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Voting Advice Applications and Their Impact on Ideological and Affective Polarization

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Abstract

Political polarization has been one of the most researched topics in political science over the past few years. While many scholars focus on the factors that foster ideological and affective polarization, less is known about the drivers of depolarization. In this article, we are addressing this gap by investigating the potential effects of using voting advice applications (VAAs) on both the ideological polarization of vote choice and the level of affective polarization among voters. Using data from the Swiss VAA Smartvote and from a field experiment within a two-wave panel survey conducted before and after the 2023 Swiss national election, this article presents partial evidence that using a VAA during election campaigns can contribute to a reduction in ideological and affective polarization among voters. Our findings have significant implications for the role of VAAs in increasingly polarized Western democracies.

Keywords

affective polarization; ideological polarization; vote choice; voting advice applications

1. Introduction

This article brings together two developments of modern democracies that are typically studied separately in research. On the one hand, the increase in ideological and affective polarization is well documented (e.g., Rogowski & Sutherland, 2016; Webster & Abramowitz, 2017). On the other hand, the usage of voting advice applications (VAAs)—online platforms that allow voters to compare themselves with candidates or parties based on their positions on political issues—is increasing in liberal democracies (e.g., Garzia &

Marschall, 2014; Munzert & Ramirez-Ruiz, 2021). This research links these two phenomena by focusing on the potential impact of VAA use on the level of ideological and affective polarization of voters.

One key aspect of modern democracies is the growing ideological and affective polarization of both the public and political elites (Abramowitz & Saunders, 2008; McCarty, 2019; Poole & Rosenthal, 2000, 2001; Stonecash et al., 2003). While the United States is often the reference example, these dynamics are also observed across Western democracies (Boxell et al., 2020; Gidron et al., 2019; Wagner, 2021). These growing divisions have an impact on democratic norms, threaten the proper functioning of democratic institutions, and can lead to their gradual erosion (Gidron et al., 2020; Hajnal, 2025; Iyengar & Krupenkin, 2018; Kingzette et al., 2021). The ideological and affective polarization of political elites and the mass public are increasingly the subject of scientific research to better understand these fundamental dynamics.

In recent years, VAAs have established themselves as an indisputable tool for providing voters with information on candidates' positions on issues in the run-up to elections. A growing body of literature investigates the effect these tools have on turnout (Germann & Gemenis, 2019; Manavopoulos et al., 2018; Munzert & Ramirez-Ruiz, 2021), issue voting, and vote switching (Gemenis & Rosema, 2014; Germann et al., 2023; Tromborg & Albertsen, 2023). However, these tools also broaden voters' overview of the pluralistic nature of the political system. Voters who use VAAs learn how their position may align with candidates from various parties, sometimes including parties that they had previously not considered as potential vote options, which could affect their actual electoral behavior and also more fundamental political attitudes (Pianzola et al., 2019).

In this article, we aim to contribute to both the literature on VAAs and on political polarization by studying the effect that the use of these tools has on the polarization of vote choice as well as on the affective polarization of voters during election campaigns. The pluralistic recommendations that VAA users are exposed to reduce the perception they have of partisan sorting—their perceived alignment between their ideology and their partisanship—and affect the extremism of voters' decisions, thereby reducing the polarization of their vote choice. Furthermore, exposure to candidates they had originally not intended to vote for reduces out-group animus, which is arguably a significant driver of the increase in affective polarization levels (Druckman et al., 2021; Iyengar et al., 2012, 2019; Webster & Abramowitz, 2017). By studying the relationship between VAA use, ideological polarization, and affective polarization, we aim to provide an answer to the question: *How does the use of VAAs affect the polarization of vote choice and affective polarization of individual voters during election campaigns?*

We draw on findings from a field experiment conducted before the 2023 national elections in Switzerland. In the experiment, a randomly selected treatment group was informed about the possibility of using a VAA as an additional source of information ahead of the upcoming elections. Using a panel survey, we investigate how the use of VAAs by individual voters impacts the change in the polarization of their vote choice and their affective polarization compared to non-VAA users. We estimate both the effect of using the VAA and the causal effect of the encouragement treatment—the invitation to use the VAA—using the Complier Average Treatment Effect (Gerber & Green, 2012). In doing so, we enhance our understanding of whether and how such tools may (de-)polarize the public. Our results provide mixed evidence regarding a link between VAA use and vote polarization. While VAA users seem to decrease the polarization of their vote choice more than non-users, as well as increase their positive affective evaluation of parties, these effects are not consistent

across all parties. Furthermore, the causal effect of our treatment does not show a clear indication that these effects are robust. Our findings nevertheless indicate a non-null relationship between VAA use, ideological polarization, and affect for parties, providing, to our knowledge, the first evidence on the link between VAA use and polarization.

In the following sections, we first review the literature on VAAs and position our study within it. We then detail the theoretical mechanism linking VAA use and the polarization of voters' choice and its effects. Finally, we present and discuss our findings.

2. What Is the Effect of Voting Advice Applications?

Since its emergence over 20 years ago, a fairly large body of literature has explored VAAs as well as the effects of their use in various ways. A first strand of VAA research focuses on the sociodemographic characteristics of voters using VAAs. Early studies found that male, younger, well-educated, and politically interested individuals are disproportionately more likely to use VAAs (Hooghe & Teepe, 2007; Manavopoulos et al., 2018; Marschall, 2014; Marschall & Schultze, 2012, 2015). Walder et al. (2024) find that this remains largely true today, at least with regard to age, educational level, and political interest. These findings also align with the results of a longitudinal study on VAA use (Albertsen, 2022), which show that while the gap in age, education, and political interest between VAA users and non-users remains, the gender gap in VAA use has lost its significance in recent years.

Another set of studies on VAAs focuses on the methodological aspects related to the design of VAAs and their impact on various outcomes. Walgrave et al. (2009) study statement selection and show that it affects the recommendation of VAAs at the individual and aggregate levels. Similarly, Lefevere and Walgrave (2014) used Belgian VAA data and provided evidence that it had an impact on parties and voter matching. Additional studies have shown that statement selection is a key design choice influencing VAA outcomes (Louwerse & Rosema, 2014; Rosema et al., 2014). The literature also investigate how response scales and matching algorithms affect recommendations (Gemenis, 2024; Louwerse & Rosema, 2014; Otjes & Louwerse, 2014; Romero Moreno et al., 2022; Rosema & Louwerse, 2016). Recently, several studies have focused on the normative, ethical, and methodological limitations in VAA design of questionnaires, also discussing the implications of ethical concerns for stakeholders, as well as the use of AI to improve questionnaires (Gemenis, 2024; Stockinger et al., 2024). Finally, studies also discuss self-selection biases and their methodological implications for VAA research (Munzert et al., 2020; Pianzola, 2014) and examine matching techniques to address this bias (Gemenis & Rosema, 2014; Germann & Gemenis, 2019).

Finally, VAA literature has also focused its attention on the effects on voters. First, studies find positive but moderate evidence linking VAA use to the level of political knowledge (Heinsohn et al., 2016; Schultze, 2014). In their meta-analysis, Munzert and Ramirez-Ruiz (2021) found modest evidence for increased issue knowledge. Second, researchers have also investigated the relationship between VAA use and information-seeking behavior. Manavopoulos et al. (2018) found that VAA users are more likely to consume media related to politics, seek election-related information, and engage in political discussions. However, Mahéo (2017) found no statistically significant effect of VAA usage on attention to electoral campaigns or active election-related information seeking. Finally, researchers have studied the effect VAAs have on the political behavior of their users. Observational studies regularly find positive associations between VAA use

and higher turnout, especially among younger voters and the less politically engaged (Fivaz & Nadig, 2010; Gemenis & Rosema, 2014; Germann & Gemenis, 2019; Manavopoulos et al., 2018; Munzert & Ramirez-Ruiz, 2021). An exception in this regard is the study by Benesch et al. (2023), which finds no effect on turnout but increased ballot splitting. Experimental studies (Enyedi, 2016; Frese et al., 2024; Mahéo, 2017; Munzert et al., 2020) tend to find smaller or no significant effects on turnout, suggesting that observational studies might overestimate causal effects due to self-selection bias (Germann et al., 2023; Munzert & Ramirez-Ruiz, 2021). Furthermore, many observational studies report that VAA usage influences voters to align their vote choice with the VAA recommendations, thus increasing issue voting and vote switching (Garzia & Marschall, 2014; Gemenis & Rosema, 2014; Kleinnijenhuis et al., 2019; Ladner et al., 2012; Tromborg & Albertsen, 2023; Walgrave et al., 2008). However, field experiments with random assignment show mixed results regarding effects on vote choice: while Germann et al. (2023) and Pianzola et al. (2019) report significant effects on vote choice, others do not find them (Enyedi, 2016; Frese et al., 2024; Mahéo, 2017; Munzert et al., 2020).

