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Using Social Media Data to Analyse Issue Engagement During the 2017 German Federal Election

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A fundamental tenet of democracy is that political parties present policy alternatives, such that the public can participate in the decision making process. Parties, however, strategically control public discussion by emphasising topics that they believe will highlight their strengths in voters' minds. Political strategy has been studied for decades, mostly by manually annotating and analysing party statements, press coverage, or TV ads. Here we build on recent work in the areas of computational social science and eDemocracy, which studied these concepts computationally with social media. We operationalize *issue engagement* and related political science theories to measure and quantify politicians' communication behavior using more than 366k Tweets posted by over 1000 prominent German politicians in the 2017 election year. To this end, we first identify issues in posted Tweets by utilising a hashtag-based approach well known in the literature. This method allows several prominent issues featuring in the political debate on Twitter that year to be identified. We show that different political parties engage to a larger or lesser extent with these issues. The findings reveal differing social media strategies by parties located at different sides of the political left-right scale, in terms of which issues they engage with, how confrontational they are and how their strategies evolve in the lead up to the election. Whereas previous work has analysed the general public's use of Twitter or politicians' communication in terms of cross-party polarisation, this is the first study of political science theories, relating to issue engagement, using politicians' social media data.

Additional Key Words and Phrases: Computational Social Science, eDemocracy, Issue Engagement, Twitter, Political Communication

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1 INTRODUCTION

Recent years have seen ever-growing importance of social media (SM) in electoral campaigns and political communication [51] with political candidates and parties having come to embrace interactive digital media as an integral part of their election campaigns [20, 61]. Analysing political strategy and how political parties compete for votes during election campaigns are well-established research foci in the political sciences [54, 57, 62]. However, understanding how politicians exploit SM applications to set agendas and discuss political issues, especially during election periods, are

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new areas of research. Political strategy can be manifested in the debate whereby politicians share ideas and dialogue with each other and with the public [18].

Ideally, all candidates would concentrate on the same issues allowing citizens to make an informed vote for the party whose program is closest to their ideals [45]. Unlike in a court of law, however, where a judge compels disputants to address the same issues, in politics, "each disputant decides what is relevant, what ought to be responded to, and what themes to emphasize" [52]. Politicians control the debate in various ways to maximise their chance of being elected: They are often said to be "skilled at appearing to say much while actually saying little" [47] and success can be achieved by stifling rather than encouraging debate [47]. A common tactic is to attack the position of an opponent rather than outlining one's own [53]. Another is to broaden the appeal by moving one's position closer to the average voter, for example, by echoing the statements of others [57]. Such behaviours have been formalised in political science with models that try to understand and explain how parties' communication during electoral campaigns affects the electoral outcome. Those models are concepts such as *issue engagement*, whereby politicians reveal their position on a given topic [18] or *issue avoidance* where a decision is made *not* to engage on a topic [62]. Setting the party agenda, i.e., deciding what the most salient issues for voters might be is known as *issue competition* [26] and *issue ownership* relates to a topic being commonly associated with a party in voters' minds.

Despite these concepts having been studied for decades [54], recent analyses have emphasised their increasing importance, particularly for Western European politics, and stressed the need to understand political parties' evolving strategies better [26, 27]. Party competition has been studied with manually annotated press material, acceptance speeches, and TV-commercials [49]. Recently, computational approaches have been applied to large datasets of party manifestos and press releases [36, 45]. Even more recently, the ever-growing importance of SM for election campaigns has led researchers in the computational social science community to use large-scale SM content as the basis to study politician communication [6, 37, 60]. These papers, however, sometimes lack clear contextualisation and framing in terms of political science theory. For one, they neglect to explain how concepts like those mentioned above can be applied to analyse parties' communication during electoral campaigns within the context of SM applications. Second, they do not link their research to theory in political science, which sees technologies and development of society as mutually dependent and explore how politicians' use of SM influences democratic ideals [50, 56]. In our study, we try to overcome these deficits by operationalising such theoretical concepts with computational approaches and framing our analyses within the context of such theories. The dataset and code to produce the findings presented here are published alongside this article and can be found in a Github repository.¹

Approach and Contributions. Inspired by recent work using computational methods to study sociological and political theories explaining politicians' practices [6, 22, 37, 60], we set out to address the points highlighted above by applying a similar computational approach. We extract topical, as well as social information from Tweets posted by prominent politicians in an election year, and relate our analyses to political science theory.

The contributions of our work can be summarised as follows:

- In section 3 we survey and summarise political theory relating to issue engagement, issue avoidance, saliency theory and issue competition in election campaign strategy.
- In section 4 we operationalise these theoretical concepts with computational approaches.
- We examine the feasibility of learning about politicians' behaviour by analysing 366,067 Tweets sent by more than 1000 politicians over a period of nine months. Section 5 describes the characteristics of the data-set in detail.

¹https://github.com/meierflo/issue_engagement_2017

- Section 6 presents the results of our study. Here we introduce the outcome of the issue identification approach, which reveals 26 issues dominating the discussion on Twitter during the election campaign period. We find evidence for high issue engagement for some topics (*Chancellor Debate*, *Foreign Policy*, *Right-Left-Conflict*) but low engagement for others (*Economic Policy*, *Education Policy*). We identify topics where issue ownership (e.g., *Environmental Policy* for the Greens) and issue competition (e.g., *Social Justice*) explain why issues are engaged with and are made salient by some parties. At the level of party behaviour, we identify that the AfD is not only topically focused and manages to stay *on-message*, but the party also exhibits a strong party-wide coherence. Regarding parties and their interaction, saliency theory hypothesises that parties seldom talk about and with their opponents. However, we identified a high degree of cross-party mentions several weeks before the election (see section 6.4.1. @-mentions are then used as an instrument of controlled interactivity to emphasise the position of the own party. Theories of issue competition suggest politicians force competitors, particularly ideologically proximate ones, to address issues they would rather not discuss. We investigate whether topical similarity in Tweets leads to increased interaction among candidates and indeed we find that users who mention each other directly tend to have similar content (see section 6.4.2).
- In our discussion (section 7) we relate our findings to both the theoretical constructs introduced in section 3 and previous empirical research presented in section 2. Before concluding the article in section 9 we address limitations and future work in section 8.

As a basis for these contributions, we first summarise important related work relating SM and politics with a special focus on Twitter.

2 SOCIAL MEDIA AND POLITICS WITH A FOCUS ON TWITTER

SM has become increasingly associated with politics, with most users having posted their thoughts about civic and political issues, reacted to others' posts, and even pressed friends to act on issues and vote [51]. SM has also provided a basis from which protest movements have emerged [21], and recent work analysing data from the Barcelona City Council election in 2015 shows that such movements can even grow into election-winning political parties [6].

Realising the power of such platforms, parties are making SM increasingly integral to campaign strategy [61]. Jungherr systematically reviewed 127 articles on Twitter's role in election campaigns, grouped by actor: (1) *the elite voice*, i.e. political parties and candidates, (2) *the public voice*, i.e. citizens using Twitter to engage in politics, (3) *the media*, i.e. Twitter use during media events [34]. For the elite voice, a dominant research focus has been on how politicians make use of Twitter features e.g., hashtags, @-mentions, RTs, and links. Furthermore, researchers studied how behaviour varies with factors such as election type (regional vs federal), candidate (e.g., gender, age), and party characteristics (e.g., size of the party, financial background, governing vs opposition) [34]. We review three further areas most related to our work: Studies of the content politicians produce, studies on how policy issues can be identified in SM messages, and how politicians publicly interact on SM.

2.1 Politicians' Tweeting Behavior

Studies of politicians' posted Tweets during elections find they mainly tweet about campaign activities and post links to their websites [19]. Some work finds limited discussion of policy [24] with much content relating to politicians' personal lives [19]. Other research emphasises political content. Hashtags referring to heavily debated issues have been found to be equally used by candidates by opposing parties [41], and controversial hashtags can be particularly

persistent as repeated exposure is necessary before contentious ideas are adopted [55]. Hadgu et al. show hashtags to be key enablers of virtual debate and help frame issues in a political context [28]. They investigate the phenomenon of *hashjacking*, where politicians adopt hashtags associated with adversaries when competing on issues [9, 28]. Recently, using Facebook data, Stier et al. analysed whether established parties in Germany engage in populist topics emphasised by right-wing newcomers [60]. In a follow-up study, Stier and colleagues showed that politicians and their audiences discuss different topics on SM than those salient among the general public [59]. Moreover, their analyses revealed campaign strategies and political communication to be influenced by sociotechnical affordances of the platforms, as politicians use Facebook and Twitter differently. While the former is used for mobilizing the public to attend campaign events, the latter is used for commentary of policies [59].

