[3], all VAA sites must employ a specific built-in rule that models issue voting (Rabinowitz and McDonald 1989; Lewis and King 1999; Westholm 1997; Tomz et al. 2006). Rules for issue voting belong to the class of Multi-Attribute-Utility-Decision (MAUD) rules also known as Subjective Expected Utility (SEU) rules (Bronner and Hoog 1981; Humphreys and McFadden 1980; Morton and Fasolo 2008) . Any given MAUD rule can only be built by making a number of assumptions about the nature of the policy space within which party issue stances and voter preferences are located. MAUD rules also embody assumptions with regard to the way in which comparisons of voter preferences and party issue stances should be transformed into measures of voter 'closeness', 'similarity' to each party, or to measures of the 'utility' that voters should associate with each party's policy stances. The results of these calculations are, of course, the source of the specific 'advice' that each individual receives when they visit a VAA site.

[3] Although we note here that these aspects of VAAs also offer potentially interesting research tangents. It is worth seeking to establish the importance of the sources and methods by which party positions are measured, and the effects of the wording and scaling of the issue statements that site users are asked to fill in on the recommendations that they receive.

The problem for designers of VAAs is that, in deciding among possible assumptions in order to choose a MAUD rule, they find themselves confronted with some of the most fiercely contested arguments in the modern political science literature. Simply put, there is very little agreement in the issue voting literature in political sicence how voters conceputalize issue spaces and how they compare or should compare their personal issue stances with those of the various parties (Lewis and King 1999; Westholm 1997; Tomz et al. 2006) . While issue voting theories are of little help to build VAA's, the data retrieved with offer new opportunities to improve theories of issue voting, since VAA's typically include more issues than national election studies and campaign studies. The research presented here is therefore not simply aimed at improving our understanding of the importance of MAUD rule selection for designers of VAA applications – it also sheds light on the substantive implications of key theoretical and empirical disagreements among issue voting scholars in political science.

Here we will focus on three controversies in the issue voting literature that allow for very different MAUD-rules to build VAA's: proximity versus direction, the dimensionality of the issue space and the curvature of the issue space.

Proximity Theory versus Directional Theory

Socio-structural accounts of voting behaviour have declined in explanatory power across Europe from the late 1960s onwards (Franklin et al., 1992; Dalton and Wattenberg, 1993; Dalton, 1996) and this has particularly been the case the Netherlands (Andeweg and Irwin, 2002: 89-92). Therefore those seeking to explain electoral behavior have increasingly turned to issue voting as the key explanatory factor in explaining vote choice in modern electorate (van der Brug, 2004). However, there remain significant disagreements as to voters' issue stances relate to party issue stances when voters are deciding how to vote (Westholm 1997; Lewis and King 1999; Tomz et al. 2006). Foremost among debates in the political science community regarding both the nature of political issue spaces and the manner in which relative voter and party positions translate into electoral utility pits the 'proximity' theory of electoral choice against 'directional' theory. These theoretical accounts of vote choice are, in fact, built on radically different conceptualisations of the very nature of political issues.

The proximity model of electoral choice was introduced in Downs's (1957) seminal work, building on Hotelling's (1929) article 'Stability in Competition'. The underlying analogy that drives this model of politics is that parties' political stances and voters' preferences can be understood in spatial terms as political 'positions' in a hypothetical issue space. This contention is intuitively highly plausible for any follower of politics; indeed, Benoit and Laver (2006) argue that 'it is difficult if not impossible to have a serious discussion about the substance of real politics without referring to "where" key actors stand on substantive matters at issue' (p. 1).

If we accept that party policy stances and voter policy preferences can be represented as spatial 'positions', then it stands to reason that they are separated by distances, and, furthermore, that some positions are more distant from each other than others. In terms of the relationship between voters' policy preferences and parties' policy positions, proximity theory assumes that, all else being equal, voters will prefer the party/candidate whose policy position is closest to their own position in the issue space. More specifically, proximity theory views the issue space within which the policy preferences of voters and parties are located as being made up of continuous graded dimensions, with each dimension containing an infinite number of possible positions between two extreme points.

In the simple, uni-dimensional case (we discuss metrics for calculating distance in multi-dimensional spaces in the next sub-section), the party that will be most-preferred by each voter is the party that has the smallest absolute distance from that voter's ideal policy position on that policy dimension. Furthermore, all other parties can be ranked in terms of their issue-based utility according to their absolute distance from the voter, with distance being inversely related to utility. This approach is of fundamental to the development of several areas of political science. Even two of its most trenchant critics acknowledged that 'no other formal paradigm has such wide use or such great impact on how people think about politics' (Rabinowitz and MacDonald, 1989: 93). Attempts by political scientists to construct theoretical models of the behaviour of parties when forming coalitions, the actions of parliamentarians, and the behaviour of institutional actors have all relied heavily on the proximity paradigm. Furthermore, proximity theory has been and remains central to political

scientists' understanding of policy competition in elections, and of voters' policy-based evaluations of political parties.

Directional theorists, on the other hand, assume that policy alternatives are dichotomous – essentially, you are either 'for' or 'against' something. Two of the major proponents of directional theory summarize the theoretical assumptions underlying their approach as follows:

'the directional theory assumes that most people have a diffuse preference for a certain *direction* of policy-making and that people vary in the *intensity* with which they hold those preferences' (Rabinowitz and MacDonald, 1989: 93).