Our article contributes to the literature on the effects of VAAs on their users by investigating a previously neglected dimension: the impact of VAA use on the ideological and affective polarization of voters. Although the primary aim of VAAs is not to decrease polarization but to help voters navigate a complex information environment, it is important to understand whether VAAs affect the political attitudes and behavior of voters beyond their main objectives.

3. Voting Advice Applications and Polarization

Political polarization has been a central focus of research in political science in recent years. Researchers have differed between ideological and affective polarization. Ideological polarization is generally defined as the extent to which issue positions and ideologies are opposed within a society (Fiorina et al., 2008; Hajnal, 2025; Iyengar et al., 2012; Lelkes, 2018). Affective polarization is rooted in the social identity theory (Tajfel & Turner, 1979), where partisanship functions as a social identity that divides the political world into an "us" (in-group) versus "them" (out-group) (Bornschier et al., 2021, 2022; Zollinger, 2024). Affective polarization occurs when the distance between positive in-group affect and negative out-group affect rises (Iyengar et al., 2012, 2019; Wagner, 2021). Both forms of polarization have substantial consequences that threaten democratic accountability and the functioning of democratic institutions by fostering mistrust, decreasing political tolerance, and increasing partisan hostility (Gidron et al., 2019; Kingzette et al., 2021). Partisans may prioritize ideology over integrity, becoming more tolerant of undemocratic practices if they serve their ideological goals, which can erode democratic norms and lead to democratic backsliding (Gidron et al., 2020; Hajnal, 2025; Iyengar & Krupenkin, 2018).

Ideological and affective polarization are theoretically different concepts. Empirically, there is mixed evidence on their relationship. On the one hand, studies find that one can experience strong affective polarization even when ideological differences are modest or shrinking (Iyengar et al., 2012; Levendusky & Malhotra, 2016; Mason, 2015). On the other hand, studies have found that greater ideological distance leads to higher levels of affective polarization (Riera & Madariaga, 2023; Rogowski & Sutherland, 2016; Webster & Abramowitz, 2017). Using longitudinal data, Lelkes (2018) finds a reciprocal relationship between ideological consistency and affective polarization, where each can reinforce the other over time. While affective polarization can be fueled by social identities, tribalism, and emotional group attachment beyond ideology, ideological consistency

and extremism also contribute to some extent to affective polarization (Druckman et al., 2021; Iyengar et al., 2019; Lelkes, 2018).

Beyond the relationship between ideological and affective polarization, several factors fuel polarization in general. First, the polarization of the political elites provides strong ideological cues to the electorate, reinforcing or shaping their ideological positions (Abramowitz & Saunders, 2008; Gidron et al., 2020; Rogowski & Sutherland, 2016). Individuals are motivated to adopt ideological positions consistent with their partisan identities due to cognitive biases and motivated reasoning, which reinforces ideological consistency and polarization over time (Lelkes, 2018). This increase in partisan sorting (Levendusky, 2009) strengthens partisan attachments and group-based distinctions (Iyengar et al., 2019; Mason, 2015). Second, the growing alignment between social and partisan identities reduces the number of cross-cutting identities, thereby lowering their moderating influence on polarization and facilitating stronger ideological divisions (Lelkes, 2018; Mason, 2015). Third, the growing partisan media system and the proliferation of online platforms and social media have intensified ideological divides by providing selectively biased information that reinforces existing ideological beliefs (Druckman et al., 2021; Gidron et al., 2020; Lelkes, 2018; Prior, 2013). In addition, negative political campaigns and strong media focus on polarization contribute to the increase in mass polarization (Iyengar et al., 2012; Sood & Iyengar, 2016), and evidence shows that campaigns generally make partisanship more salient (Michelitch & Utych, 2018).

Empirically, studies show a growing ideological polarization of political elites (Abramowitz & Saunders, 2008; McCarty, 2019; Poole & Rosenthal, 2000, 2001; Stonecash et al., 2003). For the polarization of the mass public, there is a conflict between a maximalist and a minimalist interpretation. The maximalists argue that ideological polarization among the mass public has increased significantly since the 1970s (e.g., Abramowitz & Saunders, 2008), while minimalists suggest that most of the electorate remains centrist, that the electorate's ideological distribution has not shifted dramatically, and that although partisanship and ideology are more tightly linked, this does not translate into a massive shift towards ideological extremes (e.g., Fiorina et al., 2008), which has been referred to as partisan sorting (Levendusky, 2009). Lelkes (2016) finds that, while the overall mass public has not experienced significant increases in ideological divergence or consistency, these measures have grown among strong partisans. This suggests that political polarization within the mass public may primarily result from increased sorting among strong partisans who align more closely with the polarizing positions of political elites. Consequently, elite polarization does not necessarily polarize the entire mass public but does so among strong partisans through this alignment process. Beyond their ideological polarization, studies highlight a growing affective polarization between party groups. Several pieces of research indicate that this increase in affective polarization is driven by growing animus towards the out-group (Iyengar et al., 2012), which now outweighs the in-group positive affect (Druckman et al., 2021; Iyengar & Krupenkin, 2018; Iyengar et al., 2019; Webster & Abramowitz, 2017). The increase in animus towards the out-party group increases with elite polarization (Rogowski & Sutherland, 2016), but this is not confined to the US, being widespread across Western democracies (Boxell et al., 2020; Gidron et al., 2019; Wagner, 2021).

Considering how elite polarization, partisan sorting, the disappearance of cross-cutting social identities, and the changes in the media environment of individuals affect polarization, how is the use of VAAs related to affective and ideological polarization? VAAs expose individuals to a variety of ideologies and issue positions of political parties and candidates. Exposure to varying issue positions and ideologies lowers the perception voters have of partisan sorting. VAA users are exposed to multiple parties and candidates' profiles that have

varying degrees of ideological closeness with them. This multiplication of choice creates a more balanced consideration in their decision-making process than they would otherwise experience during political campaigns (Pianzola et al., 2019), which are often more negative, vitriolic, and focused on the conflictual aspects of politics, with increasingly partisan media coverage that emphasizes the more polarizing aspects of the competition (Iyengar et al., 2019). Such effects are likely to occur particularly in countries with open-list electoral systems, such as Switzerland. Pianzola et al. (2019), based on an experimental study from Switzerland, were able to show that the use of a VAA increases the number of parties considered as viable voting options, and Benesch et al. (2023), another study based on Swiss data, found evidence that VAA use leads to an increase in vote-splitting. Since VAA users receive voting recommendations for candidates from different parties (see Figure A1 in the Supplementary File for an example), they are provided with a broader and more nuanced picture of available political alternatives and subsequently cast their votes for more parties compared to non-VAA users. Most parties are not positioned on the very extremes of the political space; thus, a larger number of parties receiving votes makes it much less likely that VAA users vote purely for extreme parties than voters who do not use a VAA. Thus, we expect that *VAA use decreases the polarization of vote choice* (Ideological Polarization Hypothesis).