2.2 Issue Identification in Social Media Posts

Identifying policy issues in legislative debates, political speeches or media content has a long research tradition in the political sciences and is typically achieved by performing content analysis using human coders [2, 63]. In the context of SM like Twitter, this is often performed by classifying messages based on the present hashtags and the idea that hashtags function as topic proxies [4]. The sheer quantity of content produced on SM platforms, however, makes it impossible for human coders to do this exhaustively. Thus researchers have turned to semi- or fully automated approaches. Among the fully automated approaches supervised and unsupervised machine learning approaches, such as Language Modeling or Latent Dirichlet Allocation, are used for issue-coding [24, 41]. Stier et al. [60], for example, applied topic modelling methods to identify issues in Facebook posts by German parties to analyse whether established political parties engage with or avoid issues emphasised by populist movements [60]. Recently, semi-automated lexicon-based approaches have been applied regularly by researchers. However, the topicality and coverage of such lexicons and thus the accuracy of this approach can vary greatly [20, 29, 30, 33]. To overcome this problem, researchers have devised strategies to improve the approach. One example being Freelon, who augments the standard LPA (Lexicoder Policy Agendas) lexicon by adding terms extracted from manually coded Facebook messages [20].

In the past, LDA-based approaches for topic detection showed reasonable success via Tweet aggregation [32]. However, our initial experiments did not yield meaningful results, possibly due to the shortness of Tweets and lack of textual data available to us. Thus, in our work, we follow the idea that hashtags function as topic proxies [4] and extract issues from Tweets by applying an approach developed by Weng and Menczer which is based on the assumption of topic locality, i.e., that semantically related hashtags are more likely to co-occur in the same Tweet [64]. The process is described in detail in section 4.1.

2.3 Politicians' Interaction Behaviour

Studies of political candidates' Twitter interaction and RTing in particular, predominantly occur within parties, leading to very high network polarisation [15, 37, 41]. Political polarization in the RT network depends heavily on the nature of the issue, however, and can be situation-specific [7]. Online behaviour is strongly connected to political events as social interactions, such as *likes* and *supports*, are heavily influenced by party affiliation, creating a highly polarised state when elections near, which lessens again after the vote [22]. In Garcia et al.'s work, the comments network featured negligible polarisation along party lines, indicating that features fostering discussion are used for inter-party debate [22]. This finding aligns with Lietz et al.'s finding that homophily effects were weakest for mentioning practices among politicians during the German federal election 2014 [37]. Lietz et al. also found that events, e.g. TV debates, have a

| Paper | Issues identified using manual approach | Issues identified using automated approach | Explicit link to sociological theory | Explicit link to political science theory | Explicit link to issue engagement |
|-------------------------|---|--|--------------------------------------|---|-----------------------------------|
| Albaugh et al. (2013) | X | X | - | - | - |
| Barbera et al. (2014) | X | - | - | X | - |
| Bode et al. (2015) | X | - | X | - | - |
| Conover et al. (2011) | X | - | - | X | - |
| Freelon et al. (2017) | X | X | - | X | - |
| Garcia et al. (2015) | - | X | - | X | - |
| Graham et al. (2013) | X | - | - | X | - |
| Hawthorne et al. (2013) | X | - | - | - | - |
| Hemsley et al. (2018) | X | X | - | X | X |
| Jackson et al. (2017) | X | X | - | - | - |
| Lietz et al. (2014) | X | - | X | - | - |
| Livne et al. (2011) | - | X | - | - | - |
| Stier et al. (2017) | - | X | - | X | - |

Table 1. Overview of literature relating to the identification of topics/issues discussed on social media by politicians. The first two columns represent whether a manual (qualitative) or automatic (quantitative) approach was used to identify topics or issues. In cases where lexicon-based approaches were chosen to identify issues, we marked both columns. The final three columns show cases where explicit links are made to sociological, political science or issue engagement theory, respectively.

strong effect on hashtag use, but RTs and @-mentions are less impacted. The election itself brings a strong focus on certain topics that are constantly repeated.

In a recent study on @-mention-use of U.S. gubernatorial candidates, Hemsley and colleagues found that the feature is not used for interactive discussion, but 44% of the Tweets that mention a political competitor are attacks [31]. Furthermore, they find @-mentions to be used as a means to control the audience and implement controlled interactivity [61] among their follower base [31].

In this section, we have summarised three bodies of related work: 1) Studies of politicians' posted Tweets, 2) efforts to identify policy issues in social media content, and 3) studies of political candidates' Twitter interaction. The reviewed literature emphasises the growing importance of social media both as a means for politicians to communicate their message and for researchers to understand how politicians behave. Table 1 provides an overview of literature explicitly relating to the identification of topics/issues discussed on social media by politicians. The table highlights that despite both qualitative and algorithmic approaches having been applied, automated approaches are typically not explicitly related to political science theory and in particular issue engagement theories have yet to be studied.

In this article, we build on recent work in the computational social science community to investigate the issues politicians engage with during a German federal election campaign. Attempting to fill the gap highlighted in Table 1, we use political science theory as the driver of our work to focus on a topical analysis of issues. The specific theoretical constructs studied are outlined and then operationalised in the following two sections.

3 THEORETICAL CONSTRUCTS

3.1 Models of eDemocracy and Controlled Interactivity

The use of information and communication technology in political debate and electoral campaigns is referred to as eDemocracy [50]. When politicians are the initiators of democratic communication and set the agenda, the two most relevant eDemocracy models are the deliberative and the liberal model [39, 56]. Whereas the former explicitly and directly connects politicians with citizens in a properly functioning public sphere for sharing ideas via dialogue and discourse, the latter views citizens mostly as consumers of issues and agendas set by governmental agencies and political

elites. This means that citizens are only indirectly involved in the decision-making process by voting in elections [50, 56].

Although it was hoped that SM applications would be able to foster the deliberative model of eDemocracy, studies show that online discussions, especially those on SM, are not truly deliberative as mainly politically active and interested citizens take part in discussions, and none of the requirements for the deliberative discourse are met by more than a few postings [56]. Instead, politicians tend to adopt a broadcasting style of SM use. That is, they distribute information to voters in a top-down manner [20, 24], which aligns with the liberal model of eDemocracy. The liberal model is strongly related to the concept of controlled interactivity, which assumes that candidates' only goal is to get elected and not to seek input from citizens or establish dialogue with them [20, 61]. In practice, this means that campaigns will limit the scope of interaction between the user base and the candidate on SM, allowing users to support parties and their message, i.e., the collection of issues that define them, only in pre-approved ways [20]. Staying *on-message* is a key goal for campaign success. Message discipline, i.e., strong coherence with respect to the issues a party addresses, as well as correspondence with issues mentioned by the party's supporters, are objectives of controlled interactivity [20, 61]. Moreover, according to Spoon, message discipline is especially important for smaller parties who try to stay on message by focusing on a smaller set of policy matters [58]. As the focus of our study is the elite voice – Tweets by politicians – our work is framed within the liberal model of eDemocracy.

3.2 Issue Engagement and Related Concepts

Informing voters about each party's political offer and help them make an informed electoral choice is a key function of their election campaigns [45]. By addressing the same topics/issues, parties give voters the possibility to learn about each party's position concerning an issue. Researchers have coined different terminologies for the phenomenon of parties addressing the same issue. Some refer to it as issue convergence [35] whereas others simply call it *dialogue* [40]. The most widely used term for two parties talking about the same issue during an election campaign, however, is issue engagement [45, 57].

The decision to address an issue and the overall level of issue engagement depends on the strategic choice of parties and how they want to campaign [45]. Numerous theories have been proposed to explain why politicians and their parties engage in some issues while avoiding others. *Saliency theory* suggests that competing parties do not provide different answers to a given agenda of political problem [12, 54]. Instead, they try to focus attention on the issues advantageous for themselves, achieving success by making these issues *salient* [17]. Saliency theory aligns with *issue ownership theory*, which argues that voters perceive certain parties as being more competent than opponents in specific policy areas [12]. So for parties to win elections, it is wise to remain true to their profile and engage only in issues for which they have a long term reputation of handling these issues well and ignoring other issues [12, 48, 57]. Green and Jennings argue, however, that there is little stability in issue ownership and the public opinion is substantially shaped by two factors: 1) "major political or policy shocks, often outside the direct strategic control of any one party or government" [25, p.236] 2) downwards trend of generalised competence for governing parties [25, p.236].

Theories of *issue competition*, propose that parties compete by emphasising issues that they would like to dominate the electoral campaign and attempt to make their issues prominent in the debate, drawing competitors into a discussion about these issues [26, 27]. This can but do not need not be issues they own. Green-Pedersen and Mortensen hypothesize that issue competition – and as such issue engagement – is high among parties from the same party family i.e., parties that are located at the same site of the RILE scale [26].

The *riding the wave* hypothesis argues that parties can benefit, i.e. win votes, from engaging in issues that are timely and newsworthy and thus highly debated in the media [5]. In doing so, candidates and parties are "more likely to be seen concerned, responsive, and informed" [5]. However, they might not always benefit from riding the wave. For example, a politician's ideals may compel them to speak out when it may not be to their advantage [57] or "the actual state of the world may make certain issues unavoidable" [12]. A terrorist attack, for example, may force parties to talk about immigration or severe weather to address global warming.

