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METHODS FOR THE RECONSTRUCTION OF THE SOCIO-SEMANTIC DYNAMICS OF POLITICAL ACTIVIST TWITTER NETWORKS

Application to the 2017 French Presidential elections

Noé Gaumont¹, Maziyar Panahi², and David Chavalarias^{*1}

¹CNRS, EHESS-CAMS / ISC-PIF

²CNRS, Institut des Systèmes Complexes Paris Île-de-France (ISC-PIF)

Abstract

In the context of the French presidential elections held in 2017, we developed the “Politoscope”, an open platform for the analysis of political tweets, which was used to collect and analyse almost 60 million Twitter exchanges between more than 2.4 million users who interacted with French political figures. In this paper, we focus on the information revealed by this data, in terms of the development of the political environment during the elections. Among the numerous types of interaction that can be used with Twitter, we focus on that of retweeting. We characterise the socio-semantic networks of the French political environment, and their development over a period of eleven months preceding the presidential election. We show that analysis of retweet graphs can allow accurate and automatic monitoring of the reconfigurations of a multipolar political environment, by characterising the different political communities, their alliance strategies and their semantic particularities.

This is the first study of the socio-semantic trends of a multipolar political environment, and contributes to the emergence of new methods, originating from computational social sciences, which significantly modify research practices in the social sciences, and in political science in particular.

Mots-clés : opinion dynamics, political activism, elections, socio-semantic networks, networks dynamics, Twitter.

1 Introduction

Digital spaces are becoming increasingly present and influential in the functioning of our democracies, to the point where events transpiring in these spaces can no longer be ignored when it comes to analysing trends in the political environment. In the wake of each of the major political upheavals that have shaken western democracies in recent months (e.g. Brexit, the election of Trump), commentators have turned to the social networks in the search for a better understanding of these events.

In the space of a few years, the use of social networks has become fully integrated into the strategies of political parties. Barack Obama was qualified as a “game changer” in 2012, when he became the first presidential candidate to make massive use of social networks for his campaign. The 2016 presidential campaign in the USA confirmed this trend, with an estimated total budget of around 500 M Euros devoted to the use of social networks [Gre15].

France followed the same trend. Nowadays, the largest political parties call on the services of specialised companies, in order to gain a better understanding of their potential voters, through the analysis of very large volumes of data provided by social networks. Among these, Twitter is very well ranked among accessible sources of information. Moreover, it is the social network used by the majority of political figures, in response to current affairs or to provide visibility for their opinions and public statements. This social network has thus become an unavoidable medium for the political world, when it comes to delivering messages or establishing legitimacy.

*Corresponding author : david.chavalarias at ehe ss dot fr

In the context of the 2017 French presidential elections, we developed the *Politoscope*¹, an open platform for the analysis of political tweets, which was used to collect and analyse almost 60 million Twitter exchanges between more than 2.4 million users. Through the use of this data to build a case study, we present a method allowing the socio-semantic trends of a multipolar political environment to be automatically monitored.

2 Related work

A considerable volume of academic literature has been devoted to Twitter, as this platform benefits from two different advantages. On the one hand, it is accessible to the general public, even though it may not be representative of the global or even France’s population [BR15], and its content is massively duplicated by the traditional press or television. Furthermore, data collection is relatively straightforward, thanks to various APIs proposed by Twitter².

Numerous methodologies can be used to access Twitter productions, in the context of the study of political activities. Some specific methods [RY10, PP11, CGR⁺11] are designed to take advantage of the content of tweets to infer the political orientation of a tweet or user. However, the constraints associated with tweet formats appear to limit the efficiency of these methods. For example, according to Cohen and Riths [CR13], the hashtags used to discuss policy do not discriminate against types of political activism for people with low levels of activism.

In an effort to avoid the problems associated with automatic language processing, research has been channelled towards methods that analyse the structure, rather than the content, of exchanges made on Twitter. They have thus been inspired by a pioneering study of political blogs made in the USA [AG05], which has shown that there are more links between two blogs if they are of the same political leaning.