According to the directional conception of issue-based evaluations of parties by voters, the 'neutral' point or 'status quo' point in a given dimension of competition is of crucial significance; the utility that a voter associates with a party's position is determined by whether the party is on the same side as the voter, or on the opposite side. If they are on the same side, increases in the extremism of the policy stance (or increases in distance from the 'neutral' point) are seen as indicators of the intensity with which a directional preference is held by a party, which gives an indicator of the likelihood that your preferred policy will actually be enacted should that party win power. Therefore, as the extremism of a party on a voter's side of the neutral point increases, so should their preference for that party. For parties that are on the opposite side of the neutral point from the voter, the same logic means that parties on the 'other' side will be evaluated negatively, and increases in extremism on the 'other' side correspond to increasingly negative evaluations.

However, directional theory also provides that there is a 'region of acceptability' in politics, and extremism beyond this region is punished by voters. Therefore, even if a party is ostensibly on a voter's 'side' of the debate, more extremism on that side is only better up to a point. The specific point at which the 'region of acceptability' is drawn is not theoretically specified, and empirical analyses often simply elide this issue by ignoring voter evaluations of 'extreme' parties and candidates[4].

[4] Westholm (1997) argues that the notions of a 'region of acceptability' and the non-specification of the scale of 'penalties' attributed by voters to parties falling outside of that zone, lessen the falsifiability of the

In terms of visualising the issue space, or representing it mathematically, directional theory requires a scaling of the political space along the following lines. The neutral point, or status quo, is scaled to zero, and the positions on either side of it are oppositely signed. Positions further from the centre are assigned higher positive and negative values, until the region of acceptability is breached, after which an unspecified punishment is doled out to parties. From the point of view of designing a MAUD, assuming as single dimension, the two theories result in divergent functional forms for issuing voting advice.

Proximity theory indicates that as the absolute distance between a voter's position and a party's position decreases, the policy-based utility a voter associates with a party increases.

Or, formally that:

U_0 increases as $|V - P_o|^r$ decreases. (1)

Where:

o is the o^{th} party from the set of existing parties;

U_0 is the policy-based utility that a voter derives from the position of the o^{th} party;

V is the voter's position

P_o is the o^{th} party's position,

r is the Minkowski-metric. In case r=2 we have Euclidean distances that we know that apply to the physical world as we observe it. In case r=1 we have "city-block" distances that appear to be more intuitive if political distances are at hand (Westholm, 1997).

Directional theory, on the other hand, indicates that as the product of voter and party positions increases (subject to the issue space being scaled around a '0' neutral or status quo point).

Formally, according to directional theory (and using the same notation as formula 1):

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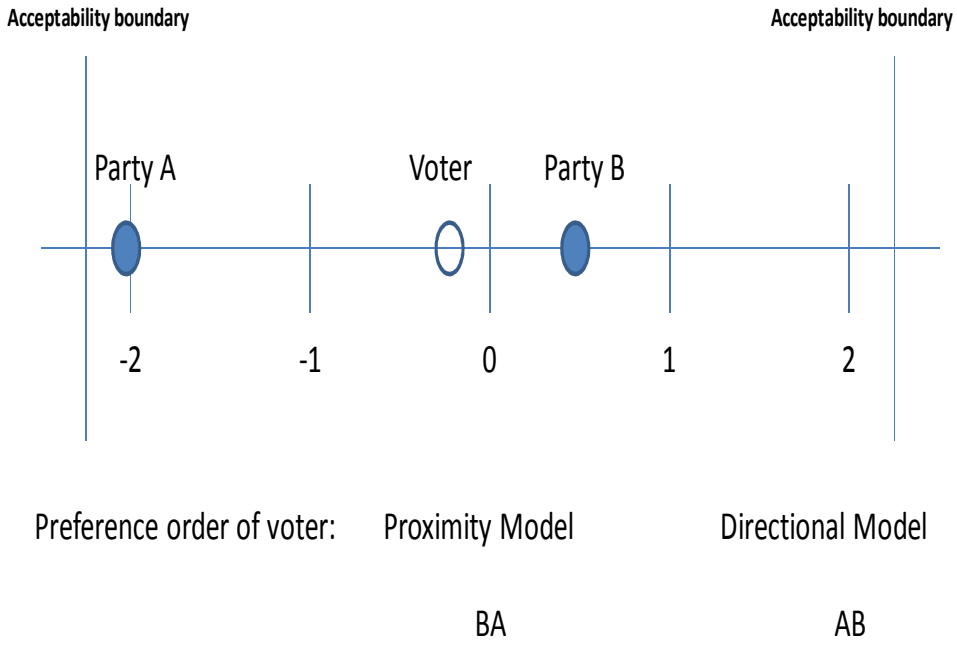
directional approach, as these freely varying parameters can be adjusted to explain away findings that are not congruent with directional theory.

U_0 increases as -(V)(P_o) decreases. (2)

The directional model resembles the proximity model with Euclidean distances (r=2), as was noted by (Lewis et al. 2008). The "directional" product - V P_o is a crucial part of the Euclidean distance, since $(V - P_o)^2 = -2\,V\,P_o + V^2 + P_o^2$. According to Lewis and King (2008) it is therefore extremely hard to find emprical data to tell whether proximity theory or directional theory fits the data better.

The different predictions of the two theories with regards to party evaluation are illustrated in Figure 1 below. We can see that the voter in Figure 1 is closer, in terms of absolute difference, to party B than to party A. Therefore, a proximity MAUD would advise the voter in Figure 1 to vote for Party B. However, because the voter and Party B are on opposite sides of the 'neutral point', the product of their positions will result in a negative number. Party A, while further away from the voter in terms of absolute distance, is on the same side of the neutral point as the voter, and inside the region of acceptability, so the product of their positions will be positive. As such, a directional MAUD would advise the voter in figure 1 to vote for Party A. This example illustrates that an identical array of voter and party positions can lead to alternative vote recommendations depending on the logic of the MAUD employed.

