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Exploring digital campaign competence: the role of knowledge in data-driven election campaigns

Sophie Minihold, Sophie Lecheler, Claes de Vreese, and Sanne Kruike-meier 

ABSTRACT

Data-driven political advertising (DDPA) is a manifestation of data-driven campaigning and is increasingly used by European political parties. Political actors can collect vast amounts of personal data to show voters targeted ads. Therefore, DDPA has received much attention from scholars. However, we lack insights into what voters know about DDPA, and how this knowledge affects (dis-)engagement with personalized ads. We approach this problem by examining (a) which voter characteristics enhance understanding of DDPA tactics and implications, and (b) to what extent DDPA knowledge plays a role for engaging with or avoiding of political ads. In a two-wave panel survey study ($N_{W1} = 1264$, $N_{W2} = 1011$), conducted during the 2021 Dutch General Elections, we show that (a) male, younger, higher educated and politically interested respondents were most knowledgeable. Yet, (b) the predictors vary when examining different types of DDPA knowledge, and (c) DDPA knowledge neither affects ad engagement nor ad avoidance, but we find that political interest and self-efficacy are crucial for ad engagement and ad avoidance, respectively. These findings discuss the relevance of DDPA knowledge in the context of data-driven campaigns, and add to the debate on how to best empower voters in a changed political advertising landscape.

KEYWORDS

Data-driven campaigns; knowledge; voters; ad avoidance; ad engagement

Voters often unknowingly serve as “data-laborers” (Helberger et al., 2020) by leaving behind digital traces. These digital bread crumbs, often in the form of personal data, have manifold implications for how election campaigns are designed, as political parties increasingly use this data to customize their political ad campaigns. Consequently, data has become the new currency for political parties. Especially during elections, having access to voter data – collected through data brokers and tech companies – is becoming increasingly important for designing targeted political ads (Votta et al., 2024). The realities of how political campaigns are conducted have changed in a digital society, requiring voters to develop competences to navigate this development.

This feeds into the more general observation that political campaigns are increasingly data-driven. This means that political campaigners leverage individual data points to inform, create, and evaluate their online campaigns with the objective of mobilizing voters (Gibson et al., 2014). By collecting voters’ online data, such as “likes,”

comments, or demographics from social media, they can create voter profiles or identify “look-alike audiences” (Kreiss, 2017). These digital traces enable the targeted delivery of political advertisements that align with voters’ interests (Bene & Kruschinski, 2021). While data-driven targeting occurs globally, the sophistication of these strategies largely depends on the campaigning resources available to political parties (Dommett et al., 2024), and is often not as microtargeted as commonly feared (Votta et al., 2024). Nevertheless, digital advertising practices can still have significant implications for citizens.

First, harnessing voter data to cater information to certain voters while excluding others leads to information asymmetry. In other words, voters receive different types of information based on targeted messages, creating publics that are one-sidedly or partially informed. This is problematic because voters have the right to be informed (Bayer, 2021) and have access to the “marketplace of ideas” to profit from the diversity of thoughts (Moorman et al., 2019). The information

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asymmetry might lead to a distorted perception of political reality between voters (Mazarr et al., 2019) and might create new divides (Park & Humphry, 2019).

Second, in line with the power asymmetry argument, political parties know more about voters, than vice versa. In other words, political parties hold power over citizens because they are increasingly able to use personal data from large intermediaries to cater political advertisements to voters with a goal in mind (Chester & Montgomery, 2017), while people overall have limited knowledge about data collection practices and its implication (Boerman et al., 2017; Tufekci, 2014). This raises ethical questions as it limits people's autonomy and benefits those in power (Herschel & Miori, 2017).

Current scholarly literature requires more insight into the extent to which voters understand the implications of this shift in the political landscape, as well as their assessment of their agency to influence the types of political online advertisements they encounter on websites and social media platforms. Hence, our aim is to explore the role of citizens by specifically focusing on one essential component of voters' digital campaign competence, namely understanding. Consequently, this study examines (a) which voter characteristics enhance understanding of data-driven political advertising and (b) how this understanding affects the engagement with or the avoidance of a data-driven election campaign.

Data-driven political advertising

Data-driven political advertising (hereafter DDPA), as a specific manifestation of data-driven campaigning, is gaining importance across the world. Data-driven campaigning on social media has a longer history in the US and Canada compared to European countries (Bennett, 2016), but especially parties in the UK were quick to adapt and increased their spending of data-driven advertising on Facebook to £3.2 million during the general election in 2017 (ICO, 2018). Meta's Facebook and Instagram are popular campaigning platforms as they enable advertisers to include or exclude ad audiences based on certain characteristics such as their demographics, location, interests, or behaviors

(Minihold & Votta, 2024; Votta et al., 2024). During the 2019 European Parliament elections, almost all parties used DDPA on Facebook, with German and UK parties spending millions of Euros, while other countries such as Austria or Denmark allocating several hundred thousand Euros (Bene & Kruschinski, 2021). After the EP 2019 elections, the use of DDPA on Facebook continued, with 16 out of 37 political parties airing political advertisements during the 2021 Dutch elections to sway votes (Beraldo et al., 2021).