In the framework of Twitter, there are several possible definitions for the relationship between two accounts. An account can follow or mention another account. It can answer, cite, comment or simply relay (retweet) a tweet from another account. All of these notions of a ‘link’ are significant, and depend on the objectives of the study [DOG15]. However, in order to rank accounts according to their political orientation, it appears that the use of retweets is the most commonly used definition for a link between two accounts. In particular, Garimella *et al.* [GDGM16] and Connover *et al.* [CGR⁺11] have observed that in order to study political debates on Twitter, the use of retweets is more relevant than Twitter mentions.

Connover *et al.* [CGR⁺11] were among the first to take advantage of retweets in a study of the structure of the political environment in the USA. They retrieved its bipartisan nature, and showed that there are significantly less retweets between two accounts when they belong to different parties. Subsequently, numerous other studies have made use of this type of relationship. Boutet *et al.* [BHY12] applied the same method to study the structure of the political space in England, and to analyse differences in practice, in terms of the manner in which political groups use Twitter mentions, hashtags and Internet links.

Garimella *et al.* [GDGM16] and Morales *et al.* [MBLB15] used the notion of retweets to measure the existence of polarisation and controversies on Twitter. Amor *et al.* [AVC⁺16] used this to characterise the debate on *care.data* of the English National Health System and Guerrero *et al.* [GS15] also used this approach to study the *Catalan Process Toward Independence*.

These techniques have made it possible to retrieve bipolar political structures, although the notion of retweets also makes it possible to retrieve multipolar structures. This was the case with Cherepnalkoski *et al.* [CM15, CM16], who used retweets to determine the political affiliation of the Members of the European Parliament (MEP). However, these authors note that it is difficult to generalise this method, because in addition to their political connections, MEPs also have national preferences.

The retweet is not the only useable relationship that can characterise the structure of a political environment. The research of Barberá [Bar15] made use of follower/followee relationships between accounts. The originality of their research is that of assigning a position, between -1 and +1 on a left-right ideological axis, to each account. Thus, an account is not assigned to the Democrats (resp. Republicans) party, but to a position close to other members of the Democrats (resp. Republicans). This approach makes it possible to compare a set of accounts over an ideological continuum. These results were successfully reproduced using Twitter data in France by Briatte and Gallic [BG15].

Using their ideological estimation technique, Barberá *et al.* [BJN⁺15] have also shown that there is a strong degree of retweet polarisation when a political subject is mentioned, i.e. that there is a high number of retweets between ideologically close, and a low number between ideologically distant, accounts.

Finally, it is important to note that despite the publication of numerous studies evaluating ideological alignments, one of the aims of political science, *i.e.* that of predicting voting intentions, remains

¹<https://politoscope.org>

²<https://dev.twitter.com/overview/api>

problematic [Hub15], in particular as a consequence of the imperfect representativeness of Twitter with respect to the real population.

In just a few years, Twitter has thus become a productive research domain for social sciences, although it has certain limitations in terms of the types of population that can be correctly studied.

In the present paper, we reappraise and improve the aforementioned retweet analysis techniques, by applying them to a corpus generated by political activists over a period of nearly one year. This prolonged period of study has, for one of the first times, made it possible to study the socio-semantic dynamics of a multipolar political environment.

3 Identification of social groups in the French political Twittosphere

In 1890, Gabriel Tarde [Tar90] proposed the following definition of a social group: “*A collection of beings as they are imitating each other or as, without imitating each other at present, they resemble each other and their common traits are ancient copies of the same model*³”. The notion of imitation that mobilised Tarde at that time was relatively general, and covers a high proportion of broader notions of *social learning* or *social influence* (see [MGFL16, Tom09] for the contextualisation of these ideas). More than 100 years later, Twitter offers an ideal terrain for the adaptation of this submission to digital information space, by analysing the characteristic ways in which people express themselves on this platform. In fact, Twitter combines three elements, allowing the propagation of these characteristics to be monitored:

- Everyone can publish, without filtering, content that is visible to all other users,
- The follower/followee system allows anyone to subscribe to the publications of any other user,
- The retweet system makes it possible to effortlessly copy (retweet) content by forwarding an identical copy to all of his/her followers.