3.3 Social Aspects of Issue Engagement

Theory also exists advocating that party relationships will influence issue engagement and how shared issues are debated. *Saliency theory* (described above) argues that parties seldom talk about opponents or their policies in election campaigns. The *theory of political valence* contrasts issues for which different parties agree, such as lower crime or economic growth with position issues, where the political spectrum divides voters and parties [13]. Here, some degree of issue engagement would be predicted, at least for consensus issues. Parties are also expected to be more responsive to competitors with a similar ideological stance, such as those closely situated on the RILE scale [11, 27]. Sigelman et al., for example, write that: "One would not normally associate a left-wing party with upholding traditional religious and moral standards. This results in it playing such questions down, thus ceding 'ownership' of the issue to the right while emphasizing those appeals that the right cannot make" [57]. Parties develop their issue-based strategies mainly by looking at proximate rivals, who are more likely to talk about the same issues and then confront these competitors [45]. Moreover, they expect newer and smaller parties to avoid issue engagement because of personnel and financial constraints [45].

Thus, extensive theory exists to explain issue engagement of parties: different theories predict varying amounts of cross-party dialogue (*saliency theory* vs. *issue competition*), as well as confrontational and supportive communication (*valence*). As noted above, limited work has tried to relate politicians' SM output to this theory. In this paper, we do exactly this by operationalising the above constructs computationally.

4 OPERATIONALISATION OF CONSTRUCTS

4.1 Issue Identification

After limited success using topic modelling approaches tailored for short SM content [3, 43], we chose to extract topics (issues) from Tweets by applying the approach developed by Weng and Menczer based on the assumption of topic locality. The premise is that semantically related hashtags are more likely to co-occur in the same Tweet [64]. Issues are identified by building a hashtag network, in which densely connected clusters of hashtags represent issues. This approach is advantageous as it allows us to map every hashtag to one issue easily and thus infer issue engagement for all candidates and parties. Issues are identified as follows:

- (1) We remove hashtags used only by a single user.
- (2) We calculate the normalized pointwise mutual information (*nPMI*) between every pair of co-occurring hashtags. Following Bouma, for two hashtags x and y their *nPMI* value is defined as [10]:

$$nPMI(x, y) = \left(\ln \frac{p(x, y)}{p(x)p(y)} \right) / -\ln p(x, y) \quad (1)$$

The *nPMI* gives the probability that two hashtags occur together ($p(x, y)$) against the probability that they occur separately ($p(x)p(y)$). *nPMI* ranges between $[-1, +1]$ with a value of -1 indicating for two hashtags

never to occur together, 0 for the independence of those hashtags, and +1 for their complete co-occurrence. By using this measure of association, we try to reduce some of the low-frequency bias and also account for chance co-occurrences [10].

- (3) We build a hashtag co-occurrence network by drawing an edge between two hashtags if their $nPMI$ exceeds a certain threshold ($nPMI > 0$).
 - (4) Finally, we apply the Louvain method for community detection to identify densely connected hashtag clusters in the network, which represent issues [8]. The Louvain method is suitable for identifying groups on large networks as it attempts to optimize the modularity measure (how densely connected the nodes within a cluster are) of a network by moving nodes from one cluster to another.
- Finally, we use the achieved modularity to judge the goodness of fit [46].

This stepwise process is applied to the subset of Tweets, which contain at least two hashtags.

4.2 Issue Engagement: Focus vs Avoidance

Issue engagement is operationalised from the perspective of parties using the z-standardized count of Tweets from the party for an issue. The z-score for party i with respect to an issue j is calculated as follows:

$$Z_{i,j} = \frac{X_i - \bar{X}}{S} \quad (2)$$

In equation 2 X_i represents the number of Tweets per issue X from party i . \bar{X} and S represent the sample mean and standard deviation for party i and all issues the party tweets about. Using the z-score, we control for the question of whether a party i posts more Tweets about issue j compared to the average number of Tweets that it contributes to all issues. The resulting distribution has a mean of $\bar{X} = 0$ and a standard deviation of $SD = 1$. A z-score of $z = 1$ for a party with respect to an issue means that the party contributes one standard deviation (SD) more to this issue than it contributes to an issue on average. This allows for the following interpretation: Multiple or all parties having a high z-score ($z > 1$) for an issue indicates an overall high engagement with this topic by all parties. Issues for which all parties have low or negative z-scores ($z < 1$) show a low overall engagement. In cases where only a single or few parties have large z-scores, we can identify issues that parties try to focus on and make salient for them. The opposite is also true. Low or even negative z-scores for one party, when other parties show higher engagement, signalizes issue avoidance. Table 3 shows the Greens to be the party that dominates our sample. Unsurprisingly, they appear to contribute a lot to most issues (see Figure 4). Using z-scores for each party has a normalising effect offering a fair comparison across parties.

4.3 Saliency Theory and Issue Competition

We measure the saliency of issues and issue competition using multiple metrics. First, *topical focus*, borrowed from [37] quantifies whether politicians address numerous issues or only focus on a small subset. Focusing on a small subset of issues is also an indicator for high message discipline and staying *on-message*. Whereas Lietz et al. use the normalized Shannon entropy to measure whether a party reveals a focus on a few selected hashtags or @-mentions, we employ the measure to quantify politicians' focus on issues.

$$F(\sigma_i) = 1 - \frac{-\sum_{j=1}^n p(a_j) * \log_2 p(a_j)}{\log_2(n)} \quad (3)$$

In equation 3 $p(a_j)$ measures the frequency with which a politician i tweets about issue a_j divided by the log frequency n of all issues tweeted on by politician i . The normalized Shannon entropy is subtracted from 1 thus F is bounded between $[0, 1]$. A high entropy value results from a politician using hashtags from multiple issues and relates to a low issue focus. A low entropy value maps to using hashtags relating to only few issues and describes a high issue focus.

The second measure is *party coherence*, which we quantify using pairwise cosine similarity of groups of politicians. The cosine similarity between a pair of politicians is measured based on the frequency with which they use hashtags associated with certain issues.

$$\cos(\theta) = \frac{A \cdot B}{\|A\|_2 \|B\|_2} \quad (4)$$

In equation 4 A and B represent count vectors containing the raw frequency values for each issue for two politicians. The dot product is calculated to measure their similarity. $\cos(\theta)$ is bounded between $[0, 1]$, whereby $\cos(\theta) = 1$ indicates perfect issue similarity between politicians. Thus, a high degree of topical focus and cosine similarity indicates whether a party has chosen to make only a few issues salient.

We additionally measure issue competition/saliency theory from a topic perspective using *political valence*, which quantifies the extent to which an issue is dominated by parties leaning left or right. Following the approach in Conover et al., we calculate the political valence of each hashtag by measuring the relative prominence of a hashtag among left- and right-leaning politicians [15]. We use data from the *Comparative Manifestos Project* to locate the parties on the RILE scale.² AfD, CDU, CSU, and FDP are viewed as right-leaning, whereas SPD, the Left, and Greens are located on the left.

$$V(t) = 2 \frac{N(t, R)/N(R)}{[N(t, L)/N(L)] + [N(t, R)/N(R)]} - 1 \quad (5)$$

Using this classification and formula 5 we can calculate the valence of hashtag $V(t)$ where $N(t, R)$ and $N(t, L)$ represent the numbers of occurrences of tag t in Tweets by right- and left-leaning users. $N(R) = \sum_t N(t, R)$ refers to the total number of occurrences of all hashtags in Tweets by right-leaning users. For left-leaning users $N(L)$ is defined analogously. $V(t)$ is bound between $[-1, 1]$ for hashtags only used by left-wing (-1) and right-wing (+1) users, respectively. The valence of an issue is defined as the mean of the valence values of all hashtags that belong to this issue. Issues with a valence close to 0 are highly debated from both sides of the scale. Issues closer to -1 or +1 are dominated by a specific wing. Averaging over all hashtags posted by a politician provides a valence score for that individual.

4.4 Social Aspects of Issue Engagement

Social aspects of issue engagement are operationalised using the measure of network polarisation i.e., modularity. "Network polarisation is defined as a phenomenon in which the underlying social network of a society is composed of highly connected subgroups with weak inter-group connectivity" [22].

In the context of political communication on the web, network polarisation has first been observed in the link structure of political blogs in the U.S. [1] and on SM platforms during election campaigns in Spain and Switzerland [6, 22].

$$Q = \frac{1}{2m} \sum_{ij} \left[A_{ij} - \frac{k_i k_j}{2m} \right] \delta(c_i, c_j) \quad (6)$$

²<https://manifesto-project.wzb.eu/>

Network polarisation can be quantified using Newman’s measure of modularity. Modularity measures the density of edges within groups compared to the density of edges between groups. In formula 6 A_{ij} is the edge weight between nodes i and j whereby k_i and k_j represent the degree values of these nodes. c_i and c_j are the indexes of communities of the nodes. $\delta(c_i, c_j)$ is a delta function which equals to 1 if c_i and c_j belong to the same community and 0 otherwise. The modularity value is bounded between $[-1, 1]$ whereby $Q = 1$ represents extreme network polarisation. We use modularity to show how strongly parties confront or communicate with each other. The Louvain method, which we use for issue detection, optimizes for modularity, and uses it as a stop criteria to find the best fit.

| Theoretical Construct | Measure | Description |
|--------------------------------------|---------------------------|---|
| Issue Engagement | Z-Score | How strongly do parties address an issue? |
| | Q-Modularity ³ | How strongly do parties talk about (@-mention) each other? |
| Saliency Theory Issue Competition | Issue Focus ⁴ | How strongly does a party focus on certain issues? |
| | Cosine Similarity | How similar are members of a party with respect to the issues they tweet about? |
| Issue Competition | Valence ⁵ | How strongly is an issue dominated by left- or right-leaning parties? |
| Issue Ownership | Z-Score | How strongly is an issue only addressed by a single party? |

Table 2. Constructs from political science theory and their operationalisation using quantitative measures.