Regarding affective polarization, while many studies have examined factors that increase polarization, few have also investigated those that reduce animosity towards the out-party. In their study, Ahler and Sood (2018) showed how correcting misperceptions about out-group supporters reduces animosity towards them. Similarly, Levendusky (2018a) showed that priming a common national identity reduces affective polarization. However, not all attempts yielded positive results, as Levendusky (2018b) found no evidence that priming partisan ambivalence lowers affective polarization. We argue that VAA use corrects the perception voters have of the closeness to the in-group and the distance towards the out-group. The exposure to candidates from different parties and the variety of plausible and reasonable options available to VAA users impact their partisan attachment and group-based distinction. As a result, VAA users challenge the perception voters have of their partisan identity, making them reconsider the pre-existing perceived division between their in-group and their out-groups. As a result, they may feel less strongly about their in-group and more positively about their out-group, thereby reducing the gap between their affect for in- and out-group parties. Most studies find that the increase in affective polarization is driven by an increase in out-party animus (e.g., Iyengar et al., 2012, 2019; Mason, 2015, 2018; Webster & Abramowitz, 2017). However, by being exposed to recommendations for candidates of different parties, the use of VAA potentially results in less out-party animus. As a result, we expect that *VAA use reduces animus toward parties* (Animus Hypothesis). As animus for parties decreases, and animus drives affective polarization, we expect that *VAA use decreases the levels of affective polarization (Affective Polarization Hypothesis).*

This article studies how VAA use affects ideological polarization of voting behavior and the level of affective polarization during the 2023 Swiss National election. However, most of the literature focuses on the US case. It is thus important to situate the Swiss case in terms of ideological and affective polarization to position our analyses in a comparative perspective. First, Switzerland operates under a multi-party system with a strong fragmentation and a proportional representation electoral system, which tends to lower ideological polarization compared to the two-party, majoritarian electoral system in the US (Gidron et al., 2020; Riera & Madariaga, 2023). Despite this, empirical evidence shows that ideological polarization has increased in Switzerland over the last decades, both in the population (Sciarini, 2023) and between parties (Walder, 2025). Furthermore, in comparative perspective, Switzerland exerts high levels of affective

polarization (Gidron et al., 2019). Finally, Riera and Madariaga (2023) find that Switzerland is an average case in terms of the effect that political extremism has on affective polarization. In sum, Switzerland has an electoral and a party system that favors less ideological and affective polarization. Still, it exerts a high level of polarization and the interrelation between affective and ideological forms of polarization is average in a comparative perspective.

4. Data and Methods

We conducted a two-wave panel survey during the 2023 national election campaign in Switzerland. The first pre-electoral survey wave was conducted six weeks before the election and the second post-electoral survey wave was conducted right after the election, which was held on October 22, 2023. National elections in Switzerland are a good case to study for two main reasons. First, the level of polarization and the affective position, as well as the relation between the two concepts, is average compared to other Western democracies across Europe (Riera & Madariaga, 2023). Second, VAAs are widely used during election campaigns, and the Smartvote VAA has been active in every National election since 2003 (see www.smartvote.ch for more information). The VAA used during the National elections contained 75 questions and 84% of all candidates for the national election responded to it (4,999 candidates out of 5,925). At the end of the VAA, voters access a list of candidates ranked from the highest to the lowest match. The first page of voting recommendations contains the first 50 recommendations, and voters are then free to navigate, look at all the matches, consult matching candidates in other electoral districts, and click on individual candidates to have more information on their profiles. On the first page, the first names, last names, birthdates, political party, and matching scores of the candidates are visible to VAA users. Figure A1 in the Supplementary File presents a screenshot of the top of the first recommendation page. In this context, the VAA helps voters navigate this highly complex information environment.

Between the two survey waves, we invited a random sample of respondents from the first survey wave to use the Smartvote VAA. The invitation to use the VAA was sent by email to the first wave survey respondents on 22 September 2023 (see Appendix A of the Supplementary File for the full invitation text). This was before voters in any electoral district had received their mail-in ballot material, which arrived, depending on the canton, between 24 September and 1 October. A reminder email was sent on 6 October. While the reminder email was sent after voters had received their mail-in ballot material, analyses of the cumulative Swiss Election Study (Selects, 2025) indicate that during elections between 1971 and 2023, only 2 to 9% of voters cast their ballot directly when receiving the mail-in ballot material (see Table D1 in the Supplementary File). Table A1 in the Supplementary File presents the full overview of the timeline of the study. Overall, 3,941 respondents participated in the first survey wave and 3,290 replied to the second wave. The survey was designed on Qualtrics, survey respondents were recruited by Bilendi, and to ensure some representativeness of the sample, we included quotas on age, gender, and education levels. We removed respondents who had not answered at least six of the policy questions to compute their ideological position (see Section 5), which leaves 2,573 observations. We invited 1,727 of them to use the VAA between survey waves, and among them, 878 actually did so. Furthermore, as the VAA is a tool used by roughly 550,000 voters during the electoral campaign (based on our own calculation with the Samrtvote data), we asked respondents in the control group whether they had used a VAA during the political campaign, and 21% of the 846 respondents in the control group reported having used it. In this article, we use both the encouragement treatment—the invitation to use the VAA—and the observed use as

independent variables to estimate how the use of VAA and the causal effect of our treatment affect the polarization of vote choice and the affective polarization of voters during the 2023 Swiss National election campaign. While the observed use compares VAA users and non-users, to estimate the intention to treat effect, we estimate the Complier Average Causal Effect (CACE) as formulated by Gerber and Green (2012).

In the pre-electoral wave, we asked respondents about their vote intention and their attitude towards the six main Swiss parties. We replicated these measures by asking respondents about their vote choice and affect for the six main parties in the post-electoral survey wave. Although Switzerland has a highly fragmented party system, with many parties presenting candidates in the national election, the six main parties in the current legislature are Die Mitte (centrist party), the FDP (liberal party), the GLP (green liberal party), the GPS (green party), the SP (social-democratic party), and the SVP (national-conservative party). These parties hold 193 out of the 200 seats and more than 90% of the national vote share. Our analyses focus on these six parties and analyze how the variation between vote intention and vote choice, as well as the difference between pre- and post-electoral affect for the parties, is influenced by VAA use.

5. Measuring the Polarization of Vote Choice

To measure the polarization of voting behavior during the 2023 national election, we relied on survey respondents' vote intention and vote choice, as well as candidates' and voters' responses to the VAA. In the first step, we ran a Bayesian Item-Response Theory (IRT) model to estimate the position of voters and political candidates in the same space. IRT models have been used in recent years to measure the ideological position of voters, groups of voters (Berwick & Caughey, 2025; Caughey et al., 2019; Cavaillé & Trump, 2015; Traber et al., 2023), or both political elites and voters in the same political space (Leimgruber et al., 2010; Masket & Noel, 2012; Walder, 2025). In this article, we apply the strategy of Walder (2024) and position both political candidates and voters on the same ideological dimension, combining data from VAA and survey data.

For political candidates and voters who used the VAA, we collected the responses they gave to the 57 questions in the VAA that used a the four point scale. These 57 items comprise policy-related questions covering a wide range of topics, including immigration, social welfare, economic policies, security, the environment, and others. For survey respondents who did not use the VAA, we asked six out of the 57 policy questions in the post-electoral survey, chosen to cover various topics and issue dimensions. Although the position measured for non-VAA users only considers a small sample of the complete set of policy questions, research by Walder (2024) has shown that using a handful of similar questions enables an accurate measure of the latent position of non-VAA users. The policy questions are categorical with four response categories. We thus use a 2-parameter ordered IRT model that can be formalized as:

$$P_r(Y_{ij} = k|\theta_j, \beta_i, \alpha_i) = \phi(\theta_j\,\beta_i - \alpha_{i,k-1}) - \phi(\theta_j\,\beta_i - \alpha_{i,k})$$

Where ϕ is the cumulative normal distribution, θ_j is the ideal position of actor j, $\alpha_{i,k}$ is the difficulty parameter of item i for the category k, and β_i is the discrimination parameter of item i. The term $P_r(Y_{ij} = k)$ is the probability of the actor j answering the k category on item i. The parameters $\theta_{i,k}$ are ordered so that the difficulty for category $k - 1(\alpha_{i,k-1})$ is lower than the difficulty for the category k of the same item $(\alpha_{i,k-1})$. To measure the ideological position of vote choice, the main parameter of interest in the model is θ_j, as it indicates the position of actor j in the latent space. Figure 1 presents the distribution of ideological positions of candidates from the six parties we consider to measure vote choice ideology, as well as those of the voters.