Thus, by concentrating on retweet events (relayed, unmodified information), we can establish markers allowing to define, for a given period, a set of user groups within which the Twitter content tends to circulate whilst being affected by modifications that are less significant (exact copies), than when they circulate between such groups (transitions during which tweets can be distorted, ironically or humorously commented, contradicted or simply not copied). We thus define social groups in the political twittosphere as dense networks of accounts that recurrently relay content, without modification, between each other. For the purposes of the present study, we developed a system to capture the real-time political twittosphere activity, which for a period of 11 months prior to the presidential election, continuously collected almost 60 million tweets concerning the main French political figures, that were communicated by more than 2.4 million individual accounts (see SI 7). We refer to this set of data as \mathcal{D} .

We estimated the proportion of retweets in \mathcal{D} sent by bots to be less than 5% (see SI 8), thus ensuring that our results remain representative of online political activism.

Retrospectively, this dataset was found to be of exceptional quality for the testing of community reconstruction methods. The exceptionally hectic nature of these elections (cf. appendix 6) in a multipolar political environment, represents a challenge for the dynamic identification of communities. Our methodology could thus be tested by verifying its ability to retrieve these developments in the political environment.

3.1 The retweet communities

On Twitter, markers of social influence related to forms of expression or opinions extend far beyond the framework of retweets. Individuals can for example influence one another in their use of expressions or hashtags, without necessarily having to retweet. Furthermore, the act of retweeting can be interpreted in several different ways, with for example a negative interpretation being common when the retweet is delayed (see SI 14). However, in the vast majority of cases, when retweeting is repeated in a political context, the retweet contributes to the propagation of ideas and opinions across the network [BGL10, KLPM10, CHBG10, BHMW11], and can be considered as a form of agreement with the ideas of a candidate or a political party.

Account following is another well-studied functionality on Twitter, which could also be used as a proxy to identify one account’s form of social influence on another. It is however rather uncommon for a user to stop following an account, such that from this perspective the “follow” action is less informative than the retweet, which is intrinsically temporal and indicates a user’s affinity with comments made on another account, at a given point in time. Furthermore, the “follow” function can be used for the simple

³“*Une collection d’êtres en tant qu’ils sont en train de s’imiter entre eux ou en tant que, sans s’imiter actuellement, ils se ressemblent et que leurs traits communs sont des copies anciennes d’un même modèle*”