In this study, we understand DDPA as a form of personalized advertising in which people's demographics, their behavior and interests are used to cater them supposedly relevant online ads by political actors. This conceptualization of DDPA is similar to previous research (e.g. Morimoto, 2021) but placed in a political context, rather than a commercial context. Not least, the importance of highlighting voters' DDPA understanding levels arises from a lack of regulatory frameworks as they are in place for commercial advertising. This means that voters lack the protection of certain profiling tactics which receivers of commercial advertising usually receive (Helberger et al., 2021). Recently, to support voters more, the EU's Digital Services Act (DSA) has mandated that very large online platforms create ad libraries. These libraries provide transparency, allowing citizens and researchers to access information about targeted political advertisements (van Drunen et al., 2022).

The role of voters' DDPA knowledge

Besides political knowledge, it is crucial for voters to understand how, in what ways and why political information finds them and tries to persuade them online in order to grasp political advertising tactics. With DDPA, political parties can fuel information asymmetries by sharing some advertisements with a certain group of people, while avoiding others (Bayer, 2021). Generally speaking, without full access to information, it is difficult to evaluate, judge, or compare the political discourse. More specifically, a fragmented information environment could lead to diverging political realities (Mazarr et al., 2019) in which voters would have

a hard time assessing political commitments. For example, if a political party continuously pushes one of their three main commitments (A) as a political ad on the Facebook feed, while showing Voter X the other two commitments (B and C) less frequently or not at all, Voter X would experience A as more important than B or C for the political party. If other people are targeted with ads featuring B or C, but not with ads including A, their perceived political reality is likely to differ from Voter X.

Furthermore, DDPA fosters power asymmetries between politicians and voters. Political parties exert power through the collection of voter data and using this information to deliver political messages to voters based on their demographics, interests, or behavior online (Burkell & Regan, 2019). Research has argued that imposing filters on the political information served to voters, for example on basis of voter data, without their knowledge, diminishes the voters' autonomy because they cannot choose content themselves as they are being categorized beforehand (Bozdog & van den Hoven, 2015). Interestingly, voters seem to be unaware of these asymmetries. Several studies have demonstrated that people's knowledge of online (behavioral) advertising (Boerman et al., 2017; Smit et al., 2014) is low. Furthermore, young Europeans lack knowledge and understanding of data collection practices by companies which likely affects their ability to evaluate the consequences (Gagrčin et al., 2021). This positions an individuals' knowledge as a central concept in order to be able to shape an informed opinion about the data-collection practice which enables data-driven advertising. This imbalance of information and power is unfair to voters because their agency to fulfil their informational and participatory democratic role is being limited.

In sum, gathering insights into voter knowledge about DDPA strategies is important for several reasons. First, knowledge is a consumer-controlled factor that influences the outcomes of personalized online advertising strategies (Boerman et al., 2017). Second, consumers should be educated with regard to the new means of advertising (Helberger et al., 2020) to minimize digital vulnerabilities which consumers of data-driven advertising experience (Bol et al., 2020).

Next to this, efforts to empower users online by giving them the option to opt-in via informed consent are based on the assumption that people are able to make informed decisions. The same applies to transparency efforts online to protect one's privacy. To make informed decisions about giving informed consent and to understand transparency, knowledge about DDPA is necessary (Helberger et al., 2020; Smit et al., 2014).

Thus, alongside other scholars, this paper argues that citizens need to understand the ways by which information is structured online (König & Wenzelburger, 2020) and how personal data can be used (Sander, 2020) to actively take part in a democracy.

Explaining DDPA knowledge

Knowledge about DDPA consists of various components. Based on previous research, we decided to specifically focus on components that are relevant in the context of DDPA. First, there is voters general personalized advertising knowledge, which refers to their understanding that advertisements can be targeted toward them personally. Second, we want to assess a more specific knowledge segment, namely online behavioral advertising. Here, we are interested to what extent voters are aware that their behavior is used to target them with advertisements (Boerman et al., 2017). Third, since data-driven election campaigns are taking place on social media platforms (Bene & Kruschinski, 2021), and ads are informed by the social network of users, we investigate voters' knowledge of personalized advertising in this context. Lastly, because private user data has to be collected in order to enable any form of personalized advertising (Morimoto, 2021), we investigate voters' understanding of privacy settings and data-collection methods. Together, through these four components of DDPA we hope to gain a more nuanced picture of what people know about political advertising tactics online.

Scholars previously voiced the importance to understand which factors might predict knowledge of ad personalization (e.g. Boerman et al., 2017; Segijn & van Ooijen, 2021), because it is vital for voter empowerment. This is also particularly true for DDPA knowledge, as it depends on political,

and technological dimensions. Based on literature investigating the driving factors behind political knowledge, and ad personalization knowledge, we investigate two types of predictors of DDPA: (a) privacy concerns as well as self-efficacy referring to the technological dimension, and (b) political interest referring to the political dimension.

First, scholars urge to investigate the relationship between privacy concerns and knowledge of advertising strategies (Segijn & Voorveld, 2021). When people are more concerned with their privacy, they are expected to be more knowledgeable about DDPA. Moreover, privacy concerns seem to play an important role in people's perception of data-driven advertising, as personalized advertising involves accessing someone's private information. Privacy concerns are defined by the extent that someone is worried that their privacy could be invaded (Baek & Morimoto, 2012). Previous work also found that people with high privacy concerns are more likely to develop negative attitudes toward data-driven advertisements (Kim & Huh, 2017). In interviews, Schaub et al. (2016) found that people's privacy concerns increased when they became more aware of tracking online. We therefore hypothesize that:

H1: People with more privacy concerns show more data-driven advertising knowledge compared to people with less privacy concerns.