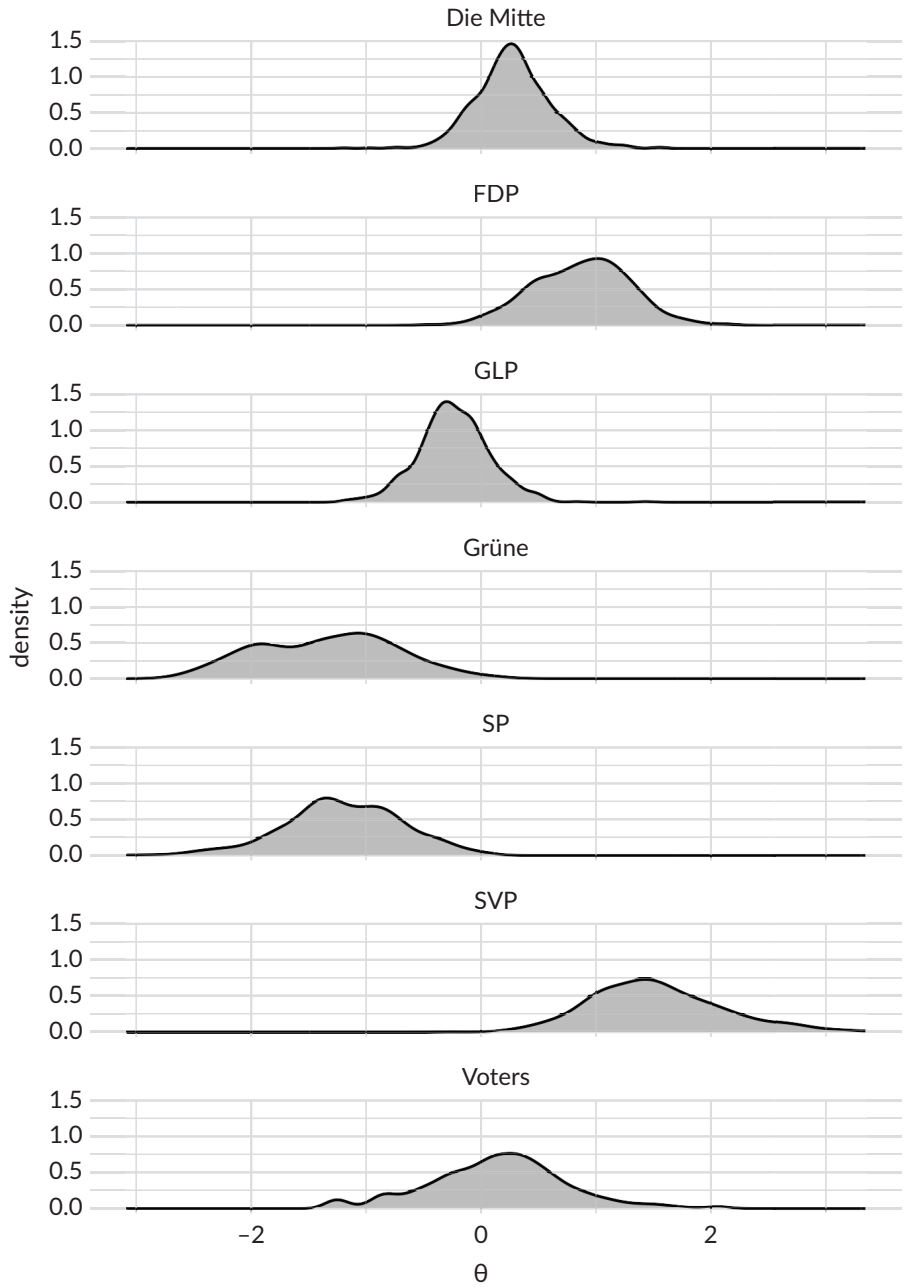

Figure 1. Distribution of latent ideological position for the political parties and for voters.

Figure 1 shows that voters' ideological positions are distributed on both sides of the status quo. We observe that the GPS and SP parties are positioned most on the left side of the political spectrum. In contrast, the distribution of SVP candidates' ideological positions is further to the right. Once the positions of the voters and the candidates were computed, we aggregated the positions of party candidates by party. We considered the mean as the average ideological position of the party. We then operationalize the ideological position of vote choice as the average position of the party respondents voted for the most.

Once we computed the ideological position of vote intention and vote choice, we measured the extremism of the vote choice with the absolute value of this ideological position. Positions closer to 0 indicate vote

intention and vote choice for parties closer to the status quo; the higher the value, the more extreme the vote intention and vote choice of respondents. Finally, we measure the polarization of vote choice with the difference between the extremism of vote choice and the extremism of vote intention. Values greater than 0 indicate a more extreme vote choice than the vote intention, and thus a more polarized vote choice than the vote intention. Values lower than 0 indicate a less extreme vote intention than the vote choice, and thus a more centralized position. Figure 2 presents the distribution of the polarization of the vote choice indicator.

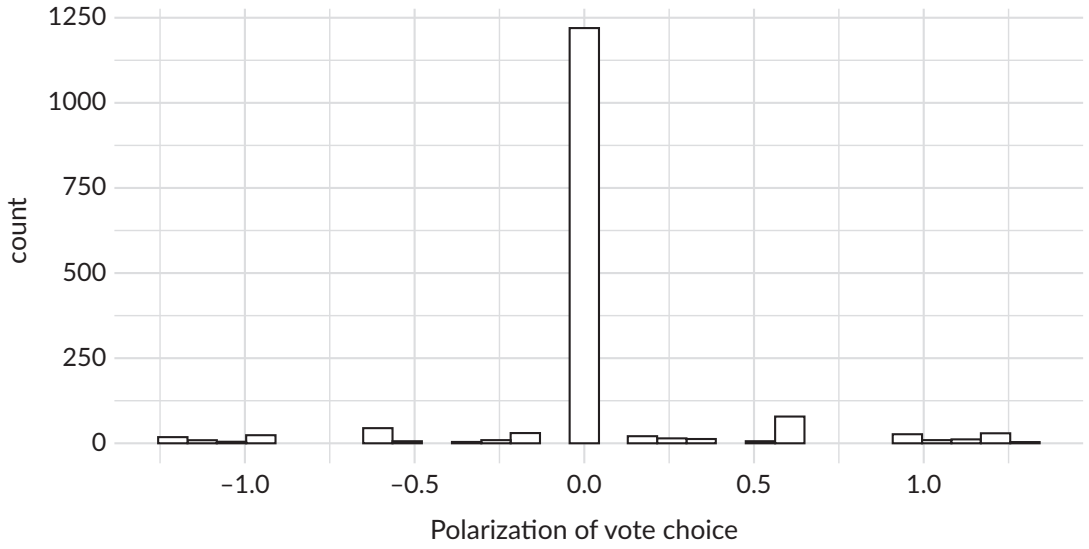

Figure 2. Distribution of the vote polarization indicator.

Figure 2 shows that individual voters are mostly voting for the same party that they intended to do in the early campaign. Indeed, for most voters, the difference in vote polarization is equal to 0, meaning that they voted for the same party they intended to. However, we observe that some voters changed the level of extremism in their vote choice compared to their initial intention. In the first part of the results, we use the difference in the extremism of vote choice as the dependent variable, indicating the polarization of vote choice during the electoral campaign.