Figure 1. Illustration of divergent predictions based on proximity and directional theories.



A series of articles in the 1990s sought to demonstrate the superiority of one model over the other, indeed, in some instances; each side 'demonstrated' the superiority of their own model using identical data. Lewis and King (1999), surveying these investigations, came to the following conclusion:

'the empirical tests (...) amount to theoretical debates about which statistical assumption is right. The key statistical assumptions have not been empirically tested and, indeed, turn out to be effectively untestable with existing methods and data' (p.21)

Recent experimental evidence has sought to overcome some of these methodological limitations, with a recent article by Classen (2009) indicating that such evidence points to spatial logic varying over policy area. According to Classen's research, military spending-based evaluations of candidate positions conformed to a logic of proximity, whereas abortion-based evaluations conformed to a directional logic. In a similar vein, Cho and Endersby (2003) concluded, based on an examination of general election surveys in the UK that the proximity model performs better for understanding voters' evaluations of incumbent parties, while opposition parties' policy stances were better explained by a directional model.

The data obtained through VAA sites are very suitable to test whether the directional or the proximity approximation of voter behaviour matches best the actual combination of issue stances of voters and party preferences of these voters, as in VAA's party choice or vote intentions of users is asked next to issues positions.

The Dimensionality of the Issue Space

In the above discussion of proximity and directional theory, we focused on examples that conceptualised policy competition as occurring along a single political dimension. Indeed, the notion of dimensionality, and the production of analyses that seek to reduce the complexities of political contestation to positions on a small subset of underlying dimensions is among the most potent weapons in the arsenal of empirically oriented political scientists. The use of dimensions or social cleavages in order to understand and compare the fundamental conflicts that shape political competition between parties has a long and storied history, dating back to the incredible political transformations that occurred in late 18th century France. The seating positions of members of the Constituent Assembly that convened to write a new constitution were observed to correspond to the opinions, beliefs, and actions of the members (Asher and Shamir, 1983; Benoit and Laver, 2006). More recently, Lipset and Rokkan's (1967) cleavage-based analysis of Western European party systems remains among the most influential accounts in political science, and empirical estimates of party positions on 'left-right' and other dimensions have been gathered over a

wide range of countries using an array of techniques: analysing party manifestos by human coders (Budge et al., 2001) and automated computer coding programs (Benoit et al., 2009; Lowe et al., 2011), surveying party elites (Farrell et al., 2006), and the general public (Powell, 1999), monitoring the voting behaviour of party members (Hix, 2001; Jackman and Rivers, 2004), and conducting surveys of political experts (Castles and Mair 1984; Laver andHunt 1992; Huber and Inglehart 1995; McElroy and Benoit, 2009; Marks and Steenbergen 2004).

In essence, political dimensions are a data reduction tool – they collapse party positions on hundreds, or even thousands of individual issues into a single indicator. Indeed, data reduction techniques such as factor analysis and principal components analysis have been used in quantitative efforts to unpick the dimensions that underlie issue competition in several democracies (Benoit and Laver, 2006; Gabel and Huber, 2000; Mair 1989). The benefit of this approach is the increased simplicity and analytical tractability of the picture that emerges, relative to the garbled messages of real-world politics. At first sight, as with any reductive approach, constraining political competition to fit onto a single dimension willl result in a substantial loss of important information. Imposing a single dimension on issue positions with respect to typical "leftist" issues such as government expenditures and typical "rightist" issues such as taxes has the advantage, however, that populist voters who are in favour of ever more expenditures but opposed to taxation will be assigned a neutral position on the left-rightist axis. There is a trade-off between detail and parsimony. As Benoit and Laver (2006) put it:

'When we set sail across the Atlantic, for example, we would get lost if our only charts were so detailed that they show the position of every single grain of sand on every single beach we might pass. We need a description of the (political) world rich enough for the purpose at hand, but not so rich we cannot see the beach for the grains of sand'. (p. 18).

So, while the addition of dimensions may improve our ability to distinguish the nuances of party policy, it also complicates our conceptualisation of the political world. This *caveat* is especially worth bearing in mind for VAA site designers. Much of the appeal of such sites lies in their attempts to construct a 'political map' and to allow users to use this map to navigate the political world, on the basis of a comparison of parties' issue stances with their own.

The data employed in this election comes from the logfiles of the kieskompas.nl site: which covered the 2010 Dutch legislative elections. The reducibility of the considerations of the Dutch electorate has been a well-debated topic among specialists. While Van der Eijk and Niemöller (1983, 1987) found that a single left-right dimension could be employed to provide a satisfactory representation of Dutch issue-based electoral competition, a series of articles in the late 1980s/early 1990s contended that Dutch party and electorate political beliefs were in fact structured along two-dimensions: socio-economic left-right, and a libertarian-authoritarian dimension to do with personal autonomy (Middendorp, 1989; 1990; Luyten and Middendorp, 1991). The content of conflict associated with these dimensions has evolved with the incorporation of various aspects of 'new' politics from the late 1960s onwards (Franklin 1992; Müller-Rommel Inglehart 1977, 1990 Evans 1999; Kriesi 1998; Manza & Brooks 1999; Lachat 2004; Oesch 2006), and especially recent developments with the emergence of right populist parties (CITS) and the uneven incorporation of European Union integration stances onto the left dimension (Hooghe et al. 2002; Van der Eijk & Franklin, 2004). Nonetheless, in a recent review of the dimensionality of several Wetern European political systems, Kreisi et al. argue that two-dimensionality of the political space is one of the first features to emerge, and that the dimensions still capture economic and cultural considerations respectively (Kriesi et al. 2006; Kriesi et al. 2008).

