Mapping the Voting Advice Application Literature

A Scoping Review Differentiating Distinctive Fields in the Study of Voting Advice Applications

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Abstract

Over the last decade, an academic literature examining the nature and role of voting advice applications (VAAs) in democratic societies has emerged. This article proposes a scoping review of this literature. By analyzing and synthesizing in a systematic and exhaustive way the literature on VAAs, we identify three areas of study defining the general research agenda. The first focuses on the design and development of VAAs. More specifically, work in this area discusses the way VAA questions are selected, how political parties are coded, and what algorithms are used to match voters to parties. A second area looks at the effects of these applications on voters’ attitudes and behaviours. Finally, the third, and substantially more limited, area of study looks at the use of the particularly large N data sets collected by VAAs. These large data sets offer the opportunity to study political behaviour in ways not possible with conventional surveys. Yet, these non-representative samples also represent a technical challenge. Due to the immense potential of VAA data, this paper invites scholars in this emerging field to establish this third area as a priority for future work.

Keywords: Voting advice application, elections, public opinion, electoral
INTRODUCTION

A subfield of electoral research on voting advice applications (VAAs) has recently emerged and already counts within its field several studies. VAAs are based on algorithms that ideologically match voters with political parties based on their survey responses to political questions (Walgrave, Van Aelst, & Nuytemans, 2008; Ladner & Pianzola, 2015). VAAs now represent a common tool especially popular during general, regional and local elections in North America and Western Europe. Creators of VAAs highlight the educational and voter engagement properties of these interactive tools (Ramonaite, 2010). VAAs were first implemented in Finland in 1996 before spreading to Western Europe and America in the late 2000s (Ruusuvirta & Rosema, 2009). These tools are now used by many millions of voters around the world. For instance, the Stemwijzer in the Netherlands had nearly 5 million users during the 2016 election, the Wahl-O-Mat in Germany was used 15.7 million times during the 2017 national election, and the Vote Compass has 2 million users during the 2011 and 2015 Canadian federal elections, as well as over 1 million users during the 2013 and 2016 Australian federal elections.

The popularity of VAAs in the population was quickly echoed by the academic sphere. The scoping review approach used in this paper allows for an exhaustive analysis of this emerging literature on VAAs. After describing the methodology of our analysis, we present the main characteristics of the publications in this field. Our observations lead to the identification of three subfields in the analysis of VAAs. Because the use of diverse scaling methods in the development of VAAs may lead to different voting recommendations (Louwerse & Rosema, 2014), many scholars have focused their attention on the development of VAAs. Thus, the first subfield identified assesses at the design of such tools. The second subfield is concerned with examining the advantages and disadvantages of VAAs as well as their effects on public opinion and political behaviour. The third subfield identified is relatively understudied compared to the first two and focuses on how the large N data that VAAs collect can be used by researchers to understand electoral behavior, political preferences, and the demographic and social characteristics of the citizenry. Because of their large samples, VAAs allow researchers to observe micro-phenomena occurring among very specific segments of the population during election campaigns. Given the simultaneous unique opportunities these data represent for the assessment of political behaviour and the unique challenges they pose with respect to the representing the population, we argue this third area should be a priority for future work in this emerging field.

SCOPING REVIEW METHODOLOGY

This analysis follows the guidelines of the Joanna Briggs Institute (JBI) to create an evidence-based mapping of the VAA literature up to May 2018. We aim to produce a scoping review of all academic studies on the topic of VAAs. Scoping reviews are defined by JBI as a type of review estimating the size and scope of a body of literature on a given topic. The conventional goal of a scoping review is to identify the various research designs and gaps existing in the literature (Joanna Briggs Institute, 2014, p.173). There already exist reviews of the academic literature on VAAs. Garzia and Marschall (2012), for example, summarizes
and meta-analyzes some studies to highlight different trends in the field. Similarly, Raab (2013) offers a literature review and a meta-analysis that focuses on a narrower topic: the use of VAAs by subgroups of the population. This paper builds on Garcia’s classification and Raab’s study using a scoping methodology, which can be considered as a rigorous, effective and transparent synthesis of the research field literature (Joanna Briggs Institute, 2015).