5.1. Measures for Changes in Affective Polarization

To measure affective polarization, we rely on the indicators developed by Wagner (2021), who proposes two measures: mean distance and spread-of-scores. The key difference between these two indicators is that while the spread-of-scores measure computes the difference between the affect score of each party and the average affect score, the distance measure computes the difference between the affect score for each party and the maximum affect value for each respondent. Furthermore, to account for the fact that not all parties have the same weight in the electoral competition, Wagner (2021) also suggests using a weighted measure of affective polarization, which, instead of taking into account the average of these differences, multiplies them by the vote share of each party. He also emphasizes that the spread measure is better suited to measure affective polarization in multiparty systems. He nevertheless shows that these measures are correlated with one another. We thus compute the weighted and unweighted spread-of-scores and mean distance, and replicate the analyses for each of these indicators.

To estimate voters' affective relation for each of the six main parties, we provided them with an 11-point scale. We asked them to evaluate their affect for each party with the following question: "What is your opinion of the following national political parties? Please rate your answer on a scale of 0 to 10, where 0 means you dislike the party very much, 10 means you like it very much, and 5 is between the two categories." We asked respondents this question in both the first and second waves, which provided individual-level measures of affective polarization before and after the election. Figure 3 presents the distribution of the weighted and unweighted spread-of-scores and mean distance measure of affective polarization before and after the 2023 Swiss national election.

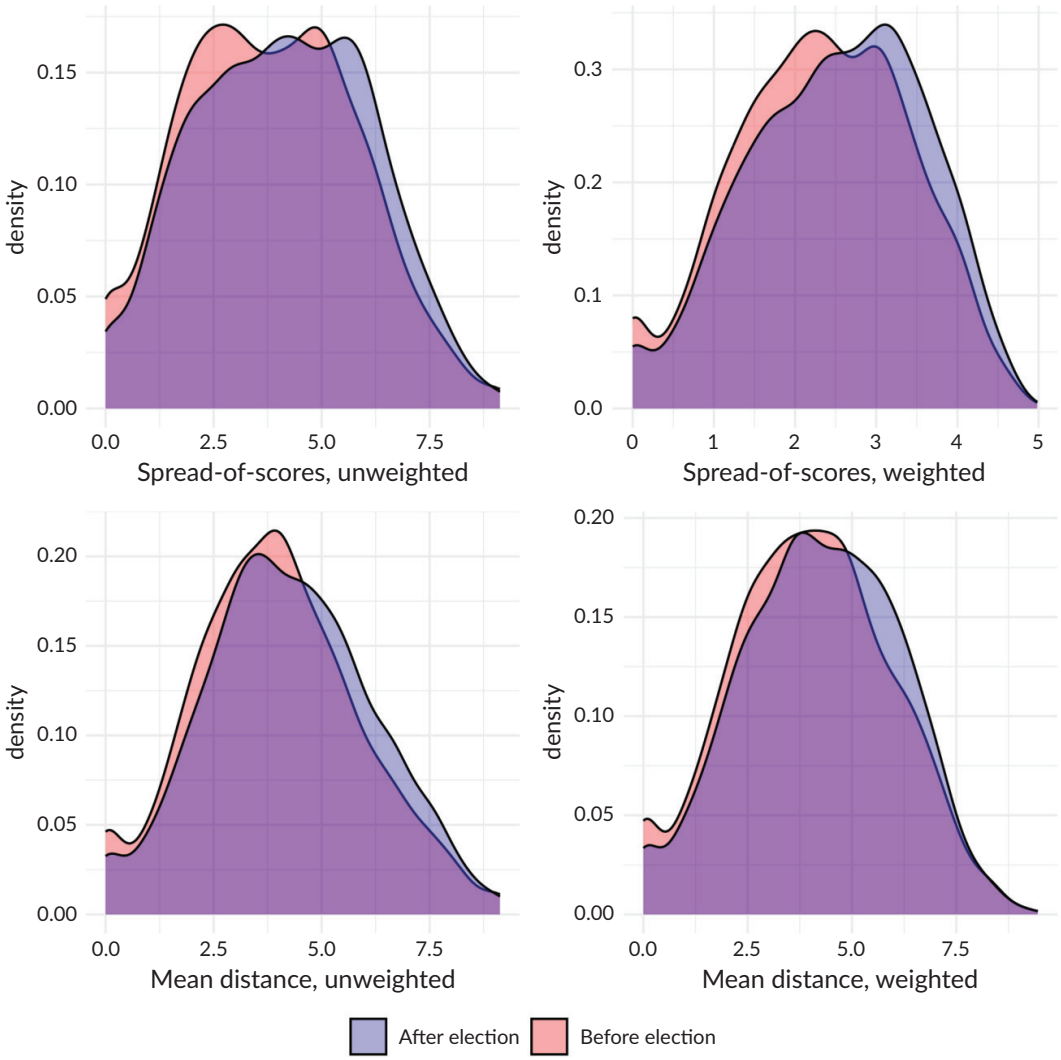

Figure 3. Distribution of affective polarization in the pre- and the post-electoral survey waves.

Figure 3 shows the affective polarization levels before and after the election campaign with all the different metrics developed by Wagner (2021). The four panels of this figure present the distribution of affective polarization scores before and after the election campaign using the four metrics developed by Wagner (2021). Figure 3 also shows that the post-electoral distribution of ideological polarization is more concentrated toward higher scores after the election than before. This result is consistent with the finding of Sood and Iyengar (2016), who found that affective polarization is substantially higher on election day than a

year before the election. In our analyses, we compute the difference in individual affective polarization before and after the election.

5.2. Measurement Models

Our study employs an encouragement treatment that invites voters to use the Smartvote VAA, which is also available to voters outside of the study. Thus, in addition to non-compliers in the treatment group (respondents who were invited to use the VAA but did not), there are also non-compliers in the treatment group (respondents who were not invited to use the VAA but did so anyway). In the post-electoral survey wave, we asked respondents to indicate whether they used a VAA during the political campaign or not. We can thus estimate the share of the treatment and control groups that used the tool during the political campaign. Overall, 51% of respondents in the treatment group used the VAA, compared to 21% of VAA users in the control group.

We conduct two types of analyses. The first type of analysis aims to estimate the effect of using the VAA on the polarization of vote choice, the affective relations voters have on the different parties, and their level of affective polarization. These analyses provide an overview of the general effect of VAA use on the various dependent variables considered in this article. This first set of analyses compares the VAA users to the non-users and estimates the effect that using the VAA has on the polarization of vote choice and affective polarization of voters. In this article, we label these estimates the effect of "observed use" of the VAA. Second, we leverage the random treatment allocation (the invitation to use the VAA) to compute the CACE as formulated in Gerber and Green (2012). Using a two-stage least squares regression with the treatment assignment as the instrumental variable and the observed treatment as the independent variable, the models estimate the causal effect of our treatment on the different dependent variables—the effect the invitation to use the VAA has on vote polarization and affective polarization. These two estimations present different effects that are interesting to study, as they do not necessarily tell the same story about the use of VAA. While the direct model estimates the direct effect of using the tool, the CACE estimates the causal effect of our treatment—the effect the tool has on respondents who would not have used it if they had not been in the treatment group.

We run these two measurement models on different dependent variables: the polarization of vote choice, the difference in affect for parties, and the difference in affective polarization. For each of these dependent variables, we control for the level of political interest of voters, their age, and their gender, as these characteristics influence the probability of using the VAA and complying with the treatment (Walder et al., 2024). As shown in Tables C1 and C2 in the Supplementary File, although the invitation to use the VAA is randomized, the share of VAA users in the treatment and the control group varies substantially by levels of political interest and for the different age groups. Furthermore, as we analyze the difference between post-electoral and pre-electoral values, these values are constrained by their pre-electoral value. Indeed, for instance, if voters intend to vote for the most extreme party in the pre-electoral survey wave, the polarization of the vote choice indicator can only have values that are negative or equal to 0. On the contrary, if voters intend to vote for the most centrist party, the polarization of their vote choice can only be null or positive. This logic also applies to the difference in the level of affect between parties and the level of affective polarization. Thus, we control for vote intention extremism in our analyses on vote polarization, we control for the initial level of affect in our analyses on the difference in affect between parties, and we

control for pre-electoral affective polarization when analyzing the effect VAA use has on affective polarization change. Additional information on key socio-demographic variables—question wording and descriptive statistics—is presented in Appendix B in the Supplementary File.