Table 2 summarises the theoretical constructs and their operationalisations. The table shows that in some cases, multiple measures can be used to quantify different perspectives on theoretical constructs. In sum, these operationalisations allow us to quantify differences in election campaign strategies among the parties. The z-scores will give evidence for issues that are highly engaged ($z > 1$ for all parties) or avoided ($z < 0$ for all parties). This will help to identify issues that parties focus on and try to make salient. This could either be because they own these issues or because they wish to set the agenda for some other reason. Saliency theory or issue competition will be evidenced by high values of topical focus and party coherence as well as issue valence scores close to the boundaries.

5 DATA SET

From Jan 1st to Sept 24th (election day) 2017, we stored the Tweets and associated meta-data posted by over 1000 of the most prominent politicians and political candidates associated with seven relevant parties in Germany active on Twitter. Thus, the number of users in the sample reflects not only party size, but politician Twitter activity. The 2017 election was notable as it resulted in the first elected officials of a far-right party (AfD) to the Bundestag in six decades.

| Party | Politicians Observed | Politicians Active | Tweet Volume | Avg. Mentions | Avg. Hashtags |
|----------|----------------------|--------------------|-----------------|---------------|---------------|
| AfD | 91 | 75 (82.42%) | 30,452 (8.32%) | 0.27 | 1.45 |
| CDU | 324 | 223 (68.83%) | 63,170 (17.26%) | 0.56 | 0.93 |
| CSU | 61 | 44 (72.13%) | 10,748 (2.94%) | 0.33 | 0.78 |
| The Left | 156 | 137 (87.82%) | 63,581 (17.37%) | 0.56 | 1.01 |
| FDP | 70 | 55 (78.57%) | 13,594 (3.71%) | 0.66 | 1.31 |
| Greens | 230 | 214 (93.04%) | 95,478 (26.08%) | 0.61 | 1.16 |
| SPD | 410 | 311 (75.85%) | 89,044 (24.32%) | 0.55 | 0.76 |
| Total | 1342 | 1059 (78.91%) | 366,067 (100%) | 0.53 | 1.02 |

Table 3. Number of politicians per party, the number and share of those actively tweeting, their produced Tweet volume and the avg. number of mentions and hashtags contained in Tweets.

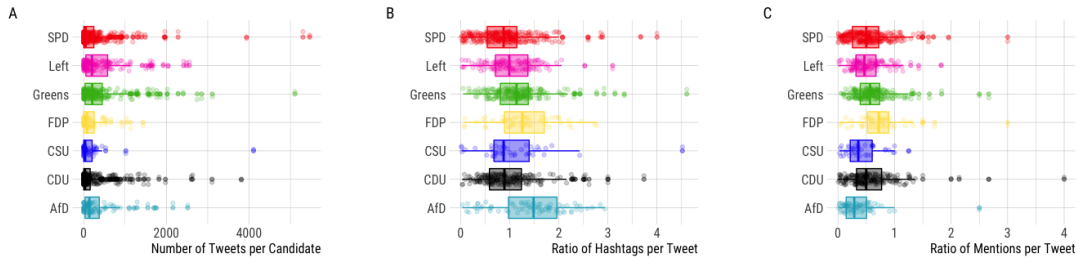


Fig. 1. Distribution of A) the number of posted Tweets, B) the ratio of hashtags per Tweet, and C) the ratio of mentions per Tweet for all politicians.

Forming a government was a tedious process needing many negotiations before another coalition between the two biggest parties CDU/CSU and SPD could be formed.

Table 3 and Figure 1 provide some overview statistics of our sample and politicians' tweeting behaviour. While our data collection method considered 1342 politicians, 1059 (78.91%) of them tweeted actively. The CDU had the least active user base with only 68.83% of its representatives posting on Twitter. The Greens had the most active politicians with 93.04%. This fits with their general political alignment; members of the CDU, a conservative party, being reluctant in using new ways of political communication, while the Greens show their progressive nature. Moreover, Figure 1A indicates that it is especially the more extreme parties (the Left and AfD) whose members equally contribute to their Tweet volume, while the bigger and central parties volume is more built on dominant voices. We don't consider this as a limitation of our study as we are mostly interested in how well their voices align (see section 6.2).

In total, we analyse 366,067 Tweets of which 191,005 (52.18%) contain at least one hashtag and 123,598 (33.76%) at least contain one @-mention. The percentage of Tweets with hashtags increased towards the election date. Politicians used 51,460 unique hashtags, of which 34,051 (66.17%) were only used by a single user. Hashtags usually do not occur in isolation. On average Tweets with hashtags contain 1.95 (*Median* = 2, *IQR* = 1, *Max* = 14), supporting the issue identification approach we took. That being said, parties vary in their usage of hashtags. Table 3 and Figure 1B show that Tweets by AfD and FDP contain almost twice as many hashtags as Tweets posted by members of the SPD or the CSU. The CDU, Left and Greens all apply a similar number of hashtags in Tweets. Although differences in the use of hashtags between parties can be spotted, these differences are unlikely to influence the valence scores, as the average number of hashtags for parties located on the different side of the RILE scale is almost identical (Left: 0.98, Right: 1.11).

6 RESULTS

6.1 Issue Identification

The issue identification process described above will make it possible to map *every* hashtag to a single issue. For building the hashtag co-occurrence network, we start by using the Tweets in our data-set that contain at least *two* hashtags. This results in a hashtag co-occurrence network with 16,164 nodes and 101,239 edges. The Louvain algorithm separates the network in 125 clusters or communities of reasonable quality ($Q = 0.37$). Examining these clusters reveals that 26 main clusters can be identified that account for 98% of nodes in the network. We use these 26 clusters to annotate Tweets containing hashtags according to the issue cluster they appear in. In doing so, we are able to successfully assign 174,617

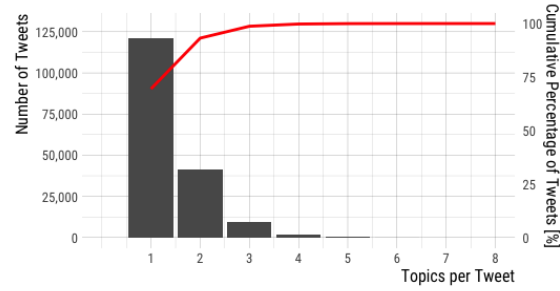


Fig. 2. Number of Tweets and how many topics/issues they address as result of the issue identification process. 98% of the Tweets address three topics or less.

(91.42%) Tweets containing hashtags to one or more topics they address. 70% of the Tweets address only a single topic. However, several Tweets that contain multiple hashtags can also address various topics. On average, a Tweet addresses 1.67 topics (*Median* = 1). A single Tweet addresses eight topics (*Max* = 8), which is a result of the community detection algorithm assigning all hashtags occurring in that Tweet into different communities.

Figure 2 shows the number of Tweets per number of topics revealing that 98% of the Tweets address three topics or less. In total, the 174,617 Tweets address the 26 topics 242,470 times. Table 4 shows the top 26 issues discussed by politicians in 2017, listing the issue name, size i.e. the number of associated hashtags, the five hashtags with the highest degree, the political valence of the issue, as well as the clustering coefficient of the sub-network of the issue, which describes the connectedness of the hashtags.