This scoping analysis intends to provide an exhaustive overview of academic findings regarding VAAs and to objectively describe the work of the entire community of scholars working in the field (Joanna Briggs Institute, 2015).

**Document Research Strategy and Selection Criteria**

This analysis follows the *Reviewers Manual Methodology for JBI Scoping Reviews*. As such, a three-step search strategy to collect relevant sources is used. First, a manual literature review of over 100 sources is conducted. The documents included in this analysis allow us to identify the main keywords used in the titles and abstracts of papers in this sample of the VAA literature.

The second step is to create specific search requests with identified keywords for the relevant databases: International Bibliography of the Social Sciences, Worldwide Political Science Abstracts, PAIS International, ABI/Inform, Academic Search Premier, Proquest Dissertations and Theses, Web of Science, Google Scholar, and WorldCat. These are multidisciplinary or specialized document databases that allow for a large scoping of academic texts originating from various disciplines such as political science, technology, communication, and economy. Requests obviously need to be adjusted to the peculiarities of each document database. Two of the eight research requests are presented in Appendix A. All requests of document databases were executed in May 2018. In order to assure the exhaustivity of our approach, no research constraints in terms of language, type of document or year of publication are used. A summary of the results of these searches is presented in Appendix B.

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1The document research strategy has been developed in collaboration with two library consultants in document search strategy development from the Library of the Université Laval. The authors wish to thank in particular Richard Dufour and Emmanuelle Raynard for their invaluable help and guidance during the entire research process.
Finally, the third step of the scoping strategy involves the creation of a list of all relevant sources cited in the list of sources found during the second step. This final gathering step allowed us to create a final list of 3697 sources.

Two research assistants independently analyzed the full list of sources to determine whether each source should be excluded or included in the scoping. To assure a common evaluation scheme, the assessments of both research assistants have been compared twice: at the beginning of the process (after the evaluation of the first 100 sources) and at the end of the process. The concordance rate was 97%, and the rare disagreements were settled by the authors after a discussion with both assistants. Figure 1 shows the process of sources’ inclusion in the scoping review. 207 sources are included in the final sources’ database used for analysis.

**Inclusion Criteria** are as follows: 1) Subject: Any source whose main subject is related to a technology, a website, or an application that recommends, assists, informs, or educates the vote; 2) Type of document: Article, book, thesis and conference paper; and 3) All languages.

**Exclusion Criteria** are as follows: 1) Duplicated sources; 2) Subject: Sources whose main subject is not related to VAAs; and 3) Type of documents: Unpublished articles, articles waiting for correction or verification, and book reviews.

**LITERATURE OVERVIEW**

Following the scoping review protocol, an analysis of the 207 included sources allows us to extract information providing a unique overview of the field of research on VAAs, its characteristics, and the scholars contributing to it.

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The coding of the documents was done by two student at the Université Laval. The authors wish to thank in particular Marc-Antoine Rancourt and Amélie Audet for their research assistance.
The academic literature on VAAs can be said to have started in 2006. Thereafter, the number of articles and conferences on VAAs increased quickly, reaching its peak in 2014. Figure 2 shows the evolution in the number of publications about VAAs from 2006 to 2018. Stefaan Walgrave, Peter Van Aelst and Michiel Nuytemans presented the first study on VAAs in 2006 at the ECPR General Conference. Their presentation was entitled *Do the vote test. Electoral effects of a vote advice application at the 2004 Belgian election*. Their innovation rested on the empirical investigation of the impact on voters of the Do the vote test VAA during the 2004 Belgian electoral campaign. An article followed this presentation; *Do the vote test: the electoral effects of a popular vote advice application at the 2004 Belgian elections* was published in 2008 in the journal *Acta Politica* and is still today the most cited publication in the field.