Second, next to privacy concerns, also self-efficacy has been in the center of scholarly attention regarding data-driven advertising. Self-efficacy can be described as people's beliefs in their own accomplishment or performance in a given situation (Bandura, 1977). Research found that self-efficacy is associated with persuasion knowledge of online behavioral advertising (Ham, 2017). This could be interpreted in the following way: If someone knows about data-driven advertising techniques, one feels confident enough to counter these techniques and the more confident one feels in their own abilities, the more they know about the topic. Continuing along the same line of reasoning, higher levels of self-efficacy could potentially reduce individuals' susceptibility to data-driven advertising techniques, a concern frequently expressed (Bol et al., 2020).

Next to this, if we look at the political knowledge literature, we find similar support for the relation between knowledge and efficacy (see Bennett, 1997): People who believe they can make a difference in politics tend to be more informed, and vice versa. Given what we know so far, about self-efficacy and knowledge, we propose the following hypothesis:

H2: People with higher levels of self-efficacy have more data-driven advertising knowledge compared to people with lower levels of self-efficacy.

Third, Turow et al. (2012) demonstrated that most American voters are interested in understanding how DDPA works, driven by their political interest. Indeed, those who are politically interested seem to be generally more politically engaged citizens and at the same time more likely to see political advertisements online (Kreiss, 2012; Lecheler & de Vreese, 2017). Nelson et al. (2021) found that those with higher political interest perceive themselves to be more knowledgeable about political advertising, although this study relied on self-reported data rather than objective knowledge measures. Those with higher interest in politics might be more interested in campaign strategies, and more motivated to learn about political advertising. Aiming to fill the gap between political interest and factual knowledge about data-driven advertising, we put the following hypothesis forward:

H3: People with higher levels of political interest have more data-driven advertising knowledge compared to people with lower levels of political interest.

DDPA knowledge and Ad (dis-)engagement

As voters play an active part in campaigns, politicians and campaigners naturally want them to engage with their online ads. However, if people perceive that online behavioral advertising bears more risks than benefits, they are more likely to avoid it altogether (Ham, 2017). Scholars previously emphasized that the perception of (dis-)advantages of data-driven advertising might

depend on peoples' knowledge about data-driven advertising strategies (Boerman et al., 2017). This means that one's DDPA knowledge might influence the response toward the ad. This relationship may be furthermore influenced by the timing of the election cycle. As the election date approaches, political advertising expenditures tend to increase (Fowler et al., 2021), providing more opportunities for individuals to engage with campaign materials (Freedman et al., 2004).

A large body of literature has explored how people respond to online advertisements. Much of this literature distinguishes between avoidance of and engagement with an advertisement (see for example Tang et al., 2015). These observable behavioral responses are discussed in the Approach-Avoid Theory (Elliot, 2006), which postulates that people direct their behavior toward positive stimuli, but turn away from negative stimuli. In other words, people's reactions to an ad depend on how they perceive it. This perception depends on the personal involvement, ad relevance and ad skepticism (Maslowska et al., 2013). Clicking on an ad could be considered as engagement, while ignoring an ad could demonstrate avoidance (Tang et al., 2015). A further distinction of these behavioral responses can happen along the active-passive-continuum. Whether a behavior is regarded as active or passive depends on how much effort it costs the online user to engage with the ad (Tang et al., 2015). In this context, a high level of engagement refers to active behavior, while a low level of engagement would refer to passive behavior. Similarly, Kelly et al. (2020) differentiate between the direction of behaviors and their intensity. They confirmed previous findings that ad relevance, informational reward, and skepticism toward the ad message determine whether a Facebook ad is approached or avoided.

DDPA knowledge and ad engagement

DDPA aims to provide voters with relevant ads (Zuiderveen Borgesius et al., 2018) which are anticipated to be perceived positively, thereby increasing the likelihood of voter engagement (Elliot, 2006; Kelly et al., 2020). Commenting on, or clicking on, and sharing of ads could be

considered active engagement (Tang et al., 2015). Ham (2017) argues that effective coping with online behavioral advertisements – either engaging with or avoiding them – is only possible once people have some knowledge about how online tracking works. People tend to engage with ads if these ads have a perceived benefit (Kelly et al., 2020). To see the benefit of engaging with a political advertisement on social media – for example, more exposure to similarly relevant content – voters would require an understanding of the mechanisms behind data-driven advertising. We ask the following research question:

RQ1: To what extent do higher levels of DDPA knowledge lead to higher levels of engagement with political ads?

DDPA knowledge and ad avoidance

Engagement with ads is, for obvious reasons, most favorable for advertisers (Tang et al., 2015), but of course not the only possible behavioral response to DDPA. From a political perspective, understanding DDPA could empower individual voters because it gives them more agency to react to political ads, a vital aspect of participatory democracies. However, increased DDPA understanding might also pose a disadvantage to political parties, as voters may become unwilling to engage with their political ads if their understanding of DDPA leads them to view these ads as unacceptable. For example, if people understand that personal data is being used to cater them DDPA, they might perceive online ads as “creepy” as they represent a privacy infringement (Smit et al., 2014). Next to this, ad skepticism can increase advertising knowledge (Campbell & Kirmani, 2000). At the same time, those with more advertiser knowledge, seem to be more critical of advertisements (Rozendaal et al., 2013). If online users try to get rid of online ads, for example through blocking ads, we speak of active avoidance behaviors. This would indicate a high behavioral effort. Ignoring online ads could be categorized as passive avoidance behavior and

represent little behavioral effort (Tang et al., 2015). In line with this, we ask:

RQ2: To what extent do higher levels of DDPA knowledge lead to more avoidance of political ads?