However, other VAA sites assume a far higher amount of dimensionality in their conceptualisation of the Dutch issue space. The Stemwijzer and Stemtest sites, for example, separately calculate the distance between the user and each of the parties for each issue included in the test, allowing users to weigh each issue according to its saliency. We discuss the issue of saliency weighting in the next section on combining distances in multi-dimensional spaces. The point at issue here, however, is that some VAA sites, such as Kieskompas in the Netherlands impose that issues are reducible into *n*-dimensional spaces (usually a 2-Dimensional Space), since contradictory stances of voters with respect to issues that belong to one dimension, for example, negative stances towards taxes and positive stances towards government expenditures, can be interpreted as neutral position on the underlying dimension. Other VAA sites, such as Stemwijzer in the Netherlands, treat every issue as essentially representing a separate dimension of possible policies, thereby counting voters who want to increase government expenditures although they want to abolish taxes

as voters who are sympathetic both towards extreme leftist as towards extreme rightist parties. In this article, we compare the 2-dimensional assumption that is embodied in the MAUD rule that the Kieskompas.nl site applied during the election campaign to an approach that separates each policy issue as a dimension in its own right and assuming a 30-dimensional issue hyperspace.

Data obtained with VAA sites can be used to test which of the two assumptions with regard to the dimensionality of the issue space is more appropriate, as a large number of issue positions of voters and parties are logged.

The curvature of the political space

The third issue explored in this article is the manner in which distances or utilities should be aggregated over multiple dimensions. It is important to bear in mind that 19th century mathematicians noted already that there exist an infinite number of possible geometries according to which distance can be calculated in a multi-dimensional space. The three-dimensional Euclidean space, *i.e.*, the functional geometry that most people use to view and interact with the world around them, is only one such geometry.

The intuitive appeal of Euclidean geometry, given its correspondence to our experience of reality, is perhaps unsurprising. Formal theorists in political science, working in the proximity tradition, have overwhelmingly favoured Euclidean geometry in modelling processes and predicting outcomes in politics. However, there is little evidence that this choice is based on an underlying body of evidence that describes how citizens and politicians actually make decisions. Benoit and Laver (2006) report a (2005) expert survey carried out by Laver which sought to uncover the underlying rationale for the popularity of Euclidean geometry among formal modellers. In explaining their use of Euclidean geometry, a vast majority of formal modellers stated that they employ Euclidean geometry because it produces models that are tractable using mathematical and statistical techniques, with only a tiny minority (2 out of 23) claiming that their use of Euclidean geometry is related to an understanding of voters' decision-making. Indeed, the calculation of 'distance' in a two-dimensional plane according to Euclidean geometry is highly complex; it involves squaring the distance on each

dimension, summing these squared distances, and then finding the square root of the sum of squared distance. Other scholars (e.g. Westholm, 1997, p.872) have therefore advanced an alternative geometry, the 'City Block' or 'Taxi Cab' metric, whic simply prescribes that the distance on each dimension is summed by the voter.

A broad variety of multi-dimensional geometries for calculating distances is incorporated in the Minkowski metric, which can be expressed as follows:

$$U_o = \sum_j |V_j - P_{oj}|^r \quad (3)$$

Where:

$|V_j - P_{oj}|$ is the distance between a voter and a party o with respect to issue j, given that o is the o^{th} party from the set of existing parties and j the j^{th} issue from the set of issues;

and r is Minkowski-metric, which is a postive real number.

In case of Euclidean distances (r=2), and more generally, in case r>0 the voter punishes the parties that have a large distance to the voter on on one issue, even if the voter agrees with that party on most other issues. If case of a Minkowski-metric r<0 the voter forgives a party that has a large distance to the voter on one issue, provided that the voter agrees with that party on most other issues. With the city-block metric (r=1) the voter is neither inclined to punish parties nor to forgive parties exceptionally in case of large distances with respect to a few issues only. Generally, this issue has received comparatively scant attention in the existing literature, though Benoit and Laver (2006) point to calculations of difference in computer science and to estimates of perceptions of difference and similarity in cognitive psychology as offering potentially interesting insights. In the analysis presented in this article, we therefore examine the impact of varying r over three values r = 2 (Euclidean, punish parties in case of a few large distances), r= ½ (forgive parties in case of a few large distances), and r=1 (city-block, neiter punishment, nor forgiveness).

VAA-data can be used to test which curvature of the political space corresponds with the actual combination of issue stances of voters and party preferences of these voters. VAA-data are better suited for this end than issue positions according to national election studies and campaign studies, since VAA-data contain more issues. As the number of issues

increases, the chance that a voter does not agree with his favourite party on a single issue increases as well. Which curvature is appropriate can be judged only when the amount of issues on which voters disagree with their favourite party is sufficiently high.

3. Method

Data

In order to address this question, we analyse the log files of 45515 users out of the over 800.000 unique users of the Kieskompas.nl VAA-website in the 2010 Dutch elections who completed the Kieskompas-questions and answered afterwards also questions with respect to their current party preference and their party choice in 2006. We will simulate the advice that the site would have produced under several alternative MAUD rules and compare the outcomes with actual party preferences of users.