Figure 3 presents the five most cited sources in the academic literature on VAAs. These articles—all published by researchers working at European universities—principally focus on the effects of VAAs on voters. Garzia and Marschall (2012)'s literature review paper is the exception.

The number of citations presented is up to July 2018.

Source: Google Scholar citations’ counter.
Figure 4: Where do Researchers Writing on VVAs Come From?

The scale represents the number of VAAs’ publications up to July 2018. The country identification with the publication rely on the location of the university of the researcher or of the main researcher.

An Europe zoom map is presented in Appendix D.
n=207.

Locating Scholars Studying VVAs

Gathering such a wide range of publications about VAAs allows us to observe the distribution of this field of research. Generally considered a European field of study, or even more precisely, a northern European field of study, scholars from a large range of countries are now beginning to assess the design and effects of these applications. The first publications about VAAs focused mainly on these applications in Belgium, Germany, Switzerland and Netherlands. Until 2018, articles on VAAs have predominantly also been authored by researchers from these countries. Sixty papers have been written and published by scholars from universities in Netherlands and 52 by researchers from Swiss universities. However, scholars from 28 countries in total have published articles on VAAs. Figure 4 shows prevalence of publications about VAAs in the world up to July 2018. Other European countries, like Italy, Greece, Portugal and Finland, gradually began to write about VAAs around 2008.

In North America, Mahéo (2016a), a Canadian researcher, published three papers presenting the results of a randomized controlled field study evaluating the effect of the Vote Compass application on users (Mahéo, 2017), (Mahéo, 2014). In Oceania, Australian (nine publications) and New Zealand researchers (two publications) have shown an interest in VAAs, particularly regarding the design and effects of VAAs. The Vote Compass was introduced in these countries, respectively, in 2013 and 2014, which coincides with the emerging research
interest in these applications of scholars from the area in the following years. In the last several years, scholars from Asian universities have also begun to develop an interest in VAAs. Uekami and Tsutsumi (2016), in Japan, published a paper about the Japanese Votematch tool, deployed for the first time in the 2007 election. In South Korea, Liao, Chen, Jensen, and Pritchard (2016a) analyzed the effects of VAAs in Japan, South Korea and Taiwan in a comparative analysis with major European VAAs. A review of the effects of VAA design on vote recommendations was also conducted by Reddy and Govindarajulu (2017) in India. Earlier, Turkish researchers showed an interest in VAAs by analyzing the effect of the Turkish Voter Advice Application during the 2011 Turkish Parliamentary elections (Çarkoğlu, Vitiello, & Moral, 2012). Scholars from South America have published once in this field; Marzuca, Serdült, and Welp (2011), from Uruguay, wrote a design description of Questao Publica, the first VAA in Latin America set up for the 2010 Senate elections in Brazil.

**Research Designs Used in Papers on VAAs**

Among the included sources, a wide range of research designs are used. We observed 26 different kinds of studies analyzing VAAs. Cross-sectional studies are predominant. All in all, 64 studies look at VAAs cross-sectionally, and 51 of these in a quantitative manner. Most of these studies analyze the effect of a VAA on the user of a specific VAA. Indeed, many articles likely focus on a particular application. 39 publications use a case study design to assess quantitatively, qualitatively, or with a mixed-method approach one or more VAAs. With 18 articles, though, quantitative case studies are the most common. Grounded theory approaches are also notable constituents of this literature. 26 studies inductively analyze data about VAAs, aiming to highlight the contributions and efficacy of these tools.

However, the field contains only a few controlled, or experimental or quasi-experimental studies. Since 2006, 13 studies of this type have been conducted. Among them, 11 have been randomized control trials. These studies mostly analyze the effects of VAAs on users. More randomized controlled studies and experimental or quasi-experimental studies would contribute to improving our understanding of the causal effects of VAAs on users when it comes to voting, turnout, civic education, and political knowledge. Relatedly, only 11 studies analyze these tools with time series or longitudinal approaches. Examining the effects of VAAs over time could lead to a more accurate analysis of the persistence of the effects of VAAs in the long run.