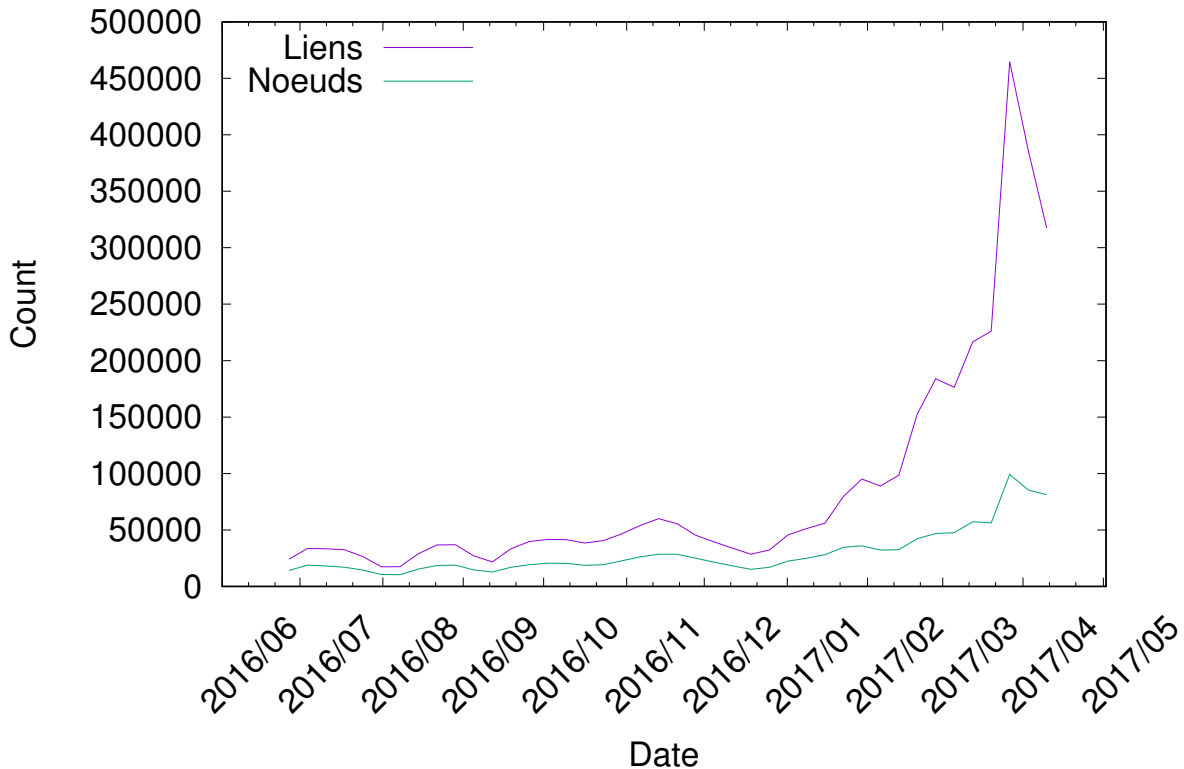


Figure 1: Variation in the number of nodes and links for the graphs of G_{T_i} .

purpose of keeping up with statements and comments made on another account, whilst at the same time maintaining a certain distance from that user.

Finally, retweeting has the advantage of quantifying the social influence present between two accounts since, for a given period, there may be no, few or many retweets between two accounts. In addition, these retweet relationships can be mono- or bi-directional, however this information is not considered in the present study.

In order to define user groups based on retweets, we selected the retweets from our dataset \mathcal{D} and defined a graph $G_T = (V, E)$ in which each node, $n \in V$, is a Twitter account and each weighted and undirected link, $(u, v, w) \in E$, represents the w retweets having occurred between accounts u and v during a period of time T .

In order to detect political groups in G_T , we adopt an approach similar to those proposed by [HKKS04, FSB06, PBV07] by applying a non-overlapping community detection algorithm to G_T . From the set of existing and regularly cited state-of-the-art algorithms [XKS13, Kan14, FH16], we apply that developed by Louvain [BGLL08] which, in view of the definition adopted for the notion of a link, computes node communities that correspond to our interpretation for the social groups we are seeking: these are account sub-groups, which exchange considerably more information without modification, within each group, than with the remainder of the network.

In the next discussion, we adopt the following definitions:

Definition - link w -strong: two accounts A and B are related by a link w -strong over the T period if they have retweeted each other at least w times, in either direction.

Definition: w -communities: communities detected on the graphs, on which only those links at least as strong as w -strong have been retained.

In the following, our analyses are related to the communities computed for two-week periods T (see SI 9 for the justification of this temporal period) and for graphs containing links that are at least 3-strong. This threshold makes it possible to retain the strongest 10% of relationships. The change in the number of links and accounts is shown in graphical form in Fig. 1. SI 11 in turn shows the reconstruction of 5-communities during the period between August 2016 and December 2016, which provides an image of the political twittosphere prior to the beginning of the presidential campaign.