Method

Sample

To test the research questions above, a two-wave panel survey was conducted during the 2021 Dutch General Elections in February and March. Panel surveys offer the possibility to analyze changes at the individual level. The panel surveys were conducted in the Netherlands by I&O Research using a representative quota-based sampling method and approved by the Ethics Review Board at FMG-UvA (filed as 2021-PCJ-13104). The quotas were based on age, gender, education levels (low, medium, high), and geographical location (North, East, South, and West). For the first wave, the data was collected preceding the election, between 23.02 and 08.03, and 1264 completed the survey. For the second wave, the data was collected on the days the election was held, 15.03–17.03, and 1011 respondents completed the survey. Participants, on average, participated 19 days ($SD = 2$) later in the second wave following the completion of the first wave. This represents a response rate of 80% and an attrition rate of 22.2%. The sample in Wave 1 consisted of 47.9% female respondents. On average, participants were 52 years old ($SD = 17.14$). Overall, 0.7% had lower levels of education (no education or primary education), 60.7% had medium levels of education, and 38.6% had higher levels of education (bachelor's, master's, or doctoral degree). For the analysis, we used a dummy variable, where 1 represents higher education levels and 0 low and medium education levels.

Measures

According to their primary role in the analysis, we report predictors as measured in Wave 1 and outcome variables are reported as measured in Wave 2.¹ We performed one integrated factor analysis for all scales (see [Appendix](#)).

Self-efficacy

To measure people's perceived abilities to protect themselves from online political data-collection, we asked respondents to indicate the extent to which they agreed (or not) with the following statements (1 = strongly disagree, 7 = strongly agree): "I am able to protect myself from online political ads that were based on my personal information;" "I am confident in myself that I can recognize online political ads that were based on my personal information;" and "I am confident that I can stop political parties from collecting my personal information and behavior on the Internet" (modeled based on Bandura, 2006). The mean score of the three items is used as a scale of self-efficacy (Eigenvalue = 1.39, explained variance = 25%); Cronbach's $\alpha = .74$, $M_{WI} = 4.23$, $SD_{WI} = 1.48$).

Privacy concerns

To measure people's privacy concerns, we slightly adapted the items by Dobber et al. (2019) and asked respondents to indicate the extent to which they agreed (or not) with the following statements (1 = strongly disagree, 7 = strongly agree):

"I am concerned that personal information (such as my online surfing and searching habits, name, and location) may be misused by others;" "When online, I feel that others are tracking what I click on and what websites I visit.;" "I am concerned that my personal information may be further disseminated to other companies on the Internet.;" "I am concerned that my personal data is being used to influence my voting behavior." The mean score of all items was used to measure privacy concerns (Eigenvalue = 2.19, explained variance = 28%); Cronbach's $\alpha = .83$, $M_{WI} = 4.23$, $SD_{WI} = 1.46$).

Political interest

The political interest of respondents was assessed through one question, "To what extent would you describe yourself as politically interested?" (1 = totally uninterested, 7 = very much interested; $M_{WI} = 5.03$, $SD_{WI} = 1.34$).

Dependent variables

Knowledge of data-driven political advertising

To assess people's understanding of personalized political online advertisements, we asked whether

they thought six statements (inspired by Smit et al., 2014) were true (1 = incorrect 2 = correct, 3 = don't know). For example, "When I visit a website, I always see the same political ads and messages as someone else visiting the same website." This statement would have been marked as incorrect. The remaining five statements can be found in the appendix. Correct answers were recoded 1, incorrect answers were recoded 0. Following previous research, don't know answers were treated as incorrect answers. The sum score ranged between 0 (none correct) and 6 (all correct) and served as the value for the DDPA scale (Eigenvalue = 1.00, explained variance = 12%, $M_{W2} = 1.84$, $SD_{W2} = 1.40$, see Table A2 in the appendix). The Mokken scale reliability coefficient indicates moderate internal consistency ($\alpha = 0.51$). Confirmatory Factor Analysis indicated moderate model fit $\chi^2(9) = 93.612$, $p < .001$, $TLI = 0.74$, $CFI = 0.84$, $RMSEA = .08$, $SRMR = .05$ (Hu & Bentler, 1999; see Table A3 in the appendix).

Engagement with political advertisements

To measure people's engagement with political ads on social media, we asked how often they engaged with an ad by sharing, liking, or clicking on it. The variable was reverse coded for a more intuitive interpretation and ranged from 1 (never) to 5 (daily). The mean score of all items was used to measure the engagement with political ads (Eigenvalue = 1.83, explained variance = 19%; Cronbach's $\alpha = .76$, $M_{W2} = 1.18$, $SD_{W2} = 0.50$).

Avoidance of political advertisements

To measure people's tendency to avoid political online advertisements that are based on personal

data (Dodoo & Wen, 2019), we presented participants with three statements and asked them to indicate how often they would take action to avoid ads (e.g. block ads), (1 = never; 7 = very often; Eigenvalue = 3.00, explained variance = 16%; Cronbach's $\alpha = .94$, $M_{W2} = 2.36$, $SD_{W2} = 1.99$).