Thus far, only one meta-analysis has been conducted. Raab (2013) assessed papers that focused specifically on the question of which strata of the population were most likely to use VAAs. She also compared if demographic trends in usage are different across seven European countries. This kind of study allows for a broader assessment and a systematic summary of early research on VAAs. Scholars working in the field should conduct more meta-analyses in order to identify results that have replicated well and those that have not. As the next section will discuss, diverging results remain a feature of the literature on VAAs, especially when it comes to results concerning the effects of VAAs on users. Taking results across studies as a whole and evaluating the quality of the presented evidence should allow us to develop a Bayesian integration of research findings that would allow the field to move forward.
Figure 5: Research Designs Used in Papers on VAAs

Cross-sectional quantitative study
Grounded theory approach
Literature review
Multiple quantitative case study
Cross-sectional jointed methods study
Multiple joint case study
Longitudinal retrospective study
Exploratory study
Quantitative case study
Randomized controlled field study
Qualitative case study
Textual analysis
Randomized controlled study
Randomized controlled field study
Multiple qualitative case study
Jointed methods case study
Quantitative case–control study
Cross-sectional study
Qualitative quasi-experimental study
dultiple qualitative case study
Multiple jointed methods case study
Meta analysis
Interrupted time series study without casecontrol
Interrupted time series study with casecontrol
Cross-sectional qualitative study
Before after study with casecontrol

Number of publications

n=181
THREE SUBFIELDS IN THE STUDY OF VAAS

The scoping review methodology allows us to identify the characteristics of research on VAAs by assessing the broadest swath of writings on the topic. As we can see in Figure 2, the literature on VAAs is growing. By analyzing and synthesizing in a systematic, rigorous and effective way the VAA literature, we are able to identify three areas of study that define the general research agenda. The first focuses on the design and development of VAAs. More specifically, work in this area discusses the way VAA questions are selected, how political parties are coded, and what algorithms are used to match voters to parties. A second area looks at the effects of these applications on voters attitudes and behaviours. Finally, the third, and substantially more limited, area of study focuses at the use of the large N data collected by VAAs. We present the evolution of these three subfields over time in Figure 6. Given the simultaneous unique opportunities these data represent for the assessment of political behaviour and the unique challenges they pose with respect to representativeness, we argue this third area should be a priority for future work in this emerging field.

Figure 6: Evolution of Subfields in the Literature on VAAs

n=191.
VAAs Development Significance

Many scholars recognize the great political importance of VAAs for opinion formation and voting behavior (Wagner & Ruusuvirta, 2009; Krouwel, Vitiello, & Wall, 2012; Trechsel & Mair, 2011), which is why a significant amount of research attention has been paid to how VAAs are framed, how they code party positions, and how they generate voting recommendations. Concerning the development of VAAs, three aspects have been highlighted for their outsized effect on voting recommendations: the questions that are asked, and how they are asked, and the way political party and citizen positions are defined in ideological space. This subfield of study is the object of many articles included in the scoping. In all, 80 sources are associated with this sub-subject in the literature.

Statement (i.e., question) selection affects the output of VAAs by having a large impact on the vote recommendations that are produced. In particular, including statements about salient issues disadvantages parties with more extreme positions on these issues, as does including left-right statements (Lefevere & Walgrave, 2014). Thus, VAA statements need to be carefully selected using a process that benchmarks based on survey data (Walgrave, Nuytemans, & Pepermans, 2009) and is carefully calibrated to produce valid results.

How VAAs are developed also influences how party positions are framed, as this development process entails calibrating parties on salient issues. To produce a voting recommendation, VAAs rely on a methodology that can compare voters and parties policy stances in a meaningful way. The VAA literature describes these methodologies as being comprised of a combination of expert judgments, assessment of party documentation, and party self-placement on statements (Krouwel et al., 2012; Trechsel & Mair, 2011). Other methods of positioning parties on political issues involves surveying voters and party elites, evaluating their roll-call behaviour in government, and evaluating statements in party manifestos (Krouwel & van Elfrinkhof, 2014).