The political communities $\mathcal{C}^T = \{C_i^T\}_{1 \leq i \leq N}$ found with this method were labelled with the names of the main political figures present in these groups, in an effort to provide a view of the development of political communities with respect to the key personalities in the French presidential campaign (cf. Fig. 2). We observe that it is possible to study the political environment coarsely or finely, by selecting a shorter or longer list of representative accounts, and by adjusting the resolution of the Louvain algorithm in order to identify distinct communities in the neighbourhood of these accounts. Although it is thus

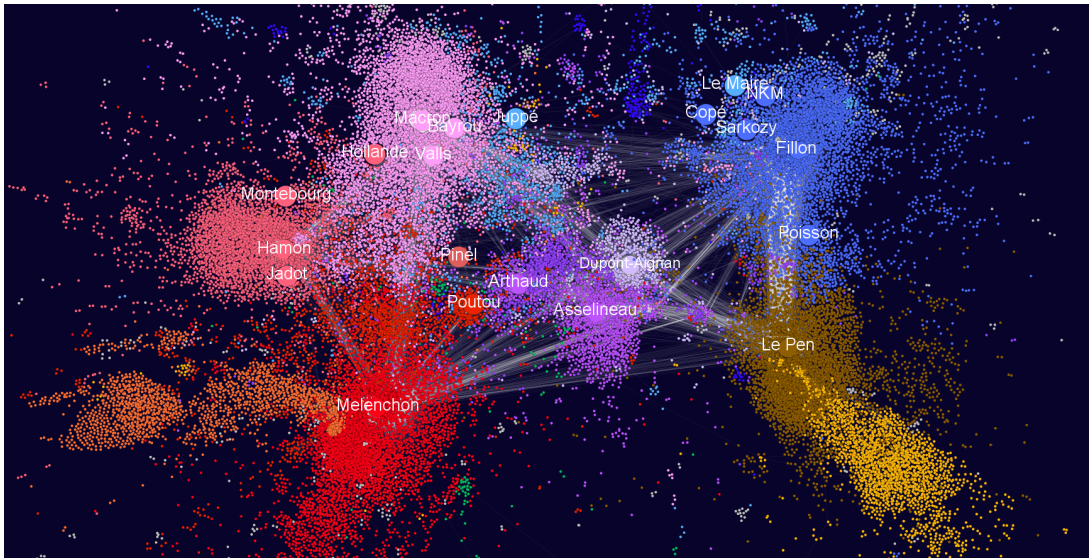


Figure 2: 3-communities in the French political environment on the day of the first round of elections (T=[9 April 2017 – 23 April 2017]). The environment is highly fragmentary and multipolar, and the main political forces are represented (the percentages shown correspond to the scores obtained in the first round): Mélenchon and *France Insoumise* (bright red - 19.58%), Hamon and the *Parti Socialiste* (light red - 6.36%), Macron and *En Marche !* (pink - 24.01%), Fillon and *Les Républicains* (blue - 20.01%), Le Pen and the *Front National* (brown - 21.30%), Dupont-Aignan and *Debout la France* (lilac - 4.7%). In the case of the “small” candidates, Asselineau (0.92%) and Arthaud (0.64%) are located inside the same community (purple), Poutou (1.09%) is positioned close to Mélenchon, but does not have a real Twitter community. It can be noted that not only is Bayrou located inside Macron’s community, which is not surprising in view of their unification on February 23, 2017, but also that Juppé, who was previously a candidate for the *Les Républicains*, primary election, is considerably closer to the community of Macron than to that of Fillon and Sarkozy. His “lieutenant” Edouard Philippe, was later to become Macron’s Prime Minister. There are nevertheless two significant communities that were not labelled with a political leader. Coloured orange, to the left of the figure and close to Mélenchon’s community, one can discern a community identified as being associated with the *Discorde Insoumise*, a video-game community which played an important role in Mélenchon’s campaign. Coloured yellow, at the bottom-right of the figure, close to Le Pen’s community, we identify a community of English-speaking populist and nationalist accounts which strongly supported Le Pen. This community is itself made up from sub-communities, in particular English-speaking supporters of Le Pen, Trump supporters, and UK pro-Brexit supporters. One can also observe significant differences with respect to the pre-presidential campaign of 2016 (Fig. 15) : in addition to the “left-right” axis, which was dominant at that time, a new (“vertical” on the map) axis appears to be significant, distinguishing between parties with a nationalist, patriotism or protectionist tendency and those adhering to the globalisation of economic trade (the fact that the “small” candidates are located at the centre of the map should not be interpreted as a form of centrality. Only topological adjacencies are significant on this type of graph. As the “small” candidate communities are not well connected with the other communities, they are located at the centre as a consequence of the spatialization algorithm used to make the graph).