In addition we make use of the IntomartGfK panel survey data about the usage of Kieskompas and about the advice given by Kieskompas in the 2010 Dutch election campaign. The IntomartGfK panel survey is a representative sample of Dutch voters in terms of socio-demographic charicteristics and the vote at the Dutch national elections in 2006 (including correct percentages of 2006 votes for "taboo"-parties, the percentage of voters for "traditional" parties such as the Christian-Democrats with many elderly voters, and the number of non-voters). The InfomartGfK panel survey data (with public television, public radio and advertising agencies as its commercial clients) include detailed data with respect to media consumption (e.g. radio, tv, newspapers, internet sites, twitter, social media). The IntomartGfK data are therefore useful for three ends. First, they can be used to obtain an empirical profile of VAA-users, and especially of Kieskompas-users. Next they can be used to arrive at estimates of the impact of VAAs, and of Kieskompas especially, on the vote choice. Thirdly, they could be used even to correct the raw outcomes of the Kieskompas-analysis to obtain more representative estimates of the distribution of issue positions in the Dutch

population. In this paper we will not use the IntomartGfK-data for the latter. [5] We will employ especially the data of one week before the elections with respect to the use of VAA-sites (n=1270), data from the first wave (10 weeks before the elections (n=1801), data from the post-election wave (n=1362), and especially data from the intersection of these three waves n=1255).

Analysis

Overall, we restrict our analysis to three sources of variation faced by VAA designers in choosing a MAUD rule:

1) The assumption of 'proximity' versus 'directional' theory in deriving voter utilities from a comparison of their positions with party positions.

2) 1 versus 2 versus 30 dimensional issue-spaces.

3) Euclidean versus City Block distance metrics.

For MAUDs derived from directional theory, we simply sum the directional utilities on issues considered and recommend that the voter choose the party with the highest value. For 'proximity' issue spaces we compare Euclidean to city block metrics in aggregating distances over multiple dimensions, and recommend that users vote for the party who is 'closest' to them, according to our calculations. This approach leaves us with 7 discrete MAUD rules, 5 derived from proximity theory, and two derived from directional theory, which we consider in our simulation. These rules are summarised in Table 2.

[5] More representative estimates of the distribution of issue positions in the population from a voluntary, and therefore non-representative, sample of VAA-users in 2010 can either be obtained by weighting 2010 users in accordance with known population parameters (e.g. the 2006 distribution of the vote) or with *propensity score matching* (Rosenbaum and Rubin 1983; Alvarez et al. 2011). Propensity score matching means that each respondent in a representative sample is matched with a couple of voters from a voluntary sample whose characteristics match the characteristics of this repondent as closely as possible. Alvarez et.al. (2011) propose to use subjective probabilities to vote for specific parties as matching characteristics. This procedure could have been used here as well, but we showed that propensity score matching had only a small impact on research outcomes with respect to the distribution of issue positions (Kleinnijenhuis and Krouwel forthcoming).

Table 2. Types of MAUD rules explored in this article

	1 Dimension	**2 Dimensions**	**30 Dimensions**
Proximity based:	1. Lowest absolute distance on left-right axis.	2. Lowest Euclidean distance (Kieskompas.nl method) 3. Lowest City Block distance	4. Lowest Euclidean distance 5. Lowest City Block distance
Directional	(not considered: awards all recommendations to most extreme parties).	6. Highest sum of directional utilities.	7. Highest sum of directional utilities (Stemwijzer method).

In order to assess the impact of choosing any of these 7 MAUD rules on the output that a VAA site would generate, we use the log files of 45,515 users of the Kieskompas.nl website in the 2010 Dutch elections to simulate the advice that the site would have produced using each rule. While the site's logfiles recorded over 800,000 unique visits receiving an 'advice', we select only the logfiles of those users who completed all 30 issue questions, rated their likelihood to vote for each of the main parties, and respondent to at least some of the 'extra questions' asked of users after they receive their advice. We do so in order to minimize the contribution of repeat users and spurious entries to our analysis. This approach also allows us to look at how the recommendations produced by each MAUD relate to users' party support patterns.

In order to perform the simulations, we re-ran the vote advice process for all 45,515 log files using each of the MAUD rules described in Table 2.

1. Proximity based, single dimension. The winning party is the one that has the smallest absolute distance from the user on the 'left-right' x axis.

2. Proximity-based, 2 Dimensions, Euclidean metric. The winning party is the one with the smallest Euclidean distance from the user on the 'left-right' and progressive-conservative' axes. This was the approach used by the kieskompas.nl site.

3. Proximity-based, 2 Dimensions, city-block metric. The winning party is the one with the smallest summed distance from the users on the on the 'left-right' and progressive-conservative' axes.

4. Proximity-based, 30 Dimensions, Euclidean metric. The winning party is the one with the smallest Euclidean distance from the user over all 30 political issues measured by kieskompas.nl.

5. Proximity-based, 30 Dimensions, city-block metric. The winning party is the one with the smallest summed distance from the users over all 30 political issues measured by kieskompas.nl.

6. Directional-based, 2 Dimensions. The winning party is the one with the largest score when the product of party and voter positions on the x and y axes is summed.

7. Directional-based, 30 Dimensions. The winning party is the one with the largest score when the product of party and voter positions over all 30 issues is summed.

For two-dimensional MAUD rules, we used the x and y axis co-ordinates of users and parties generated by averaging their positions on 'left-right' and 'progressive-conservative' issues, respectively. For thirty-dimensional MAUD rules, we compared the responses of users and parties on each issue separately.