While parties often place themselves on VAA statements, significant biases can emerge from such self-placement. Ramonaite (2010)s paper on use of VAAs during Lithuanian parliamentary elections suggests that parties might be able to manipulate results by adopting non-ideological populist policy positions and adjusting to the median voter. To help situate a political party with accuracy, it may be useful to rely on their party positions that have been documented on the internet. Neutral expert coders can provide unique data for comparing parties by analyzing published political texts and speeches in an approach based on judgmental coding (Gemenis & Rosema, 2014). This method incorporates an anonymous iteration, known as the Delphi-Method, which consists of the coding of political content, especially political manifestos (Gemenis, 2012), by a panel of expert coders. Ultimately, all of these methods serve to try to map policies and parties onto the same multi-dimensional ideological space. It remains, though, that the political positionings developed by VAAs are estimates that are largely based on the algorithms that do the mapping. The coding behind the spatial maps of VAAs is often defined by a priori reasoning (Germann, Mendez, Wheatley, & Serdiilt, 2015) and has not always necessarily been empirically validated. To improve the validity and reliability of the dimensionality of the ideological spaces space and scales in VAAs, Gemenis (2013) proposes combining deductive reasoning and quasi-inductive statistical techniques.

Like with parties, many techniques are also used to position users on policy issues and in ideological space. Once users have been located, they are then associated with the positions of
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political parties in a matching model (Fossen & Anderson, 2014), which relies on algorithms to aggregate policy preferences. But design choices with respect to algorithms are not neutral and contribute to the fact that the way VAAs are developed has a direct impact on the recommendations given to users (Mendez, 2012; Wall, Krouwel, & Kleinnijenhuis, 2012). Moreover, a social dimension has recently been introduced to the field of vote aid development by adding a social network component to the way that users are scaled to parties. Social VAAs provided community-based recommendations and compare users political opinions using collaborative filtering (Katakis, Tsapatsoulis, Mendez, Triga, & Djouvas, 2014; Tsapatsoulis, Agathokleous, Djouvas, & Mendez, 2015).

Combining many coding sources to when positioning parties and users in ideological space is an effective way to reduce random error and biases and helps create better matches of voters and parties. While the biases that crop up in VAAs are manageable within the development of the tool itself, more difficult to resolve are issues of representativeness. Krouwel et al. (2012) illustrates the methodological issues that arise when voters opinions are aggregated into easy-to-understand output that represents voters within the ideological landscape of competing parties. This criticism is similar to Louwerse and Otjes (2012)s comment on the homogeneous application of spatial models of electoral compasses in established democracies, semi-authoritarian systems, and transitional systems. This one-size fits all model, the authors argue, fails to accommodate crucial variation between party systems. Other authors have documented that the length of the scale used in VAAs can also affect the validity of spatial matching (Rosema & Louwerse, 2016). In a similar vein, Wagner and Ruusuvirta (2009) argue that VAAs often rely on proximity voting models that do not take the valence of issues when formulating issue statements into full account. These authors also point out limits inherent to these applications: VAAs mostly disregard accountability, salience, competence and non-policy factors; they treat policy positions and not outcomes as paramount; and they can be subject to strategic manipulation by political parties (Wagner & Ruusuvirta, 2009, p.400). Often presented as a mirror that offers a reflection of users compared to political parties, even a well-developed VAA does not reflect users perfectly and neutrally, given that the information input into a VAA is informed by developers assumptions (Fossen & van den Brink, 2015). As a result, VAAs should be considered tools in voters toolkits, or preference lists and guides, rather than voting recommendations that must be followed to the letter. Given that these recommendations depend so strongly on VAA design, spatial dimensions and matching algorithms should be developed with great care.