6. Results

In this section, we present the results of our analyses. First, we present descriptive evidence showing that VAA users are exposed to recommendations for candidates from different parties and varying shares of in-party candidates. Second, we present the analyses on the effect VAA has on the polarization of vote choice. Third, we present results on the effect VAA has on affect for the different parties, and finally, how it impacts the affective polarization of voters.

6.1. Descriptive Statistics: The Multi-Partisan VAA Recommendations

In the first part of the results, we present descriptive evidence to support our claim that VAA users experience high levels of exposure to various party candidates, which serves as the starting point of our theoretical argument leading to the development of our hypotheses related to the effect of VAA use on affective and ideological polarization. Figure 4 presents the distribution of the number of parties VAA users are exposed to and the share of in-party candidates that are recommended to them in the first 20 matches.

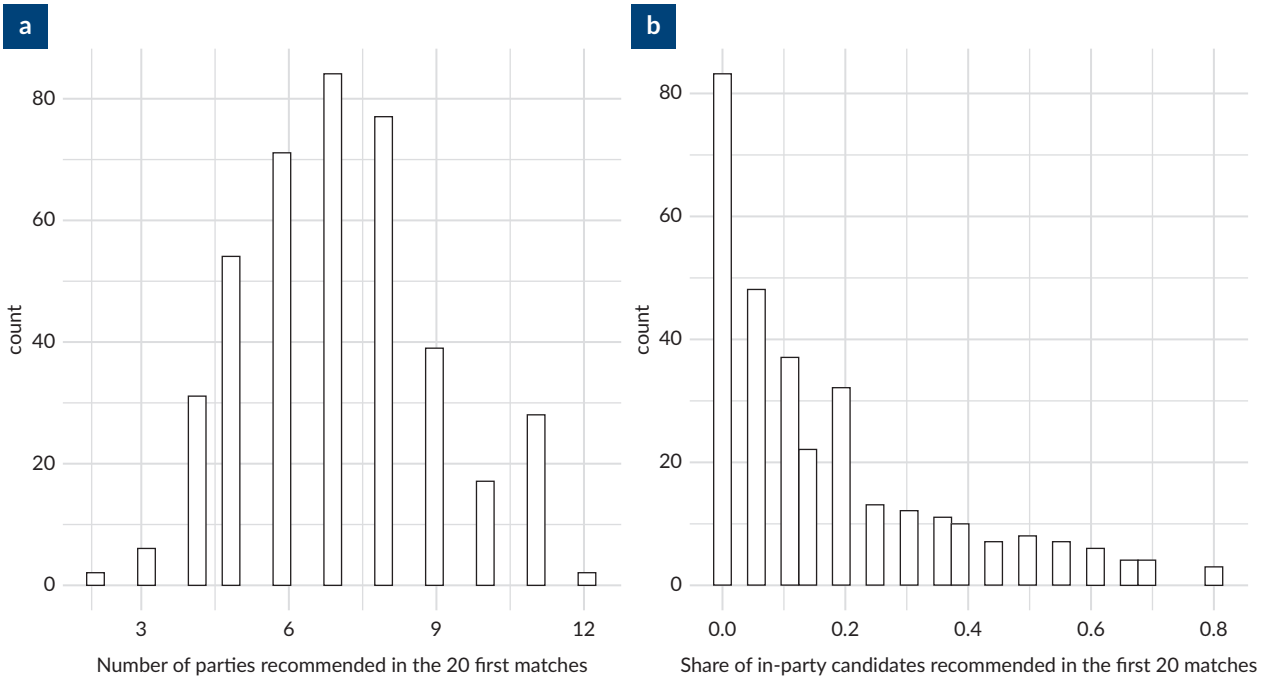

Figure 4. Number of parties (a) and share of in-party candidates (b) present in the first 20 matches of surveyed VAA users.

In Figure 4a, we see that the number of parties to which VAA users are exposed at the top of the recommendation list (the first 20 matches) varies between 1 and 12 and follows a relatively normal distribution, slightly skewed on the left, with a mean of 7 parties. Additionally, we observe that a small percentage of VAA users have only one or two parties in their recommendation list. In Figure 4b, we plot the

share of in-party candidates in the recommendation list, which means candidates from parties voters intend to vote for. We observe that a large majority of users see no, or only a small share, of in-party candidates in the first 20 recommendations, and only a small portion have a majority (more than 50%) of in-party candidates. This result shows that VAA users experience great exposure to out-group party candidates, which supports our claim that using VAAs challenges the perception voters have of partisan sorting, and their in-group and out-group affect.

6.2. VAA Use and Vote Polarization

In this section, we present the results of our analyses on the effect of VAA use and the causal effect of the treatment on the polarization of vote choice. Because voters are subjected to multiple parties in their recommendation list, this lowers the perception of partisan sorting, which decreases the polarization of their vote choice. Figure 5 presents the causal effect of our treatment and the effect of using VAA on the polarization of vote choice.

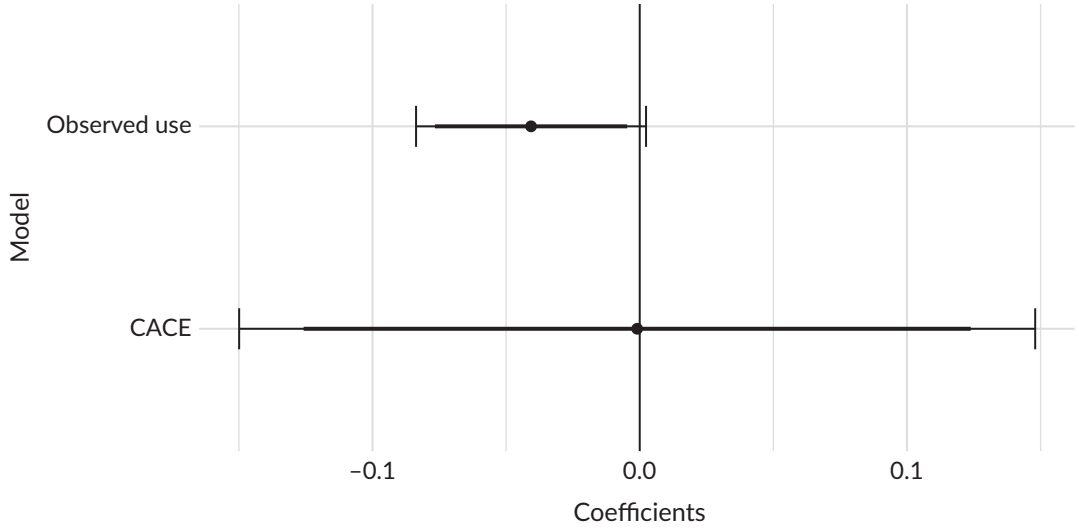

Figure 5. Effect of VAA use on the polarization of vote choice.

Figure 5 shows no significant effect of VAA use or of our treatment on the polarization of vote choice. However, we see that the VAA use has a negative effect on the polarization of vote choice, with a p-value close to the standard threshold of confidence ($p = 0.06$). While this is not conclusive evidence, our results tend to indicate that if VAA has an effect on the polarization of vote choice, it is more directed towards a depolarizing one. However, when examining the causal treatment effect, we see that there is no clear effect of the treatment on the polarization of vote choice. Although using VAA seems to decrease the polarization of vote choice, our results do not provide sufficient evidence to confirm the ideological polarization hypothesis.

6.3. VAA Use, Party Affect, and Affective Polarization

In this section, we present the results on the change in affect voters have on parties and the change in their level of affective polarization. Figure 6 presents the effect of VAA use and the causal treatment effect on the difference in affect for parties between the pre- and the post-electoral survey waves.