Having thus generated 7 separate sets of site outputs, we proceed to examine how these compare with each other and with the political preferences of the site users themselves in the next section. We begin by examining the aggregate 'volatility' engendered by changing

MAUD rules, where we investigate how much of an overall difference changing from one rule to another represents in terms of aggregate site output. We do this by looking at aggregate differences between sets of MAUD rules in terms of the proportions of 'first preference' advices issued. Secondly, we analyse whether certain parties, and, indeed, certain types of parties, benefit or suffer in terms of the advice that is issued, depending on the type of MAUD rules employed. Finally, we examine the relative performance of the MAUD rules in terms of their correspondence with users' stated likelihood to 'ever' vote for each of the parties.

4. Results

Profile of VAA-users

The best estimate on the basis of the representative IntomartGfK panel survey data is that roughly 39% of the Dutch voters made use of a VAA-website. 13.3% made use of Kieskompas.

Table 1: media use, knowledge and cynicism of VAA-users

	non-users VAA	Users Stemwijzer	Users Kieskompas
newspapers (%)	0.74	0.75	0.75
tv news (%)	0.81	0.87	0.87
news websites (%)	0.43	0.44	0.72
social media + twitter (%)	0.41	0.55	0.51
knowledge, average [0..1]	0.72	0.75	0.82
cynicism, average [0..1]	0.27	0.23	0.19

Source: IntomartGfK Panel Survey, intersection wave 9 and wave 1 (n=1270)

Table 1 shows that VAA users typically belong to the well-informed citizenry, who make use more often of newspapers, television, news websites and social media than non-VAA-users. Their political knowledge is relatively high, and their political cynicism relatively low. This holds especially for users of Kieskompas. Media use, knowledge and cynicism are partly an outcome of social-demographic contextual factors, rather than of individual choice. High and middle class voters, Islamic and non-religious voters, middle and higlhly educated voters, voters younger than 50 years, and women consult relatively often a VAA. VAA use is less often observed within the lower class (segment D), catholics, low educated voters, voters older than 65 and men in general.

Impact of MAUDs that underlie VAAs

Here we will illustrate the impact of the decision rules that underlie VAAs in three ways. We will demonstrate the impact of a multidimensional or a low-dimensional representation in VAAs on the distribution of advices obtained by VAA-users. Next we will illustrate the impact of VAAs on turnout. Last we will provide an elementary illustration of the impact of a VAAs on the vote.

Dimensionality and the distribution of advices. If separate issues are not considered as items on underlying dimensions, then each issue is counted as a separate dimension, as in the Dutch Stemwijzer. As a result voters who want higher government expenditures but who want to abolish taxes will end up either with the advice to vote for a radical leftist party (e.g. SP), or to vote for a radical rightist party (e.g. PVV). A low-dimensional VAA, such as Kieskompas (2 dimensional) would conclude that these voters are somewhere in the middle, because they combine both leftist and rightist ideas.

Table 2: impact of high vs low dimensional VAAs on advices to vote for extreme parties

	Prior Vote preferences	Advice Stemwijzer (high dim)	Advice Kieskompas (2 dim)	Election result
SP, socialist Party	4.9%	11.5%	7.1%	12.6%
PVV	7.5%	23.0%	7.7%	12.8%
Total extreme parties	12.4%	34.5%	14.8%	25.4%

Source: IntomartGfK panel survey wave 1 (column 1), wave 9 (col 2,3) and wave 11 (col 4)

Table 2 confirms these expectations. Advices from a high dimensional VAA (Stemwijzer) were far more often in the advantage of extreme parties than advices from a low dimensional VAA (Kieskompas). As compared to the prior distribution of votes, even advices from the 2-dimensional Kieskompas were slightly more often in the advantage of extreme parties. The last column of Table 3 shows that SP and PVV did win indeed at the elections.

As an indicator of the huge difference between advices from VAA's that employ different MAUDs is that only 44.9% of the voters who used both Stemwijzer and Kieskompas (n=147) received a similar vote advice from both VAA's.

Impact of VAA-advice to vote for extreme parties on the vote.

A comparison between the columns of Table 2 suggests that VAA-websites may indeed have an impact on the vote. A straightforward way to test whether this is the case at the level of individual voters indeed is to calculate the conditional probabilities that a voter casts his or her vote on an extreme party (SP or PVV) at the elections (wave 11), given his prior vote preference (wave 1) and the advice obtained from a VAA. Here we will show the impact of Stemwijzer.

Table 3: Conditional Probability to vote extreme (SP or PVV) given prior party and advice High-Dim VAA (Stemwijzer)

Prior party preference	Advice Stemwijzer (high dimensional)	Probability to have voted SP or PVV	N
Neither SP nor PVV	Neither SP nor PVV	10%	259
	Did not use Stemwijzer	10%	528
	SP or PVV	31%	94
SP or PVV	Neither SP nor PVV	64%	22
	Did not use Stemwijzer	89%	122
	SP or PVV	96%	48
			1073

Source: IntomartGfK, wave 1 (column 1), wave 9 (column 2) and wave 11 (column 3)

Table 3 shows a fairly large impact of using a high dimensional VAA on votes cast for extrememist parties. For those voters who neither intended to vote for the SP nor the PVV the probability that they ended up with a vote for SP or PVV increases from 10% to 31% in case they received a Stemwijzer advice to vote for either SP or PVV. This percentage difference of 21% can be considered as a *conversion* effect. There is also a *reinforcement* effect. The probability to vote either for the SP or the PVV rises in case SP or PVV voters receive the advice to vote SP or PVV from 89% to 96%, but drops to 64% in case of a negative advice. The reinforcement effect of 96% - 64% = 32% is even more impressive than the conversion effect.