THE EFFECTS OF VOTE RECOMMENDATIONS

In most modern and advanced democracies, voter turnout is low, which is alarming for the quality of representation. Political participation is especially low for younger citizens. In this context, VAAs are interesting tools to potentially increase turnout. Attracting millions, these applications are used by an meaningful proportion of voters to inform themselves about candidates and parties; moreover, they are especially popular among young voters (Fivaz & Nadig, 2010). The question is whether such tools actually increase voter turnout. Other questions regarding the effects of VAAs concern the impact of VAAs on vote volatility, on the nature of the vote itself, on citizens political information, and on party behaviour. Answering these questions has led to the development of the most developed subfield within the literature
Mapping the Voting Advice Application Literature

Since 2006, 84 publications have been focused on evaluating the effects of these applications.

Fivaz and Nadig (YEAR??) show that VAAs indeed tend to lead to higher voter turnout, as well as greater political interest and political knowledge. From a political participation perspective, user behaviour seems to be directly affected by exposure to VAAs. Users are more likely to take part in elections as compared to non-users, and a growing body of evidence supports the idea that VAAs have mobilizing potential in and of themselves (Garzia, Trechsel, Vassil, & Dinas, 2014). The contribution of VAAs on turnout is estimated to be about 4 percent of the reported turnout (Gemenis & Rosema, 2014).

In addition to increasing turnout, the recommendations generated by VAAs have a notable impact on the nature of the vote itself. Research shows that a non-negligible proportion of VAA users is willing to move their vote in accordance with the advice obtained (Garzia, Trechsel, et al., 2014). However, a more important congruence is observed between recommendations and the vote when the recommendation coincides with users pre-existing preferences (Wall et al., 2012). The influence of VAAs is thus less notable when the recommended party was not previously seen as a contender for the vote, but highly impactful when the recommendation substantiates an already strongly considered party. Others argue that the algorithms of certain VAAs, by favouring some parties over others, can contribute to voter migration substantial enough to increase vote swing (Pianzola, 2014b). Nevertheless, some scholars like Walgrave et al. (2008) are more skeptical, arguing that the effects of VAAs are more limited and diverse than is often assumed.

The mobilizing effect of VAAs tends to be larger among groups that typically vote in smaller numbers, such as young voters and those that are less interested in politics. Alvarez, Levin, Trechsel, and Vassil (2014) highlights the fact that socioemographic and attitudinal factors determine the extent to which users find VAAs useful. Embracing new technologies, believing that politics are complicated and having a stronger interest in politics heightens the perceived utility of VAAs and correspondingly, increases an individuals probability of using such an application. Given that VAAs are hosted online, there is bias in their usage corresponding to bias in Internet penetration among the population, with differs by gender and age (Andreadis, Wall, & Krouwel, 2015). Moreover, the usage of VAAs induces a kind of paradox, in the sense that the most educated are the most likely to use VAAs but also the least likely to be influenced by them (Dumont & Kies, 2012), largely because they are also already well-informed about politics and do not need help in coming to a voting decision (Van de Pol, Holleman, Kamoen, Krouwel, & De Vreese, 2014). Ultimately, VAA users are heterogeneous and their motivations for using these applications are also variable.

More broadly speaking, VAAs may affect citizens general political knowledge. Because VAAs tend to be built according to high academic standards, they may represent meaningful opportunities for citizens to become more knowledgeable about the political positions of parties, candidates, and themselves citeandreadis2013voting, ladner2012voting, kamoen2015efffect. That said, VAA users seem to possess higher levels of information about party positions compared to controlled nonusers at the outset (Schultze, 2014), which may explain the nature of vote switches as a product of using VAAs.

The fact that such a non-partisan actor can have an effect on citizen turnout, political information and vote choices means that candidates and parties may have to adapt their strategies and positions. Political actors are losing control of their message (Garzia, De Angelis,
& Pianzola, 2014) with the increasingly relevance of VAAs in politics. Moreover, VAAs can be used and promoted as a tool to reinforce transparency and accountability during elections. They may also be considered a way to increase democratic representation (Kamoen, Holleman, Krouwel, Van de Pol, & De Vreese, 2015) if they are properly designed by helping citizens to vote for the party that best represents their opinions.