| ID | Issue | Number of Hashtags | Top 5 Hashtags | IV | CL |
|-----|----------------------------|--------------------|---|-------|------|
| 12 | Foreign Policy | 1637 | Deutschland, Europa, EU, Trump, Tuerkei | -0.27 | 0.10 |
| 114 | Right-Left-Conflict | 1507 | AfD, R2G, BTW2017, Thueringen, BTW | -0.13 | 0.07 |
| 15 | Environmental Policy | 1442 | Gruene, Klimaschutz, Gruenen, Niedersachsen, Energiewende | -0.56 | 0.11 |
| 40 | Chancellor Debate | 1297 | BTW17, SPD, CDU, Merkel, FDP | -0.17 | 0.07 |
| 36 | Berlin | 1232 | Berlin, AGH, MAHE, Tegel, Neukoelln | -0.43 | 0.07 |
| 59 | Regional Elections NRW | 1142 | NRW, Digitalisierung, Wahlkampf, LTWNRW, Duesseldorf | -0.03 | 0.10 |
| 2 | Social Justice | 1041 | Darumgruen, Rente, Frauen, Gerechtigkeit, Gesundheit | -0.51 | 0.13 |
| 101 | G20 Summit | 709 | Hamburg, G20, Polizei, Freiheit, Terror | -0.16 | 0.13 |
| 18 | CDU in Brandenburg | 651 | Bundestag, fedidwugl, Brandenburg, Steineke, TZT | 0.16 | 0.17 |
| 1 | Media & News | 621 | Fakenews, ARD, ZDF, NetzDG, Maas | 0.09 | 0.17 |
| 23 | Emissions Scandal | 571 | Dobrindt, Dieselgate, Diesel, Verkehrswende, Mobilitaet | -0.35 | 0.17 |
| 100 | Education Policy | 471 | Sachsen, Demokratie, Bildung, Muenchen, Heimat | -0.13 | 0.14 |
| 14 | Bavaria | 430 | Bayern, HLT, LTBY, Wuerzburg, Cannabis | -0.24 | 0.24 |
| 58 | Baden-Wuerttemberg | 405 | Politik, Stuttgart, Badenwuerttemberg, Pforzheim, Sonntag | 0.08 | 0.21 |
| 104 | Bremen | 396 | Bremen, RLP, Mainz, HBBUE, Transparenz | -0.15 | 0.19 |
| 108 | Sexual Equality | 389 | Ehefueralle, Zukunft, CSD, Schoeneberg, Queer | -0.55 | 0.19 |
| 44 | German Football | 378 | Frankfurt, Dortmund, Frieden, Fußball, BVB | -0.13 | 0.20 |
| 54 | Asylum Policy | 332 | Afghanistan, Bundesrat, Asyl, Abschiebung, Nuernberg | -0.32 | 0.17 |
| 31 | Digitalisation | 260 | GROKO, Schaeuble, Kanzlerin, Datenschutz, Internet | -0.27 | 0.20 |
| 22 | Federal President Election | 224 | Seehofer, Steinmeier, Bundespraesident, Kohl, Lammert | -0.13 | 0.24 |
| 73 | Economic Policy | 210 | Wirtschaft, Innovation, Mittelstand, Ausbildung, Handwerk | -0.06 | 0.26 |
| 107 | Religion & Culture | 198 | Kultur, dekt17, luther, Kirchentag, Kunst | -0.24 | 0.27 |
| 116 | Public Events | 129 | ESC2017, ARM, Eurovision, den, onthisday | -0.13 | 0.44 |
| 113 | Saxony & Saxony-Anhalt | 118 | Digital, Opendata, Lausitz, Hartz, C | -0.28 | 0.48 |
| 111 | Green Campaign Berlin | 88 | Zukunftwirdausmutgemacht, Zweitstimme, Mutludirekt, Erststimme, ilike | -0.53 | 0.36 |
| 13 | Miscellaneous | 60 | Gemeinsam, Pfingsten, Besuch, Oekologie, bmbf | 0.06 | 0.56 |

Table 4. Result of the issue identification with (ID) from community detection algorithm, (Issue) description given by the authors, the number of hashtags (Size) in the sub-network/community, the five hashtags with the highest degree in this sub-network, Issue Valence (IV) and Clustering Coefficient (CL).

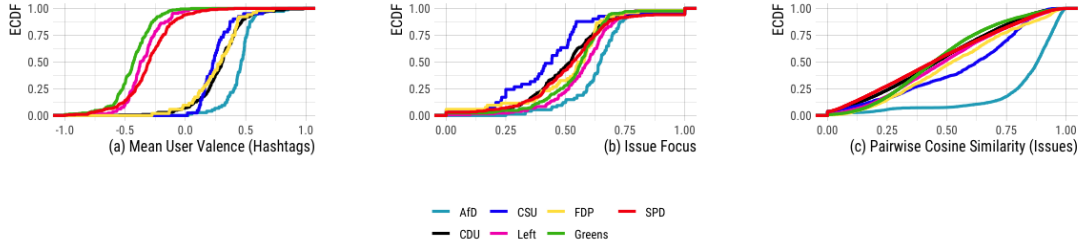


Fig. 3. Distribution of mean user valence (calculated based on hashtags), issue focus and cosine similarity (calculated based on issues and pairs of the same party) for each party

Our process of issue labelling followed the steps recommended by Maier et al. [42] when assigning labels to topics in topic modeling. All three authors were involved simultaneously. 1) We checked the hashtags to see whether the issue is semantically coherent, 2) We performed close reading of Tweets from certain sub-clusters to determine appropriate labels for the issues. 3) We discussed possible labels and picked the most appropriate one. The issues identified span prominent national and international themes, from economic, educational, and foreign policy, to local issues in Bavaria, Berlin and Baden Wuerttemberg that received national coverage, to salient events like the G20 summit and the election of the federal president Frank-Walter Steinmeier.

6.2 Issue Engagement and Valence

Figure 3(a) shows the distribution of valence scores for politicians in each party, revealing the sample to have a leftist tendency, which can be attributed to the fact that ~70% of Tweets are posted by left-leaning parties. Parties associated with the right have scores closer to 0, meaning the issues they discussed were also discussed by parties on the left. The Greens focused most on issues posted on by left-leaning parties, while the AfD posted mostly on issues posted on by right-leaning parties.

Figure 3(b) shows how the issue focus is distributed over politicians in each party. The bulk of the parties seem to have similar levels of issue focus, outliers being the AfD, which has the tightest focus on issues and the CSU, which exhibited the largest spread. The distributions of pairwise cosine similarity values of party members within each party (shown in Figure 3(c)) are again similar for most parties. Once more, the AfD and CSU are exceptions with both parties showing very high overlap in the issues discussed. The AfD politicians are the most similar in the issues tweeted on with 75% of the compared politician pairs having a cosine similarity score $\cos(\theta) > 0.87$.

Therefore, not only is the AfD topically focused and manages to stay *on-message*, but the party also exhibits a strong party-wide coherence. In comparison, the other parties contribute to more diverse issues, and the issues, that are engaged with vary much more across the politicians within the party. The CSU, the other outlier in the presented analyses, has a lower issue focus, but they have a higher similarity between the issues discussed by politicians. This may mean factions exist within the party with different factions posting on different issues, but within factions, posts are topically similar.

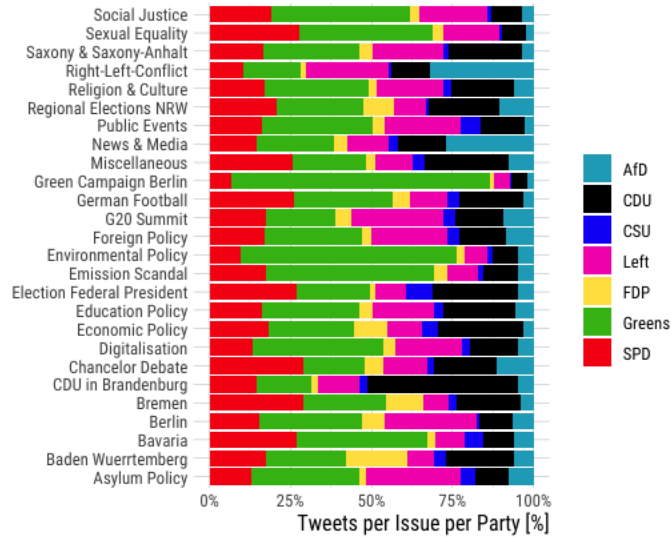


Fig. 4. Attention profile of each parties' contribution to each issue.

6.3 Issue Engagement, Focus and Avoidance

In this section, we explore the extent to which individual parties dominate or share the discussion on specific issues. Figure 4 shows an *attention profile* [57] and depicts which party devotes how much attention to which issue and in doing so highlights how the Greens dominate the discussion overall. The attention profile is, however, a bit misleading as it does not account for the total numbers of Tweets per issue but only the relative engagement of each party per topic. Normalising to consider the Tweet frequency of differing parties, i.e. using z-scores, reveals the issues *Chancellor Debate*, *Foreign Policy* and *Right-Left-Conflict* to be the topics with the highest degree of issue engagement. At the same time topics for which parties only have zero or negative z-scores are proportionally less engaged and play a subordinate role in the parties campaigns. Among issues with lower overall engagement are the following twelve: *Asylum Policy*, *Bremen*, *Digitalisation*, *Economic Policy*, *Education Policy*, *German Football*, *Green Campaign Berlin*, *Public Events*, *Religion & Culture*, *Saxony & Saxony Anhalt* and *Sexual Equality*. Figure 5 gives an overview of all z-scores for all parties and issues.

The number of Tweets addressing the issue *Chancellor Debate* is considerably above-average for every party as shown by the high z-scores (AfD:z = 1.5, CDU:z = 3.5, CSU:z = 3.3, Left:z = 1.8, FDP:z = 3.2, Greens:z = 1.4, SPD:z = 4.4). Tweets addressing this issue discuss the rivalry between the chancellor candidates Angela Merkel and Martin Schulz and their direct confrontation at the TV debate. Furthermore, this issue focuses on the election in general, indicated by the fact that the general hashtag for the election (#BTW17), as well as the hashtags of the biggest parties (#SPD, #CDU), belong to this issue. An issue valence value close to 0 ($IV = -0.17$) signalsises high engagement from parties on both sides of the RILE scale.