Analysis strategy

The analysis consists of two main parts. In the first part, our goal is to determine the individual characteristics that predict knowledge about DDPA through lagged dependent variable linear regression analyses. In the second part, we shift our focus to predicting individuals' engagement with political ads or their tendency to avoid them through lagged dependent variable regression models. Lagged dependent variable models are common in panel studies because they provide the advantage of controlling for previous dependent variable values. When predicting values in Wave 2, we thus use DDPA knowledge, ad engagement, or ad avoidance from Wave 1 to take advantage of this feature. This offers a robust estimation method because it eliminates residual autocorrelation (Wilkins, 2018). Assumptions (linearity, no multicollinearity, and independence) were met.² To counter heteroscedasticity and address skewed dependent variables, we report bootstrapped results.

Results

To answer *which* voter's characteristics enhance understanding of data-driven political advertising, we first conducted a multiple-regression analysis

Table 1. Bootstrapped multiple regression for DDPA knowledge Wave 2.

DDPA Knowledge W2			
	B(SE)	CI	β
Intercept	1.94, (0.28)***	[1.40, 2.50]	
Education	0.18, (0.08)*	[0.03, 0.33]	.06
Women	-0.28, (0.07)***	[-0.42, -0.13]	-.10
Age	-0.02, (0.00)***	[-0.02, -0.01]	-.19
Privacy concern	-0.01, (0.02)	[-0.05, 0.04]	-.01
Self-efficacy	-0.02, (0.02)	[-0.06, 0.03]	-.02
Political interest	0.06, (0.03)*	[0.01, 0.12]	.06
DDPA knowledge	0.46, (0.03)***	[0.40, 0.51]	.46
$F(7,1001) = 76.50$, $p < .001$, Adjusted $R^2 = .34$			

Unstandardized coefficients (standard errors), [CI lower, upper]. Predictors are from Wave 1. ($N = 1009$). + $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

predicting the overall data-driven political advertising knowledge scores. Subsequently, we examined each of the four components of DDPA knowledge independently with logistic regressions. Including the lagged values of each knowledge dimension as predictors in these models, enables us to assess changes over time.

Table 1 shows that younger respondents seem to have more DDPA knowledge than older respondents ($\beta = -.19, p < .001$), as do males ($\beta = -.10, p < .001$), and those with higher educational levels ($\beta = .06, p < .05$). We do not find support for H1 that people with more privacy concerns have more data-driven political advertising knowledge (see Table 1). In other words, we did not find evidence that respondents who worry about their privacy online have a better understanding of DDPA.

In H2, we expected that people who report more self-efficacy will have more DDPA knowledge. We did not find support for this hypothesis. Table A1 (in the Appendix) shows no correlation between DDPA knowledge scores and self-efficacy. This means that we do not find support for the assumption that people's perceived abilities to protect themselves from online political data-collection would affect their knowledge of personalized advertising strategies.

Lastly, in H3, we expected that politically interested respondents would be more knowledgeable about DDPA. We found support for this hypothesis ($\beta = .06, p < .001$). This means that people who demonstrate a stronger interest in politics are more aware of how their data contributes to data-driven campaigning.

Taken together, the results suggest that socio-demographics and political interest are important for voters' overall understanding of DDPA, whereas privacy concerns, and self-efficacy are not. To get more nuanced insights, we turn our attention to the sub-dimensions of DDPA next.

To explore DDPA knowledge in more depth, we ran four lagged dependent variable logistic regression models (see Table 2) to determine how voter characteristics predict the four sub-dimensions: (a) general personalized advertising knowledge, (b) online behavioral advertising, (c) personalized advertising on social media, and (d) understanding of privacy settings and data-collection methods. This approach is useful to identify differences and similarities between the DDPA knowledge dimensions, and thus informs us about where voters need support.

Echoing the previous results, higher levels of education are significant predictors of knowledge about general personalized advertising ($\beta = .41, OR = 1.51, p < .01$), online behavioral advertising ($\beta = .50, OR = 1.68, p < .01$), and personalized advertisements on social media ($\beta = .38, OR = 1.45, p < .05$). However, education does not appear to be a significant predictor for understanding privacy settings or data-collection methods.

Another common denominator that influences knowledge levels is age. Older individuals consistently show less knowledge about general personalized advertising ($\beta = -.069, OR = 0.98, p < .001$), online behavioral advertising ($\beta = -.070, OR = 0.98, p < .001$), and personalized advertisements on

Table 2. Lagged dependent variable binary logistic regression predicting DDPA knowledge components in Wave 2.