Both the conversion effect and the reinforcement effect allude to possible persuasive distortion effects of VAAs. A positive effect of VAAs is their impact on turnout. Of the 14% of voters who did not intend to cast their vote in the first wave of the panel study, a remarkable 39% decided to cast a vote after all, even without having used a VAA. This effect may be due in part to answering political questions each week as a result of participation in

the IntomartGfK-panel. The probability to cast a vote for voters who did not intend to cast a vote increased to 68% once a VAA was used, which amounts to a possible VAA-effect of 29%.

Simulations of MAUD rules on which VAAs could be build

Table 3 records the aggregate output generated by our simulations using the competing MAUD rules described in the previous section. The parties which do particularly well in terms of aggregate numbers of recommendations according to each MAUD are circled. In our analysis of these outputs, we look at three factors: 1) The aggregate consequences of MAUD rule choice, 2) The party-specific consequences of MAUD rule choice and 3) performance of each rule in terms of user's correspondence to the party recommended to them.

1) Aggregate Consequences

We begin by looking at how much of an overall difference MAUD rule selection makes to the general output of our VAA. First we show the aggregate partisan recommendations generated by the different MAUD specifications (see table 3). In order to summarise the differences between these different MAUD rules for the aggregate outcome, we measure the (1979) Pedersen index of volatility generated by changing from one MAUD rule to another. The Pedersen index was originally intended to measure the extent of aggregate electoral volatility at the party system level between two elections, but here it is used to measure the extent to which aggregate a VAA's aggregate vote advice differs according to the specific MAUD in use, holding user and party issue positions constant. The Pedersen index ranges from 0% (identical outcomes) to 100% (where no parties who won votes in the first election win any votes in the second). In order to present these figures, we construct a pair-wise matrix of volatility between each of the 6 MAUD rules (Table 4). This analysis gives us an estimation of how different the aggregate recommendations were from each other, viewed at the party system level.

When we first look at table 3, we seen that it matters substantially which MAUD rule is used. There are partcularly large differences in aggregate proportions of parties recommended between proximity and directonal MAUD rules.

Table 3. Aggregate Partisan Recommendations generated by Alternative MAUD Rules (% of first choice recommendations per party)

Party	1. Prox. 1-D	2. Prox. 2D, Eucl.	3. Prox. 2D, CB	4. Prox. 30D, Eucl.	5. Prox. 30D, CB	6. Dir. 2D	7. Dir. 30 D
VVD	1.5%	2.4%	2.2%	7.9%	10.4%	11.8%	8.4%
PvdA	11%	17.5%	24.6%	48.7%	45.6%	.4%	7.9%
PVV	24.2%	4.5%	9.5%	6.4%	8.4%	0%	26.3%
CDA	4.4%	1.2%	1.3%	6%	4.7%	0%	4.2%
SP	1.8%	1.4%	1.3%	2.6%	3.8%	57.4%	21.5%
D66	9.6%	8.5%	8.4%	5.2%	4.8%	4.9%	5.6%
GL	9.1%	5.5%	5.6%	4.6%	6.09%	5%	13.8%
CU	31.3%	27.9%	26.3%	1.5%	1.4%	0%	2.5%
SGP	3.3%	.3%	.4%	1.8%	1.4%	20.3%	21.5%
PvdD	0%	14.5%	6.5%	6.3%	5.4%	0%	6.2%
TROTS	3.6%	16.2%	14%	8.9%	7.8%	0%	2.5%
Total	100%	100%	100%	100%	100%	100%	100%

What most clearly emerges from summarising aggergate parties recommended is that directional models (such as Stemwijzer) give dirsproportional large numbers of VAA users a recommendation to vote for an extreme party (SGP, PVV and SP). The proximity models give a disporportional large number of recommendations for the PvdA (centre left), the Christian Unions (centrist, religious party) and TROTS (an anti-immigration populist party). It seems

that, particularly when summarising positions over two dimensions, voters are seen to have centripetal tendencies and are given the recommendations that they are closest to one of the centrist parties. No doubt this is re-enforced when voters have inconsistent policy preferences.

When we then switch to the Pedersen-index to summarise the differences between the advices provided by VAAs with different MAUDs, as shown in Table 4, we see that that diffrences are enormous.

Table 4. Pedersen index of volatility for pairwise comparisons of 7 MAUD rules

	1	2	3	4	5	6	7
1	0%	34.4%	31.1%	58.1%	55.4%	82.9%	47.5%
2		0%	12.3%	46.1%	47.6%	85.4%	70.5%
3			0%	37.3%	36.8%	87.8%	65.25%
4				0%	7.3%	77.7%	59.4%
5					0%	74%	55.8%
6						0%	49.6%
7							0%

Particularly the contrast between proximity and directional theory approaches, especially when directional theory is applied in a two dimensional context. When one considers that a 100 per cent score indicates that two distributions are as different as can be, we find that index score for differences between proximity and directional (2D) MAUD's range between 74 and 87.8 per cent. Not so dramatic when directional accounts took in all 30 dimensions, however differences are still substantial. There are also strikingly different outcomes

between low dimensional and high dimensional approaches, with volatility at around 50 percent between the two (comparing 1,2, and 3 with 4 and 5 in proximity and 6 with 7 in directional). If similar MAUDs and number of dimensions are used and the only variation is between Euclidean and city block metrics – the Pedersen index is very low (only 12.5 percent between 2 and 3, and only 7.3 per cent between 4 and 5).