A further issue exhibiting high engagement by all parties is *Foreign Policy* (AfD:z = 0.40, CDU:z = 1.0, CSU:z = 2.80, The Left:z = 1.68, FDP:z = 0.33, Greens:z = 1.42, SPD:z = 0.92), which stresses Germany's relation to the US and

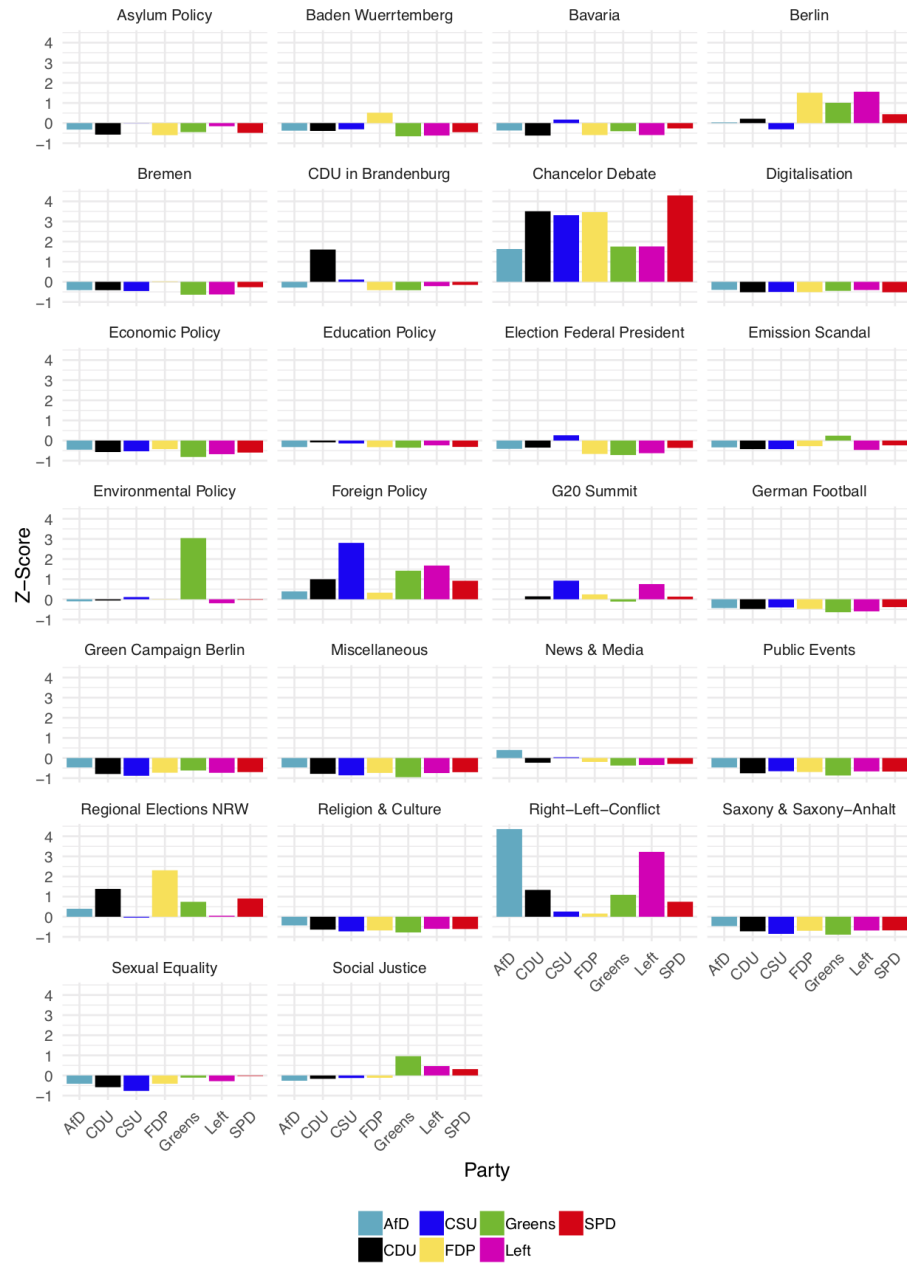


Fig. 5. Z-score normalized values of each parties contribution to each issue.

Turkey, the leaders of these countries, as well as matters regarding the EU e.g. *Brexit* and the citizens' initiative *Pulse of Europe*. This topic is traditionally not associated with a specific party (*issue ownership*) why it is worthwhile for parties

from both sides of the RILE scale to talk about foreign affairs and Germany's role in Europe, in particular, to make this issue salient.

Surprisingly, the CSU — only a regionally electable party, but nevertheless part of the parliament — is the party which shows the highest engagement with this issue. Looking at the Tweets by the CSU addressing this issue reveals one politician, the Federal Government Commissioner for Ethnic Germans and National Minorities, to have a strong voice in this issue. His tweet accounts for more than 50% of Tweets.

The issue showing the highest focus from only a single party is *Environmental Policy*. The Greens over-proportionally dominate this issue as is demonstrated by a z-score of $z = 3.04$, while all the other parties from both sides of the RILE scale more or less avoid this topic ($z < 0.11$ for all other parties). A high negative value of issue valence ($IV = -0.56$) underlines the dominance of the Greens.

Previously published studies suggest that it can be strategically wise for parties like the Greens to make topics such as climate protection (#Klimaschutz) and the transition to renewable energy sources (#Energiewende) salient in their campaign. Green parties are generally seen as more competent with handling such topics well [57]. As Green parties usually own these topics, it also makes sense that other parties avoid it [12, 49]. A similar although not so a pronounced pattern can be seen for *Emission Scandal*, (Greens: $z = 0.25$, all other parties: $z < -0.24$), which not only refers to Volkswagens' cheating on emission tests but also revolves around alternative drive technologies. Again, this is a topic one would typically associate with the Greens.

An issue showing signs of issue competition between all parties from the left side of the RILE scale is *Social Justice*, which revolves around social equality, retirement pay, minimum wage, and affordable living, as well as gender equality. These are topics traditionally owned by the Left and SPD, but neither dominates this issue in our data (Left: $z = 0.46$, SPD: $z = 0.31$). However, the Greens contribute most to this issue (Greens: $z = 0.95$). Although not traditionally associated with this issue, the Greens try to make this topic salient and associated with them and thus engage in competition with other parties from the left-wing. The right-leaning parties avoid the issue to a large degree (AfD: $z = -0.26$, CDU: $z = -0.16$, CSU: $z = -0.12$, FDP: $z = -0.11$), ceding saliency of this issue to the parties on the left ($IV = -0.51$).

Signs of issue focus by right-wing parties, which potentially could be explained by ownership or issue competition amongst them, are sparse. Three local issues, *Baden Württemberg*, *CDU in Brandenburg* and *Regional Elections NRW*, show a certain dominance of Tweets by the FDP ($z = 0.51$), CDU ($z = 1.60$) or both of these parties (CDU: $z = 1.38$, FDP: $z = 2.31$). The strong presence of issues that relate to regional politics or federal states in Germany shows that the results of these elections are taken as a barometer for public opinion in general, and parties try to use regionally relevant themes to win votes for the federal election. This is certainly true for the issue *Berlin*, which partly relates to the closing of Tegel airport and led to heated debate among local politicians in Berlin, but also received national coverage. Nevertheless, the low clustering value ($CI = 0.07$) indicates that this issue revolves around several sub-themes, such as politicians' daily practices (#agh: Abgeordnetenhaus/Berlin House of Representatives), different districts of Berlin and social housing in the city.

As noted previously, the AfD has a strong topical focus and high party coherence. The issues most emphasised by the AfD are: *News & Media* and *Right-Left-Conflict*. *Right-Left-Conflict* is one of the most engaged topics and a very heterogeneous one ($CI = 0.07$), containing hashtags both supporting and opposing the AfD as well as an over-proportionally high engagement by the Left. Many revolve around the extreme right-wing views held by AfD representatives, in particular, Björn Höcke and Alexander Gauland. Hashtags relating to immigration, which played a big role in the AfD campaign, also feature in this issue. The fact that no common hashtags exist with the topic *Asylum Policy* shows just how separate the conversations on immigration are between the left- and right-winged parties. Other

hashtags associated with *Right-Left-Conflict* are #r2g, which stands for "red-red-green" and represents the coalition of all left-wing parties. The evidence points to the AfD and the Left addressing similar topics but from opposing ideological stances. Although the AfD and the Left are clearly in competition with each other, they do not address or compete with each other directly — which will also be shown in section 6.4 — but focus on selective emphasis of different nuances of the issue [17].

Another issue, strongly emphasised by the AfD, is *News & Media* ($z = 1.66$, $IV = 0.09$), which revolves around criticisms of public media institutions incorrectly and negatively reporting (#fakenews), particularly about the AfD and its supporters. In this cluster, several hashtags (e.g. #illner, #hartaberfair, or #maischberger) refer to German political talk shows and appearances of AfD politicians in particular. Another prominent theme is #NetzDG, a law relating to censorship on SM platforms, which was heavily discussed by the AfD. Focusing on this issue, the AfD tries to position itself in the role of the victim of public news outlets, which they accuse of trying to hold them down in favour of the political establishment. Other parties except for the Greens ($z = 1.07$) avoid this issue, as indicated by low z -scores in the negative area.