	General personalization knowledge		Behavioral personalization knowledge		Social Media personalization knowledge		Privacy and data collection knowledge	
	B (SE)	OR	B (SE)	OR	B (SE)	OR	B (SE)	OR
Constant	0.18 (0.54)	1.21	-0.44 (0.58)	0.65	-0.58 (0.61)	0.56	0.79 (0.53)	2.18
Education	0.41 (0.15)**	1.51	0.53 (0.16)**	1.68	0.37 (0.17)*	1.45	-0.12 (0.15)	0.89
Gender(female)	-0.11 (0.15)	0.89	-0.17 (0.16)	0.85	-0.19 (0.17)	0.83	-0.80 (0.15)***	0.45
Age	-0.02 (0.00)***	0.98	-0.02 (0.00)***	0.98	-0.03 (0.01)***	0.97	-0.01 (0.00)+	0.99
Privacy concerns	-0.13 (0.05)**	0.88	0.07 (0.05)	1.07	0.11 (0.06)+	1.11	0.02 (0.05)	1.02
Self-efficacy	-0.02 (0.05)	0.98	-0.08 (0.05)	0.92	-0.01 (0.06)	0.99	0.10 (0.05)*	1.10
Political interest	0.10 (0.06)	1.10	0.16 (0.06)*	1.17	0.08 (0.07)	1.08	-0.05 (0.06)	0.95
General personalization know.	1.44 (0.15)***	4.17						
Behavioral personalization know.			1.99 (0.15)***	7.19				
Social Media personalization know.					1.83 (0.17)***	6.12		
Privacy and data collection knowledge							1.33 (0.14)***	3.75
N	1009		1009		1009		1008	
McFadden's pseudo R ²	0.14		0.22		0.21		0.11	

Predictors are from Wave 1. B = Unstandardized coefficients, SE = standard error. OR = Odds Ratio. 5000 bootstrapped resamples.
+ $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

social media ($\beta = -1.08$, $OR = 0.97$, $p < .001$). Age is, however, not a predictor for knowledge about privacy and data-collection methods.

While privacy concerns, and self-efficacy did not emerge as significant predictors for the composite measure of DDPA knowledge, they do play a role when we highlight the individual sub-dimensions. Privacy concerns seem to be a significant predictor only for general personalization knowledge ($\beta = -.38$, $OR = 0.88$, $p < .01$), but not for the other sub-dimensions of DDPA knowledge. Specifically, this result indicates that individuals who are more concerned about their privacy are less likely to understand how political ads and messages can be targeted toward them personally.

Self-efficacy seems to be a significant predictor of knowledge about privacy settings and data-collection methods ($\beta = .29$, $OR = 1.10$, $p < .05$). This finding indicates that people with more self-efficacy tend to know more about how to protect their privacy online. Specifically, this knowledge encompasses understanding the implications of deleting third-party cookies, knowing how deleting cookies could impact the types of political ads one receives, and being aware of the implications of using anti-tracking software.

Lastly, political interest levels are significantly associated with knowledge about online behavioral advertising knowledge ($\beta = .42$, $OR = 1.17$, $p < .01$). This result indicates that politically interested people were more likely to understand that the behavior of online users can be used to target them with political advertisements.

In the second part of the analysis, we examine how DDPA knowledge affects the engagement with or the avoidance of political advertisements using

two lagged dependent variable regression analyses. Due to the non-normal distribution of ad engagement and ad avoidance we report bootstrapped results including robust confidence intervals to confirm our findings (Hayes, 2009). Table 3 shows that DDPA knowledge neither predicts ad engagement nor ad avoidance. However, those who are interested in politics ($\beta = .08$), and younger ($\beta = -.05$), engage more with political ads, whereas individuals with higher levels of self-efficacy tend to avoid political ads more ($\beta = .12$), as do those with lower education ($\beta = -.35$).

Discussion

This study has aimed at contributing to the literature by exploring voters' DDPA understanding in data-driven election campaigns. In particular, we emphasize how crucial further research on DDPA knowledge among voters is. In line with previous research (Boerman et al., 2017; Smit et al., 2014; Tufekci, 2014), we see that DDPA knowledge among voters is low and we find this across all four DDPA knowledge sub-dimensions: general personalized advertising, online behavioral advertising, personalized social media advertising, privacy, and data collection. Low knowledge levels are especially prominent when it comes to ascertaining the validity of privacy statements and data-collection implications. On average, only one-fifth of the respondents were able to correctly discern right from wrong DDPA statements in both waves. This showcases how little voters are aware of the possibilities and restraints of political advertisers. Our findings show that the highest knowledge levels can be seen for online behavioral advertising

Table 3. Predicting ad engagement and ad avoidance in wave 2 – bootstrapped.

	Ad Engagement			β	Ad Avoidance		
	B (SE)	[95% C.I.]			B (SE)	[95% C.I.]	β
(Intercept)	0.28, (0.12)**	[0.09, 0.46]		1.25, (0.42)**	[0.39, 2.11]		
Education	-0.04, (0.02)	[-0.08, 0.01]	-.03	-0.35, (0.12)**	[-0.59, -0.12]	-.35	
Gender(female)	0.01, (0.02)	[-0.04, 0.05]	.01	-0.21, (0.12)+	[-0.44, 0.02]	-.21	
Age	0.00, (0.00)*	[0.00, 0.00]	-.06	0.00, (0.00)	[-0.01, 0.01]	.00	
Privacy concerns	0.00, (0.01)	[-0.01, 0.02]	.01	0.06, (0.04)	[-0.02, 0.13]	.06	
Self-efficacy	-0.01, (0.01)	[-0.02, 0.01]	-.02	0.12, (0.04)**	[0.05, 0.20]	0.12	
Political interest	0.03, (0.01)***	[0.01, 0.05]	.08	-0.06, (0.05)	[-0.16, 0.03]	-.06	
DDPA knowledge	0.00, (0.01)	[-0.02, 0.02]	.00	0.00, (0.04)	[-0.09, 0.08]	-.01	
Ad Engagement	0.73, (0.06)***	[0.68, 0.78]	.67				
Ad Avoidance				0.41, (0.03)***	[0.36, 0.47]	.41	
	F(8,1000) = 121.1, $p < .001$, $R^2 = .49$			F(8,992) = 38.36, $p < .001$, $R^2 = .23$			