The left side of Figure 6 shows that the treatment has no causal impact on the levels of affect for the different parties. Indeed, in no instance is the effect on parties significantly affected by our treatment. While this suggests that VAA has no clear impact on the change in affect voters have on parties, the right side of Figure 6 tells another story. Indeed, we see that for half of the parties, the use of VAA significantly increases their affective evaluation by voters. This effect is significant for the Mitte party and the GLP, which are the two centrist parties. However, the effect is not significant for the SP and the FDP. Furthermore, while the GPS is not a centrist party, VAA use seems to increase the affective evaluation of this party by voters. Finally, we see that the affect for the SVP seems to decrease with VAA use, which goes against the animus hypothesis.

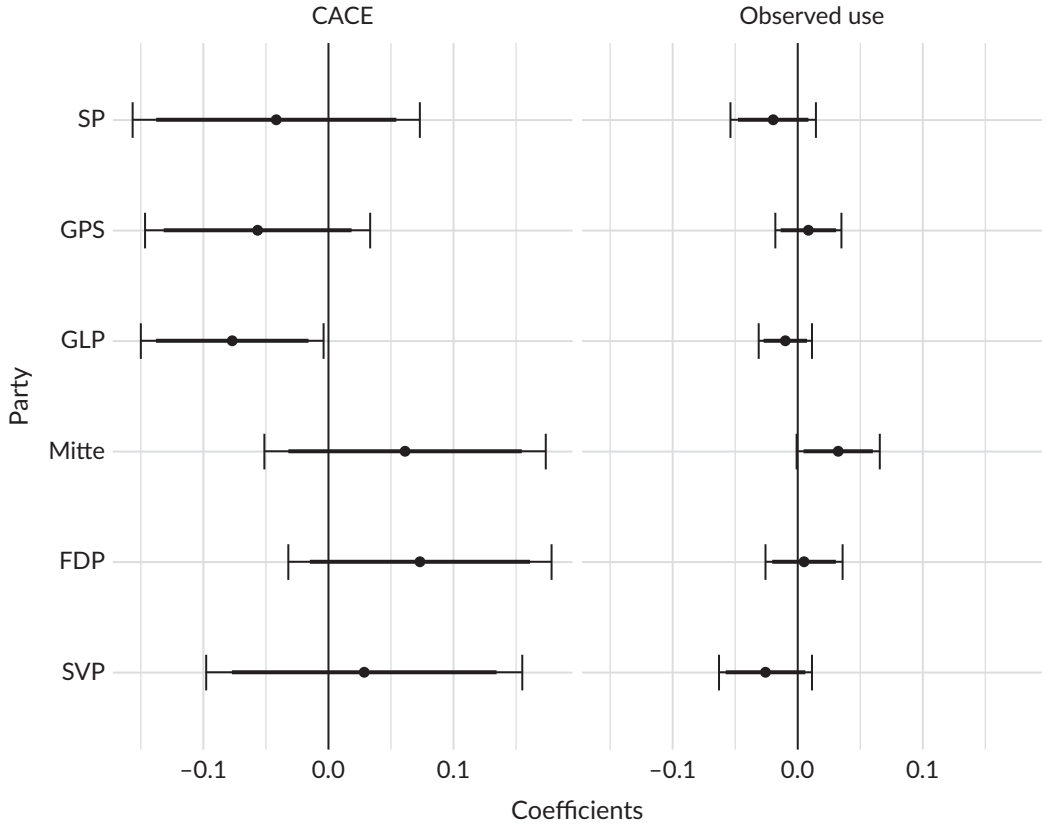

Figure 6. Effect of VAA use on the difference in affect for the different parties.

Figure 6 shows no clear trend in the effect VAA has on party effect. On the one hand, the causal effect of the treatment has no clear impact on the level of affect for parties. On the other hand, while the effect of using VAA is positive for most parties, it is negative for the SVP and the GLP, and none of the estimates reach the 95% threshold of significance.

The final part of our analysis focuses on the causal effect of the treatment and VAA use on individual change in affective polarization. Figure 7 presents the results of these analyses.

Figure 7 shows no clear effect of VAA use or treatment effect on the change in affective polarization. Moreover, the causal effect of the treatment and the effect of using VAAs seem to go in different directions. Indeed, while the left side of Figure 7 shows a non-significant positive effect of the treatment, indicating an

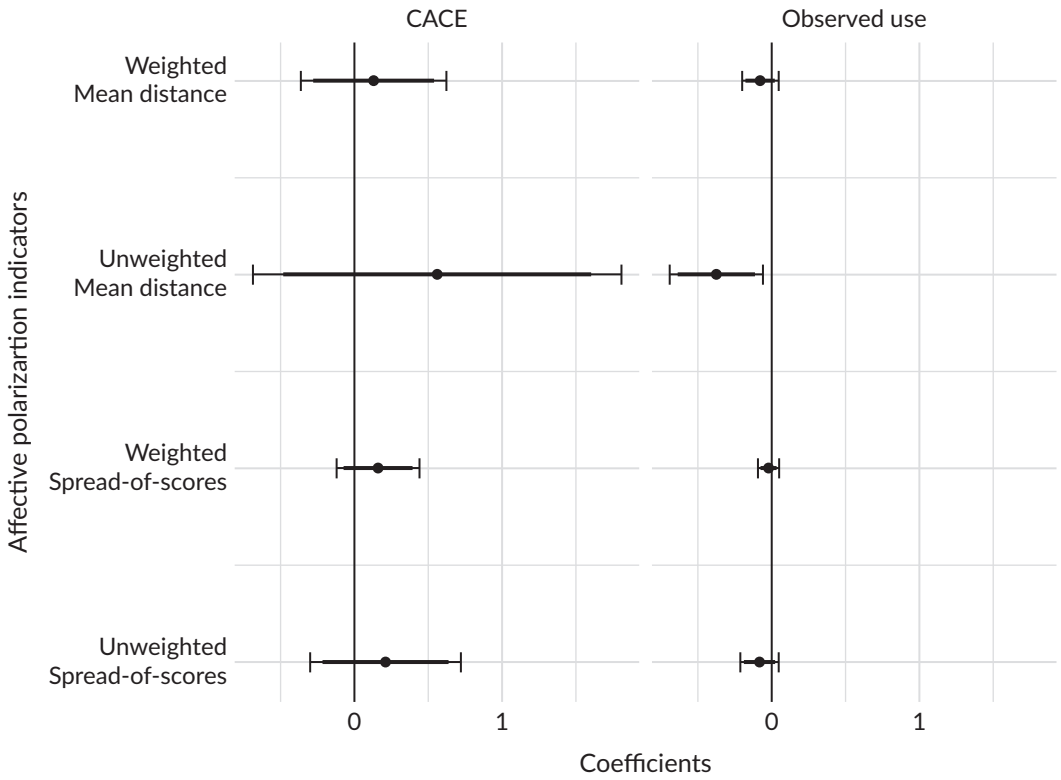

Figure 7. Effect of VAA use on the difference in affective polarization.

increase in affective polarization, the right side, focusing on the effect of VAA use, systematically presents negative estimates, which are not significant except for the unweighted distance indicator. This final finding does not enable us to confirm the affective polarization hypothesis.

7. Discussion

The results indicate no clear effect of VAA or treatment effect on the polarization of vote choice, the level of affect for parties, and the levels of affective polarization. However, this does not mean that VAAs generally have no impact on voter polarization. Indeed, if we focus our attention on the observed use of VAAs, most results go in the expected direction and indicate decreasing polarization levels. Figure 5 shows a negative effect of VAA use on the polarization of vote choice, which does not pass the 0.05 significance threshold generally accepted as significant, but is quite close to it. VAA use also has a positive impact on the change in affect for five out of six parties, but is not significant for the SP and the FDP, and is negative for the SVP. Finally, the use of VAAs has a consistent negative effect on the level of affective polarization, but again fails to pass the significance test. Taken all together, these results are encouraging but not strong enough to have a definitive conclusion on the use of VAAs.