THE USE OF DATA PROVIDED BY VAAS PROCESS

In using VAAs, users answer political, demographic, and social questions. They can also express their agreement on political issues. VAAs collect of a large volume of data on a wide swath of the population. Often made available for the academic community, these ample datasets represent an interesting resource for scholars of mass public opinion, especially those studying electoral behavior. Although the literature on the design and effects of VAAs is widespread and has begun to develop some consistency, work on how these data ought to be used by researchers remains sparse. Only 27 sources included in the scoping review deal directly with the use of data gathered by VAAs or use VAA data to observe a phenomenon.

As scholars, it is necessary to try to validate data from VAAs and be aware of the potential biases such data may bear. As previously discussed, the design of VAAs directly impacts the validity of the voting results produced. Two other components can also affect the quality of VAA data. First, there may be coverage error due to the fact that a part of the population does not have Internet access, which can affect the representativeness of data and generate measurement error. The second is largely arising from the first issue mentioned. Comparing demographic characteristics, policy preferences and the vote intentions of VAA users with those of the population, (wall2009picking show that VAAs attracted users who are not representative of the wider population.

In order to improve the data collected by VAA process, some scholars are looking at ways to optimized VAAs design. To identify potential invalid, unconsidered, or imprecise answers to VAA questions when cleaning a VAA dataset, Andreadis (2012) demonstrate that recording the time users spend answering each question can be useful. This additional information allows scholars and VAA designers to identify questions with outlying response times, determine the expected response time for each question, and project when users will get tired. By recording response time, VAA researchers can eliminate invalid responses that correspond to about 5 percent of total answers (Andreadis, 2012, p.18). Still, important sources of potential bias in studies using VAA data are the fact that answers are self-reported and the sample is self-selected (Pianzola, 2014a). (Pianzola, 2014a) makes the point that VAA users both self-select into the sample and self-select into treatment.

CONCLUSION

Using a scoping review approach, we aimed to map and chart the literature on voting advice applications (VAAs). We show that the usage of VAAs is expanding globally and the that the literature, correspondingly, on the subject is expanding as well. Thus, with this methodology, we aimed to produce a rigorous, effective and transparent overview of the research field. This
The paper summarizes what we know to date, points out the literature’s gaps, and identifies divergences in research results.

The scoping review allows us to identify the persistent lack of information about VAAs design which affect users, and researchers. The degree of sophistication inherent in the design of VAAs is still greatly heterogeneous and no formal framework for aggregation algorithms has yet been agreed upon (van der Linden & Vowles, 2017). By producing detailed coding handbooks, VAAs could increase their transparency and allow scholars to develop applications that are more representative and generate more accurate voting recommendations. Ultimately, though, the field lacks a wide, systematic and rigorous meta-analysis that compares the pooled results of work on VAAs. In this scoping review, we noticed diverging results regarding the effects of VAAs on users, political actors, and, citizens voting behavior. Evaluating the global quality of proofs in research in the field may highlight specific findings and promote evidence-based acknowledgement. Furthermore, there are now VAAs in about 30 different countries. Even though research on these tools is developing outside of Europe and North America, there are still great lacunae in our knowledge about the nature and quality of VAAs in Latin America, in particular, as well as Asia. Our primary goal was to use a scoping approach to identify subfields in the literature. The scoping sources can be fit to three subfields. The first deals with VAA design. Researchers in the subfield focus on analyzing algorithms, statement selection, and the calibration of issues to political parties and users. Scholars in this subfield share the aim to generate a better understanding of VAA development in order to reduce bias in vote recommendations and party and user positionings. The major question for this subfield is who should be coding and positioning parties, voters and issues and choosing VAA questions? Though there are still disagreements with respect to the answer, scholars tend to agree that VAAs are more accurate in general when they rely on plural coding sources, such as scholars, experts and political party members.