Predictors are from Wave 1. Unstandardized coefficients, standard errors in brackets. CI low, high. β = standardized coefficient. Bootstrapped with 5000 resamples. $N_{(Engagement)} = 1008$, $N_{(Avoidance)} = 1000$. + $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

(OBA). However, on average, less than half of the respondents could correctly judge the implications of OBA in both waves. These findings lend support to the worry that voter manipulation or undermining of voters' autonomy can go unnoticed in DDPA (Helberger et al., 2021). To be more concrete, the existence of a possible political information asymmetry, fueled by DDPA, is not grasped by voters. In line with this, it seems to be a logical conclusion that voters lack awareness of an unequal distribution of informational power which restricts their autonomy (Herschel & Miori, 2017). Less autonomy of voters means fewer possibilities for them to act on and even recognize illegitimate forms of political persuasion. As outlined in previous research, awareness of information and power asymmetries are crucial for assessing informed consent and transparency efforts, and are, arguably, also in the public interest.

Next to this overall DDPA knowledge assessment, our study offers three main insights. First, we examined which voter characteristics predict the understanding of DDPA. Looking at the composite measure of DDPA knowledge, we find that male, younger, and higher educated respondents were most knowledgeable about data-driven political advertising which is in line with previous research on knowledge of ad personalization strategies (Park, 2013; Segijn & van Ooijen, 2021; Smit et al., 2014). The finding that females are among the least knowledgeable is contrary to earlier findings by Segijn and van Ooijen (2021). In line with our expectations, political interest is a significant predictor of DDPA knowledge.

Second, by splitting DDPA knowledge by category, we get more nuanced insights into which voter characteristics increase the likelihood of being knowledgeable. In exploring DDPA sub-dimensions, we discovered an unexpected result: privacy concerns are linked to lower general ad personalization knowledge. This contradicted our expectation based on prior research (Schaub et al., 2016), which indicated that increased awareness would correlate with better comprehension of online tracking and, consequently, heightened concerns about online privacy. Another important finding was that politically interested people seem to be more knowledgeable about online behavioral advertising. The often confirmed finding (Deth,

1990) that those who are interested in politics are more informed of political campaigns in general, might extend to data-driven campaigning tactics too.

Third, we looked at how DDPA knowledge affects both the engagement with and the avoidance of political advertisements in data-driven election campaigns. DDPA knowledge does neither explain why people engage with political ads nor why they would avoid them altogether. It is noteworthy that self-efficacy is vital for ad avoidance, while higher levels of political interest lead to more engagement with political ads.

These findings have several theoretical implications. First, our study demonstrates the importance of regarding data-driven political advertising knowledge as a multifaceted construct. This proves to be valuable in order to distill which voters understand what part of DDPA, and where they struggle. Distinguishing between diverging informational needs opens up ways of creating educational interventions geared toward specific voter groups. Research on civic educational programs (Geers et al., 2020) demonstrates that they can enhance people's confidence in their political competence.

Second, our study finds that voters' DDPA knowledge is not the main driver when deciding if they want to engage with a data-driven political campaign ad or not. In response to the plea to investigate the political implications of data-driven advertising (Kruikemeier et al., 2016), our study shows that future research should explore the role of political interest and self-efficacy. Political interest plays a central role in both overall DDPA knowledge and ad engagement, while self-efficacy seems to matter specifically for knowing about privacy and data-collection methods. Feeling confident enough to counter DDPA techniques seems to affect behavioral responses toward political ads. An implication of this is the possibility that knowing about the "marketplace of ideas" (Moorman et al., 2019) is not sufficient, as one needs the means to shop at the marketplace. This currency, which voters need to actively participate in the marketplace, could be self-efficacy and interest in politics.

Third, we suggest expanding research about DDPA toward conceptual understanding and

evaluative perceptions of DDPA to account for its multidimensional conception, as done in the persuasion knowledge literature (Rozendaal et al., 2016). For example, assessing voters' comprehension of the economic model behind DDPA or their acceptance of DDPA might advance our understanding of what drives the engagement with or avoidance of data-driven campaigns. Indeed, previous research has shown that, even though knowledge is crucial, attitudes toward ads guide behavioral outcomes (i.e. ad avoidance; Ham, 2017). Future studies should assess skepticism toward DDPA, as done in ad evaluation research (Boerman et al., 2018), to develop a complete picture of digital campaign competence.

Despite these ample areas for future research, our current findings add insights to the recent debate of how voters could be supported to feel empowered to participate in data-driven politics (Sander, 2020; Segijn & van Ooijen, 2021), and minimize their digital (Bol et al., 2020), and informational vulnerabilities (Smit et al., 2014).

One important limitation of our study is the fact that we measured DDPA knowledge with six questions referring to four knowledge categories. This means that three knowledge categories were assessed by one statement each, while the data collection and privacy categories were assessed by three statements. This might imply that we have more nuanced insights into the knowledge surrounding data-collection and privacy, but lack this for the other three categories. Considering response bias in one-item knowledge categories is crucial, as using multiple-item scales can enhance measurement validity. Therefore, future research should employ a more balanced set of statements to assess DDPA knowledge. Due to the limited survey space, our study used a condensed set of questions based on existing literature to gauge respondents' DDPA knowledge.