Surprising Omissions. Although being a constant focus of discussion in the media many weeks before the election, the issue *Asylum Policy* received an overall low engagement by politicians on Twitter. Surprisingly none of the conservative or right-wing parties — which are usually known to own topics relating to immigration etc. — focus on that issue or try to make it salient for them. Neither did parties on the left try to *ride the wave*. We see an explanation for this later. Furthermore, the issues *Economic Policy* and *Education Policy*, which are usually also known to be topics owned by conservative or right-wing parties, show an overall low engagement and are not addressed as frequently as they could have possibly been. Whether or not the choice not to focus on these issues was a conscious, strategic decision by the parties is a question beyond the scope of this investigation.

In sum, we find evidence for high issue engagement for some topics (*Chancellor Debate*, *Foreign Policy*, *Right-Left-Conflict*) but low engagement for others (*Economic Policy*, *Education Policy*). We can identify topics where issue ownership (e.g. *Environmental Policy* for the Greens) and issue competition (e.g. *Social Justice*) explain why issues get engaged and are made salient by some parties. Thus we can observe differing strategies (deliberate or otherwise) by parties on the left, who seem willing to engage opponents on their issues (highlighted by the debate in *Social Justice*) and the right, who avoid issues associated with the left-wing.

6.4 Social Aspects of Issue Engagement

We study confrontation by analysing the social structure of the @-mention network. Using the 123,598 (33.76%) Tweets with mentions to build a network, we can characterise how politicians of different parties interact. Tweets with mentions contain, on average, 1.57. Politicians from FDP, Greens, Left, CDU, and SPD mention twice as many other politicians as the AfD or CSU, with members of the AfD (0.27) being the least and members of the FDP (0.66) the most active mentioners (see Table 3). The resulting network has 1,107 nodes and 16,276 edges (we exclude self-mentions).

Figure 6a shows the @-mention network using the force-directed Fruchterman-Reingold algorithm. The structure resembles mention graphs from related work, where less network polarisation along party lines is visible ($Q = 0.43$ in our case). RT⁶ networks on the other hand ($Q = 0.73$) are known to be strongly biased towards politicians from the same party [6, 37].

⁶In this work, we exclude quote RTs to make our results more comparable with existing insights into the RT behaviour of politicians. Newer research on the usage of quote RTs has shown that this feature is used differently compared to the regular RT feature [23, 44]

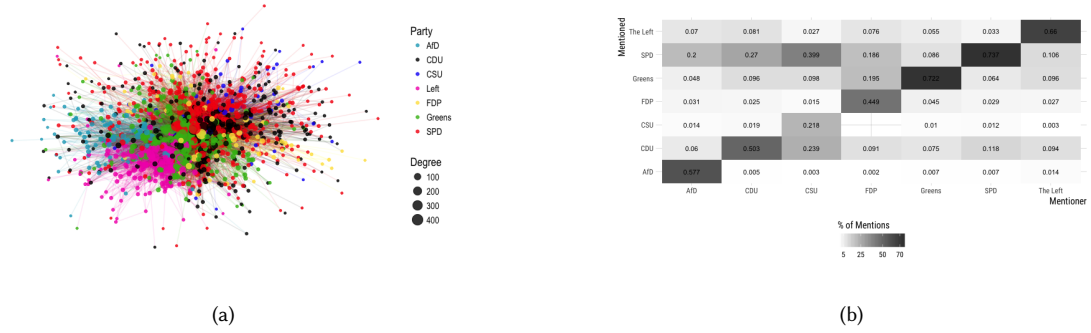


Fig. 6. @-mention behaviour of politicians visualized as network (6a) and heatmap (6b).

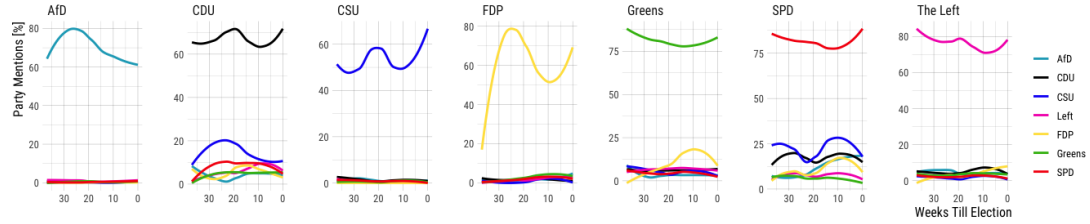


Fig. 7. Time series of @-mention behaviour across party lines indicated by the relative frequency of @-mentions directed at parties for each week.

@-mentions typically link politicians of different parties e.g. are used to confront competitors, make them aware of recently posted issues and engage them in a discussion. However, @-mentions can also be used for endorsement and to support party members.

Figure 6b is a heatmap visualisation of the @-mention network. The dark diagonal indicates politicians of a party mentioning members of their own party and visualizes polarisation. This behaviour is strongest among members of the Greens, SPD and the Left. Only 14.77% of mentions from left-wing parties are attributed to members of parties on the right side of the RILE scale. We can see a strong tendency among conservative parties, however, to mention parties from the opposite side of the scale. 43.36% of mentions from right-wing parties are directed to left-wing parties. In particular SPD members are often addressed by AfD, CDU, CSU and FDP members. A chi-square test confirms the relationship of political orientation and mentioning behaviour ($\chi^2 = 4481.3, df = 1, p < 0.05, Odds - Ratio : 4.42$). Finally, the AfD is isolated from all other parties, who mention AfD politicians extremely seldom in their posts, overall. It seems other politicians are, in general, unwilling to engage in debate with the AfD, although this strategy does change slightly over time, as the following section shows.

6.4.1 Temporal aspects of party confrontation. Temporal aspects of party confrontation are investigated by (1) fitting LOESS regressions for each party to the relative frequency of cross-party mentions at weekly intervals (see Figure 7),

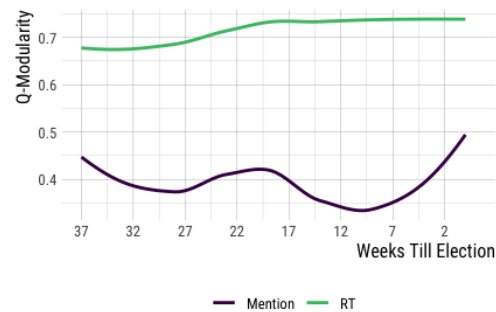


Fig. 8. Time series of Q-modularity for the RT and @-mention network. polarisation in the @-mention graph is much more volatile.

and (2) constructing a time series of @-mention and RT network modularity scores for each party, each week and again fitting LOESS regressions.

Figure 7 reveals that compared to the frequency with which they mention their members, politicians from AfD, CSU and FDP very rarely mention members of other parties. For the remaining parties, however, temporal trends in cross-party communication can be observed. It is striking that SPD politicians primarily mention members of parties on the right, whereas members on their side of the RILE scale e.g., the Greens and the Left, are not mentioned as often. SPD mentions of right-leaning parties stay consistently low throughout our data collection period, with one exception being roughly ten weeks before the vote, where both the Greens and the SPD confront members of the FDP. Manually checking these Tweets revealed heated debate on various issues between these three parties. The number of mentions attributed to the FDP again declines as the election comes closer. It seems, moreover, that the SPD is the only party to engage with the AfD. Starting 20 weeks before the election (5% of mentions) until the week of the election (10% of mentions), SPD politicians increasingly engage with the AfD. It should be noted, however, that these account for a tiny proportion of @-mentions overall (see Figure 6b).

Temporal changes in @-mentioning behaviour are also reflected in the modularity values of the @-mention graph. Figure 8 charts the modularity values for the @-mention and RT networks per week. The modularity of the @-mention graph troughs around ten weeks before the election, which seems to be a decisive point for several parties. From this stage, all parties, except for the AfD, increasingly mention only their party members, whereas the percentage of own party @-mentions decreases for the AfD. Overall, from week ten, the modularity value of the @-mention network rises until shortly before the vote, peaking in the week of the election at $Q = 0.49$. This aligns with Garcia et al.’s findings [22] and suggests that immediately before the election, parties support members of their party and try to draw the attention to their voice rather than engage in confrontation with opponents.

The modularity value of the @-mention graph is more volatile than the RT graph, which shows a continuous increase to a value of $Q = 0.75$ in week 20 — extremely high network polarisation — and remains fairly constant at that high level. Politicians almost exclusively spread content from members of their party. As previous results on the analyses of RTing have shown the feature seems to be a mechanism of endorsement resulting in strong homophilical effects [6, 37].

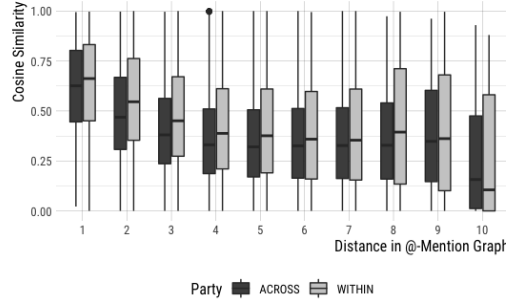


Fig. 9. Topical similarity (issue-based cosine similarity) for different distances in the @-mention graph. Candidates who mention each other directly also tweet on similar issues.