Furthermore, the CACE hinders our confidence in these results. Indeed, none of the results are significant, and the CACE even indicates an opposite effect to that expected by the hypotheses, especially for the affective polarization hypothesis. While it is difficult to understand precisely what could explain such small effects and why the CACE and VAA use show such different findings, some elements related to VAA use and

the distribution of the treatment should be taken into account. Section C of the Supplementary File provides empirical evidence that the compliance with the treatment and the control group is not random and is influenced by pre-treatment characteristics.

Importantly, VAA users are not randomly distributed among voters and exhibit higher levels of political interest, education, and seek more information from politically relevant sources (Albertsen, 2022; Hooghe & Teepe, 2007; Manavopoulos et al., 2018; Marschall, 2014; Marschall & Schultze, 2012, 2015). Walder et al. (2024) show that perfect knowledge about the availability of a VAA does not correct for these biases in the self-selection of voters with higher interest. However, they highlight how, under perfect information conditions, a VAA would be used by a greater number of people with lower digital literacy skills, i.e., older voters. These observations suggest that not only are VAA users distinct from other voters, but also that the invitation to use a VAA has a differential impact on voters. Table C1 in the Supplementary File shows that the difference in VAA use between voters with different levels of political interest is similar in the treatment and the control group. This means that while the treatment encourages voters to use the tool, it does not mitigate the difference in usage between voters with different levels of political interest.

Additionally, two elements also warrant further attention. First, to estimate the effect of VAA use on vote polarization, vote intentions for the different parties must be similarly distributed across the compliers and non-compliers of the treatment and control groups. Figure C1 in the Supplementary File presents the distribution of party vote share for the different treatment groups. In Figure C1 in the Supplementary File, we observe that both the treatment group non-compliers and the control group compliers have higher vote shares for the conservative party SVP, the most extreme party according to our calculations. Furthermore, they also have the lowest vote share for the GLP, which is one of the most centrist parties in the country (see Figure 1). This difference in the distribution of vote intention among parties with different ideologies impacts the distance from the status quo of the vote intention of VAA users and non-users. Table C3 in the Supplementary File shows that while non-VAA users intend to vote for a party that is, on average, above 1 point away from the status quo, the VAA users intend to vote for parties that are, on average, below one point away from the status quo. The uneven distribution of this essential pre-treatment variable poses a problem in estimating the effect of VAA use and the CACE on vote polarization. Indeed, as non-VAA users exhibit more extreme vote and less centrist vote intentions, they also have more room for depolarization than VAA users.

Second, voters in the different groups should also show similar distributions of pre-treatment affective polarization levels. Table C4 in the Supplementary File presents the average affective polarization score for VAA users and non-users in the treatment, the control group, and the whole sample. This table also shows that VAA users have, on average, lower levels of affective polarization than VAA users before the treatment. These differences make it difficult to estimate a reliable causal effect of the treatment when computing the CACE. They may explain the differing directions of the results between the effect of VAA use and the CACE on the effect for parties, as well as the level of affective polarization.

Overall, VAA users have less extreme vote intentions, lower levels of pre-treatment affective polarization, and higher levels of political interest. The additional analyses in Appendix C of the Supplementary File show that these differences remain in the treatment group. Indeed, Table C5 in the Supplementary File presents the results of a regression model in which the extremism of vote intention has a significant effect on the probability

of using the VAA in the treatment group, the control group, and the whole sample. Despite the lower room for depolarization in the group that uses the VAA, our results indicate that the VAA has a depolarizing effect on vote choice.

8. Conclusion

To our knowledge, this article is the first study ever to investigate the effect that VAAs have on voter polarization. We study the impact of VAAs on the polarization of vote choice, the affect voters have for parties, and their levels of affective polarization, using a field experiment conducted within a two-way panel survey wave during a national election campaign. We argue that VAAs, by exposing voters to candidates from a wide range of parties, lower the perception of partisan sorting and challenge voters' partisan identity by recommending closely congruent out-party candidates. While our results do not provide strong evidence on the relationship between VAA use and ideological or affective polarization, the evidence presented points to a decrease in vote polarization and a decrease in party animus, albeit not for all parties.

By investigating the relationship between VAAs and polarization, this article contributes to the literature on depolarization. The evidence presented suggests a depolarizing effect, although, as highlighted, the non-random nature of VAA use, even with an encouragement treatment, makes it challenging to form definitive conclusions. While many researchers study what affects and drives polarization, only a few studies investigate elements that have the potential for depolarization (Iyengar et al., 2019). Both ideological and affective polarization threaten democratic accountability, increasing mistrust in political institutions, decreasing tolerance towards one another, and fostering hostility (Gidron et al., 2019; Kingzette et al., 2021). Growing polarization and negative partisanship threaten democratic norms by prioritizing ideological goals, even through undemocratic practices, which represents a rapid slope toward democratic backsliding (Hajnal, 2025; Iyengar & Krupenkin, 2018). Given the threats posed by growing polarization, future studies should aim to better understand how initiatives, such as VAAs but not limited to them, can lower polarization levels.

While our study addresses questions regarding the link between VAA use and ideological or affective polarization, several aspects remain underexplored. First, while we study how VAA use generally affects the levels of voters' polarization, we only compare voters who use VAA and voters who do not use the tool. However, the effect the VAA has among VAA users may vary depending on the recommendations voters get from the VAA. Indeed, while centrist voters who intend to vote for a rather extreme party might experience a depolarization of their vote choice following its use, the opposite is true for a rather extreme voter who intends to vote for a rather centrist party. Future studies should investigate the moderating impact that vote recommendations from VAA have on the polarization of vote choice and the affective polarization of voters. Second, in Switzerland, the vote is an open list system, meaning that voters can add candidates from other parties to their list. Our study focuses on the change in party list between the vote intention and the vote choice, but other aspects of voting (i.e., adding candidates from another party to the list) may also be affected by the use of VAA. While the cumulative Swiss Electoral studies indicate that the share of voters who do so is relatively limited (between 13% and 30% depending on election year, see Table D2 in the Supplementary File for a full overview), the use of VAA may also affect the addition of out-party candidates to the party list. Finally, the number of candidates and available seats in the 26 cantons varies between 2 for small cantons and 35 for the canton of Zurich. This affects both the number of candidates and the number of choices voters have to make. The number of seats in the district heavily impacts the number of candidates

and, thus, the potential for vote switching and the relevance of using a VAA. Indeed, VAA lose their importance if voters have to select one out of two candidates, or if they have to select thirty out of a thousand candidates.

We present evidence that indicates that there is a potential in VAAs to contribute towards a decrease or at least a moderation of political polarization. Previous VAA research has highlighted that VAA design and statement selection matter with regard to the impact a VAA can have on vote choice and various other aspects of voters' behavior (Gemenis, 2024; Louwerse & Rosema, 2014; Otjes & Louwerse, 2014; Romero Moreno et al., 2022; Rosema & Louwerse, 2016; Stockinger et al., 2024; Walgrave et al., 2009). However, the role the design of a VAA plays regarding the impact on their users' polarization levels is an unexplored dimension of VAA research. Future studies should examine how VAA designs and also communication measures can contribute to a better exploitation of this potential for reducing political polarization.

In general, the main goal of VAAs is to allow voters to make informed electoral decisions. However, VAAs potentially have additional benefits. They provide voters with a broad range of views on different parties or candidates, which can be seen as a valuable effect in its own right—especially in the case of Western democracies, where the public is more divided and polarized than ever. They carry the potential to balance ideas and highlight common political ground, while providing voters with a strong perspective to navigate complex information environments. These functions are crucial for the democratic institutions and socio-political cohesion of the public. This effect should not be underestimated, as democratic backsliding is gaining traction in more and more established democracies.

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Conflict of Interests

Daniel Schwarz and Jan Fivaz are co-founders of Smartvote, the voting advice application that was part of the field experiment used in this article.

Data Availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

LLMs Disclosure

The authors have used Grammarly to enhance the text of the article and Coral AI to conduct a comprehensive literature review.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

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