Notwithstanding the limitations, this study fulfilled a strong need for more thorough insights into voters' DDPA understanding. It can bring interesting findings for political campaigners, or digital literacy initiatives aiming to empower voters in an online environment, alike.

Notes

1. See Table A4 in the appendix for variable descriptives from Wave 1 and Wave 2.
2. Find data and code on OSF: <https://osf.io/s3r6t/>

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Appendix

Appendix A. Data-driven political advertising measures

Statements used to assess DDPA knowledge. The correct answers are shown in brackets:

- (1) When I visit a website, I always see the same political ads and messages as someone else visiting the same website. (incorrect)
- (2) The websites I have visited in the past determine which online political advertisements and messages I see. (correct)
- (3) Political ads and posts I see on social media are based on people in my online network. (correct)
- (4) Deleting cookies on my laptop will directly affect the type of political ads and messages I see. (incorrect)
- (5) Disabling third-party cookies is better for protecting my online privacy than regularly deleting cookies from my laptop. (correct)
- (6) If I use ‘anti-tracking’ software such as ‘privacy badger,’ my personal preferences cannot be identified by online advertising services. (incorrect)

Appendix B. Additional tables

Table A1. Correlation coefficients.

Variable	1	2	3	4	5	6	7	8	9	10	11
1 DDPA knowledge											
2 DDPA knowledge W2	.55**										
3 Engagement	.14**	.15**									
4 Engagement W2	.12**	.14**	.70**								
5 Avoidance	.03	.03	.07*	.04							
6 Avoidance W2	-.00	.01	.04	.02	.46**						
7 Privacy Concerns	.07*	.03	.02	.04	.17**	.10**					
8 Self-Efficacy	.03	.00	.01	-.01	.06*	.12**	-.13**				
9 Political Interest	.15**	.13**	.09**	.13**	-.09**	-.07*	.03	.09**			
10 Age	-.28**	-.32**	-.25**	-.21**	-.01	.03	-.03	.07*	.16**		
11 Gender	-.16**	-.19**	-.05*	-.05	-.01	-.05	.02	-.13**	-.29**	-.02	
12 Education	.20**	.22**	-.01	-.01	-.06*	-.12**	-.01	-.04	.15**	-.26**	-.07*

Gender (1 = female), Education (1 = higher). *** $p < .001$, ** $p < .01$, * $p < .05$.

Table A2. Factor analysis for all scales.

Kaiser-Meyer-Olkin measure of sampling adequacy						.74
Bartlett's Test of Sphericity	Approx. chi-square					19033
	df					18
	Sig.					<.001
	Privacy concerns	Self-efficacy	Ad engage-ment	Ad avoidance	DDPA know-ledge	
Rotated component matrix						
Concerned about personal information misuse	0.84					
Feel tracked online	0.68					
Concerned about data dissemination	0.86					
Worried about data influencing voting	0.59					
Protect from targeted ads		0.72				
Recognize personalized ads		0.81				
Stop political data collection		0.57				
Share political ads			0.80			
Like political ads			0.79			
Click on political ads			0.70			
Block ads				0.90		
Hide ads				0.95		
Hide ads from a specific advertiser				0.94		
See same political ads as others (incorrect)					.45	
Past visits influence ads (correct)					.70	
Social network shapes ads (correct)					.53	
Deleting cookies affect ads directly (incorrect)						
Disable third-party cookies for privacy (correct)					.25	
Anti-tracking hides personal preferences (incorrect)					.24	
Eigenvalue	2.19	1.39	1.83	3.00	1.00	
Variance explained (%)	.28	.25	.19	.16	.12	
Average communality	.58	.52	.59	.87	.20	

Principal component analysis. Oblimin rotation. Loadings > 0.16 only (Stevens, 2002). The item “deleting cookies affect ads directly” had a factor loading of .07 on the DDPA knowledge factor. All items are from Wave 1. Items were recoded if necessary and all items were rephrased (original in methods section).

Table A3. Confirmatory factor analysis (CFA) for DDPA knowledge items.

	Measurement model	Cutoff criteria (Hu & Bentler, 1999)
Value (chi-squared)	93.612	/
Df	9	/
p-value	<.001	/
Chi-squared/df	10.4	<3.0
CFI	0.84	≥0.90
TLI	0.74	≥0.90
RMSEA	0.08	<.06 (good), <.08 (acceptable)
SRMR	0.05	<.08

Table A4. Descriptive statistics from both waves.

	M	SD	Skew	Kurtosis
DDPA Knowledge W1	1.77	1.39	0.40	2.44
DDPA Knowledge W2	1.84	1.40	0.38	2.35
Ad Engagement W1	1.17	0.46	3.72	19.36
Ad Engagement W2	1.18	0.50	4.06	22.48
Ad Avoidance W1	2.53	2.12	1.10	2.72
Ad Avoidance W2	2.36	1.99	1.28	3.26
Privacy Concern W1	4.22	1.46	-0.15	2.49
Privacy Concern W2	4.21	1.48	-0.15	2.42
Self-efficacy W1	4.17	1.48	-0.18	2.61
Self-efficacy W2	4.18	1.42	-0.20	2.86
Political Interest W1	5.03	1.31	-0.68	3.27
Political Interest W2	5.12	1.28	-0.71	3.53

W1 = Wave 1, W2 = Wave 2; N = 1011.