In sum, although saliency theory hypothesises that parties hardly ever talk about and with their opponents, we identified a high degree of cross-party mentions several weeks before the election. However, right before the election, when solidarity among party members is needed most, parties’ message strategies appear to change. @-mentions are then used as an instrument of controlled interactivity to emphasise the position of the own party. Results from previous studies show that @-mentions are not used to engage opponents into discussions about issues, but rather as an instrument to attack the opponent [31]. However, not all interactions across party lines can be attributed to being attacks only, as the next section shows.

6.4.2 Social proximity via issue similarity. Theories of issue competition suggest politicians force competitors, particularly ideologically proximate ones, to address issues they would rather not discuss. Based on this assumption, we wanted to discover whether topical similarity in Tweets leads to increased interaction among candidates. We hypothesize that the closer two candidates are in the @-mention graph, the more similar their content should be. Figure 9 shows the cosine similarity of pairs of users in our data set and their distance in the @-mention graph. The figure supports our hypothesis: users who mention each other directly tend to have similar content. Cosine similarity decreases until the distance is four hops, after which the similarity stays fairly constant with decreasing distance. Moreover, similarity among party members (Party WITHIN) is not significantly different from similarity across pairs of candidates from different parties (Party ACROSS). This underlines that the @-mention feature is both used for confrontation and endorsement. It also hints at the existence of thematic groups outside party borders. Political candidates’ Twitter activity is, therefore, not only influenced by homophily and social influence, as Livne et al. suggest, but also by topical structure from campaign strategies i.e. theories of competition [41].

7 DISCUSSION

In this work, we empirically operationalise issue engagement and related theories from the political sciences using computational metrics. We frame our analysis within the liberal model of eDemocracy by analysing the Twitter campaign strategies of political parties and candidates in the lead up to the German federal election in 2017. After identifying issues political parties engage in by means of community detection on a hashtag co-occurrence network, we were able to learn about aspects of *issue engagement*, *avoidance*, *competition*, *saliency* and *ownership* at party level.

In this section we discuss our findings in two stages: First, we relate our results to the theoretical constructs outlined in Section 3, highlighting, for example, how strategies relating to issue engagement differ across parties, over time and to what extent the observed patterns are explained by theories of issue competition and saliency. Second, we relate our findings to previous computational analyses that were less theoretically motivated or driven by theories from other fields.

7.1 Relating our findings to theoretical constructs

Using our approach we identified highly engaged issues (*Chancellor Debate*, *Foreign Policy* and *Right-Left-Conflict*) but also topics that received less attention (*Economic Policy* or *Education Policy*) by all parties. We observed differences in strategy across parties, as well as between parties at opposing sides of the RILE scale. Whereas parties to the left (and the Greens in particular) seem willing to reveal their position on issues important to the right (e.g. *Foreign Policy*), parties on the right do not seem to emphasise issues they are traditionally known to handle well. One exception is the AfD. The theories of *issue competition* and *saliency theory* best describes the behaviour of the AfD who exhibited high topical focus (message discipline), strong party coherence, as well as the focus on the issue *News & Media*, and their members made efforts to stay "on message" and keep these issue in the debate. This also aligns with Meyer and Wagner's theory that smaller and newer parties refrain from engaging in multiple issues [45] and Spoons findings of smaller parties focusing on a narrow set of policy issues [58]. The left-leaning parties provided both evidence for *issue ownership* and *issue competition*. For example, no party dedicated as much attention to a single issue as did the Greens with *Environmental Policy* and *Social Justice* was an issue made salient by all parties from the left. However, other interpretation might apply as recent investigations among parties in different countries showed that issue ownership is not a stable characteristic a previously thought [25, p.237].

Somewhat contradicting other aspects of *saliency theory*, however, most of the cross-party interaction (i.e. @-mentions) was not with neighbouring parties on the RILE scale, as suggested by Meyer and Wagner [45], but with those on the opposite side of the scale. Our results showing the link between topical relatedness and @-mentions provides further evidence for *saliency theory*. By showing that the network is not purely drawn along party lines, but also topical ones, we indicate that debate is occurring. Moreover, *issue competition* suggests that debate and thus issue engagement should peak before the election. In our data, ten weeks before voting seems to be when cross-party engagement is most prolific, after which politicians concentrate increasingly on their own party's message and again focus on controlled interactivity. This changing use of @-mentions fits with Barbera et al.'s observation that communication structures are flexible and situation-specific [7]. Why political parties change their approach ten weeks before the election is, though, unclear and deserves further investigation.

7.2 Relating our findings to previous empirical research

Our results align with previous computational analyses. As discovered by Lietz and colleagues, RTing seems to be used for endorsement, whereas @-mentions are for discussion and confrontation and are less prone to homophily [37]. Also aligning with past work, we found topical trends vary over time [60]. Our approach goes beyond past research in many ways. Not only was our analysis framed within political science theory and motivated by different theoretical constructs, but our issue focus identification process also proves advantageous compared to studying unique hashtags. A case in point was our discovery of a lack of hashtag co-occurrence in *Right-Left-Conflict* and *Asylum Policy* issues, demonstrating how left- and right-leaning parties can frame the related issues differently. This is something you cannot learn by studying hashtags individually. Our dataset provides further novelty in that it relates to the first German

election with notable success for a far-right party and we were able to observe how parties interact (or in this case not) with such parties. We observed the tendency of right-wing parties to mention left-wing parties, especially the SPD, but this was less so in the other direction. As Stier et al. noted with Facebook data, traditional parties (CDU, SPD) do not debate issues owned by AfD [60]. Their work suggests that the lack of *issue engagement and confrontation* by most of the established parties results in a vacuum where the AfD can freely spread nationalist and populist messages. We see comparable trends in our data, and this lack of confrontation may partially explain AfD's success in this election. Another explanation for AfD's success may lie within the strong topical focus and within-party similarity exhibited by members of the party. The high message discipline and controlled interactivity it resulted in may have helped them attract voters. In summary, the AfD seems to apply a disciplined Twitter campaign strategy in contrast to other conservative parties such as the CDU or FDP who do not emphasise issues, e.g. *Economic Policy*, relevant for their potential voters over other topics.

8 LIMITATIONS AND FUTURE WORK

Although we feel our work adds to the literature in diverse ways, we must highlight some key limitations.

The issue identification process based on hashtags did work well. There are, nevertheless, some points relating to this method that we need to acknowledge as limitations. First, as this process only worked with Tweets with hashtags, many of the politicians' Tweets were necessarily omitted from our analyses. This may have presented a biased view of politician behaviour. To justify this, however, we argue that this is a standard approach used in many social media analyses (e.g. [4, 28]), it is also the approach used when Tweets related to particular topics or events are studied e.g. [38]. Hadgu et al. write, for example, that: "On Twitter, hashtags are used to label tweets as being related to a particular topic. Through them, users join virtual debates and they are used to 'frame' issues". There is even precedence within politics where Cunha and colleagues study gender-specific discursive strategies relating to political topics by studying hashtags [16]. Thus, we are not the only scholars to take such an approach.

A further problem relating to the issue identification process was that some issues and topics were somewhat heterogeneous, e.g. *Right-Left-Conflict* or *Berlin*, spanning a wide range of diverse sub-themes as indicated by the low clustering coefficient.

Another point to note is that our discussion often related to the left and right of the RILE scale, which is known to be an oversimplification in a multi-party context with party characteristics being much more subtle in Germany to be forced onto a two-dimensional scale.

Several insights we gained hint at the fact that discussion groups among politicians exist. Following [22], one way to further analyse this would be to identify communities in the @-mention network via a community detection algorithm and see whether community structure imposed by the algorithm yields higher modularity compared to modularity via party alignment. Analyses like these could shed more light on intra-party politics [14] and identify diverging ideological camps within parties or party members who do not stay on message due to individualized campaigning [65]. Our results suggest this should be done and compared for different points in time as communication structures are flexible and situation-specific. Further potential future work could explore the relation of topical and social structure in more detail. We were able to show that similarity predicts closeness in the @-mention graph. However, further measures we based our analysis on could be used, for example, in a prediction task to further explore the topical and social structure politicians build on SM platforms when competing for votes.

9 CONCLUSION

We have presented a computational approach to measuring politician and political parties' election campaign strategies on Twitter. Our approach is framed within the liberal model of eDemocracy and rooted in theoretical constructs of issue engagement from political science. We devised computational means to measure constructs such as issue engagement, avoidance, competition and saliency theory. We presented our approach and demonstrated its utility in a study of the German federal election in 2017. Using our approach, we were able to identify highly debated issues but also issues, which could have received more attention and could be seen as potential opportunities in the context of theories of issue competition. Overall we found party practices can differ significantly, particularly along the RILE scale. As in the case of the AfD, we even were able to find insights into campaign strategies — high message discipline among own party members and less confrontation with others — that can be linked to a positive electoral outcome. The approach we take is not limited, however, to this single case, but can be applied to study diverse groups discussing issues on-line.

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