2. Partisan Consequences

In this part of the analysis, we examine the partisan implications of MAUD rules for the parties competing in the 2010 Dutch elections. We evaluate the impact of changes in MAUD rules for the amount of 'first preference' recommendations given to each party. In order to do so, in Table 5, we employ the stated 2006 vote choice of users as a baseline for comparison (accepting that many users may have changed their opinions since voting in 2006). As Wall et al. (2010) argue, it can be counter-productive to compare VAA outputs to election results, as VAA users are not a representative sample of the overall population. Yet here the baseline merely serves to compare the seven MAUD rules.

When we first focus on the major Dutch parties, we see that under all MAUD rules the VVD is less frequently advised than their level of support in 2006. This is even more the case for the Christan democratic CDA, which has very low proportions of first receommended party, compared to their level of popular support. While the centre-right parties are underrepresnted in the number of recommendations given regardless of the MAUD rule, the social democratic PvdA has a very mixed record when it comes to the effect of the different models. Directional models give relatively few recommendations for the PvdA, while proximity models that impose 30 separate dimensions are very benificial for the social democrats in terms of frequency of being recommended. The Socialist Party benefits from MAUD rules based on directional theory, due to their extreme position, while the proportion of recommendations under proximity model MAUD's for the SP are substantially lower than their actual vote share. The PVV benefits from all models, as they are more often recommended than their level of popular support.

Table 5. Proportion difference in first-preference vote advice, by party, compared to reported (2006) voting behaviour of site respondents.

Party	2006 party choice[6]	1 Prox, 1D	2 Prox, 2D. Eucl	3 prox, 2D, CB	4 Prox, 30D Eucl	5 Prox, 30D, CB	6 Dir, 2D	7 Dir. 30D
VVD	**17%**	-15.5%	-14.6%	-14.8%	-9.1%	-6.6%	-5.2%	-8.6%
PvdA	**20%**	-9.0%	-2.5%	4.6%	28.7%	25.6%	-19.6%	-12.1%
PVV	**4.7%**	19.5%	-0.2%	4.8%	1.7%	3.7%	-4.7%	21.6%
CDA	**17.2%**	-12.8%	-16.0%	-15.9%	-11.2%	-12.5%	-17.2%	-13.0%
SP	**14.5%**	-12.7%	-13.1%	-13.2%	-11.9%	-10.7%	42.9%	7.0%
D66	**8.9%**	0.7%	-0.4%	-0.5%	-3.7%	-4.1%	-4.0%	-3.3%
GL	**9.3%**	-0.2%	-3.8%	-3.7%	-4.7%	-3.2%	-4.3%	4.5%
CU	**5.6%**	25.7%	22.3%	20.7%	-4.1%	-4.2%	-5.6%	-3.1%
SGP	**0.7%**	2.6%	-0.4%	-0.3%	1.1%	0.7%	19.6%	20.8%
PvdD	**2.1%**	-2.1%	12.4%	4.4%	4.2%	3.3%	-2.1%	4.1%
ToN	**0.0%**	3.6%	16.2%	14.0%	8.9%	7.8%	0.0%	2.5%

[6] Counting only those users who reported voting for one of the 11 parties considered, n = 37,181.

These findings suggests that a parties' policy position, particularly their centrality or extremism causes these different effects of MAUD rules used for the aggregation of the recommendation. Also, MAUD rules that position parties in a two dimensional plane will discriminate parties that cluster together and more frequently receommend parties that have a spatially more unique position. Overall, however, it is clear that MAUD rules used to aggregate the issue stances of voters matter. Different MAUD rules generate dramatially different outcomes or recommendations which party is closest to these preferences.

DISCUSSION

The research presented here shows the importance of issue voting, the importance of Vote Advice Applications (VAAs) to support issue voting, and the importance of multi-attribute decision rules (MAUDs) to shape the advices that VAA's give to their users.

More broadly, this research seeks to build upon Sartori's (2004) call for political scientists to work towards the development of an applied science of politics. One area where political scientists should be able to provide practical advice to members of the public, who fund the entire endeavour in most European countries, is the realm of party policies. Scholars of politics and political communication should be able to tell the public a considerable amount about the issues that parties address, but also about the impact of the latter on their voting behaviour. After all, we have, as a profession, been studying the topic for several decades, yet progress is slow. VAA websites represent practical instruments that can convey the detailed knowledge of parties' policies and the political issue space within which they operate to the wider public, but they are also useful to conduct scientific experiments and generate databases that can help us further in understanding the dynamic between voters and parties or candidates. The analysis presented here examines how certain technical choices in comparing party to user preferences would have played out using real user responses and real party positions generated for Kieskompas.nl, a site dedicated to the 2010 Dutch legislative elections.

Simulation studies based on issue preferences as presented here provide a wealth of new data to study issue voting, but also new evidence that it is hard to find a single decision rule that predicts the vote sufficiently well.

The simulation results on the Kieskompas logfile data show enormous differences between vote advices generated by alternative MAUDs to build VAAs. IntomartGfK panel survey data show that the theoretically expected differences on the basis of these simulations can be observed indeed. A high dimensional VAA results in more advices to vote for extreme parties for example. Advices to vote for extreme parties have a real impact on the vote. The panel survey data show a conversion effect to vote for extreme parties of 21% and in addition a reinformcement effect of 32%. A positive effect of VAAs is that after having used a VAA the probability to cast their vote increases with 29% for voters who did not intend to do so.

The academic contribution of the paper is to allow us to assess the extent to which methodological choices made by the designers of voter advice application websites impact on the advice generated by such sites. We also shed some light on the issue of which MAUD may be 'best' at predicting users' vote intentions.

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