The subfield containing the largest number of publications is that focused on evaluating the effects of VAAs. Scholars in this field try to observe the impact of these applications on voter turnout, the volatility of the vote, the nature of the vote itself, citizens political information, and political party behaviour. As mentioned above, there is less agreement among researchers in this subfield, particularly regarding the impact of these application on the vote itself. However, research tends to show that VAAs have a positive effect on users knowledge of social issues, political parties and the democratic process as a whole.

Finally, a third subfield has recently emerged to analyze how data emerging from VAAs can be leveraged for research. Because they include millions of datum, VAAs datasets represent ample resources to study not only electoral behavior, but also to political preferences more broadly as well as demographic and social trends in the population. With their large samples, VAA data allow researchers to observe micro-phenomena, such as the behaviour of subgroups of the population during election campaigns. That said, there is still work to be done to improve the representativeness of this data and reduce measurement error in its instruments. Given the unique opportunities these data represent for the assessment of political behaviour and the unique challenges they pose with respect to representativeness, we argue this third area should be a priority for future work in this emerging field.
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APPENDICES

A. EXAMPLES OF DATABASE REQUESTS

INTERNATIONAL BIBLIOGRAPHY OF THE SOCIAL SCIENCES

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Academic Search Premier

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"Voting advice" OR "voter advice" OR "voting engagement" OR "voting education" OR "voting aid*" OR "voting recommendation application*" OR "vote recommendation tool*" OR "vote matcher*" OR "matching voter*" OR "voting tool*" OR "vote advice*" OR "electoral compass*" OR "vote compass*" OR "election compass*" OR "electoral diorama*" OR "profiling voter*" OR "social vote*" OR "political matchmaker*" OR smartparticipation OR "Outil* de recommandation de vote" OR "application* de recommandation de vote" OR "application* dducation au vote" OR "aide au vote" OR "aide aux lecteurs" OR "boussole* lectorale*" OR "boussole* prsidentielle*" OR Stemwijzer OR "Wahl-O-Mat" OR VotingAid OR Smartvote OR ParVaPret OR Valkompas OR Kieskompas OR "Vote Match" OR Glasometar OR Wahlkabine OR "VoteVous" OR Vokskabin OR Voksmonitor OR "Kend din kandidat" OR "Who Shall I Vote For?" OR iSideWith OR "GPS Electoral" OR "El Teu Vot" OR "Itanes VoteMatch" OR "Questao Publica" OR "EU Profiler" OR "Votr" OR "Vote Compass" OR iVoter OR PositionDial OR YourCandidates OR Tickbox OR "Who gets my vote" OR Verto OR Awedience OR "Fantasy Frontbench"

Coordinated with OR

Search in: SU Subject Terms

("voting advice applications (application software)") OR ("voters – attitudes") AND ("technology")]
B. Research Results Obtained in Each Database Used

International Bibliography of the Social Sciences 618 results
Worldwide Political Science Abstracts 91 results
PAIS International 11 results
ABI/Inform collection 113 results
Academic Search Premier 149 results
Web of science 123 results
ProQuest Dissertations Theses Global 18 results
WorldCat 679 results
Google Scholar 1898 results

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3Results of requests made in May 2018
4Because of Google Scholar research specificities, eight requests have been formulated in this database. We observed a significant decline in sources relevance after the first 250 sources. Thus, we collected the first 300 sources for each request when possible.
C. Most Cited Scholars in the Literature on VAAs

Figure 7: Most Cited Scholars in the Literature on VAAs and their Country of Residence

The country identification with the publication relies on the location of the university of the researcher.
D. A Zoom on European Countries Publishing on VAAs

Figure 8: Where do Scholars Writing on VVAs Come From?

The scale represents the number of VAAs’ publications up to July 2018. The country where the university of the researcher or of the main researcher is based is used for publications’ identification to a country.

n=175.