possible to reveal the multi-scale structure of the organisation of a political space, such an analysis lies beyond the scope of the present study. In the following, we have taken labels from the list of presidential candidates, and added a small number of political figures who, although they were not candidates, played an important role in this campaign (e.g. outgoing President, former President, preferred personalities in the polls, etc., see SI 7.3). The resolution used with the Louvain algorithm was its default value.

The methodology we propose for the identification of social groups does not assume that these groups can be determined accurately or exhaustively. The method takes on board qualification inaccuracies at the level of the individual (for example, accounts that would be catalogued with groups found to be inappropriate, following an investigation of the owners of these accounts), and the arbitrary nature of certain choices related to the positioning of boundaries between these groups, after tuning of the Louvain algorithm or the threshold w . Social groups, whatever their definition, have blurry and shifting boundaries. Our approach is not entirely focused on finding the location of social group boundaries, but rather on the way in which they shift with time, the forking they can reveal, and the sub-corpus of tweets that can be established using this approach (cf. 4.4). However, by studying the sensitivity of the results with respect to the main parameters (Louvain granularity, temporal period, threshold on links weight), we ensured that the results presented here are not an artefact resulting from certain choices made when implementing the model.

3.2 Characteristic period of community stability

Socio-semantic networks evolve together: the actors are influenced by the content they are exposed to, which leads them to develop their local network, and thus to modify the nature of the content they will be exposed to in the future. As a result, it is common for individuals to change their sphere of political influence during a presidential campaign, or to be influenced by new political figures, which leads to a modification of the Twitter patterns.

In order to take this phenomenon into account, we consider sets of graphs $\mathcal{G} = \{G_T\}_{T \in \mathcal{T}}$ where \mathcal{T} is a set of time intervals, $\mathcal{T} = \{T_i\}_{1 \leq i \leq K}$, such that $T_i = [t_{min}^i, t_{max}^i]$, with t_{min}^i and t_{max}^i being the positive integers representing dates in the Unix reference system (to which we refer using the conventional date). The links in a graph G_{T_i} are defined only by retweets that occur within the time interval T_i .

The choice of \mathcal{T} is important: if the intervals are too long (several months), it will not be possible to follow the social group reconfigurations as a result of excessive temporal aggregation. On the other hand, if the intervals are too short (e.g. 1 day), the corresponding graphs will be almost empty and have no statistical significance. It is thus important to find a suitable compromise between the temporal adaptability of the political group reconstruction method and its stability.

As a consequence of variations in political opinion, resulting from the overlapping of several dynamic processes with highly different time constants (e.g. reconfiguration of trends inside a party, reconfiguration of parties themselves, development of the European political context, etc.), it may be relevant to analyse the data using several different time scales. For the present study, we chose a time scale matching the context of Twitter and the media. By analysing the temporal distribution of retweets within our corpus, we observed that both current political events and Twitter activity have a weekly periodicity, and that on average the retweet period of an original tweet is of the order of one week, with 98.13% of retweets being made within a period of seven days (see SI 9).

We thus considered seven-day intervals to be a characteristic period for political activity on Twitter, and used two-week intervals T_i in order to obtain overlapping periods. In the following analyses, we consider the communities computed every Monday, with $\mathcal{G} = \{G_T\}_{T \in \mathcal{T}}$ where \mathcal{T} is a set of temporal intervals, such that $\forall k \in [2, K - 1], |T_k| = 14 \text{ days}, |T_{k-1} \cap T_k| = |T_k \cap T_{k+1}| = 7 \text{ days}$, when the intervals are arranged according to their starting date.

Each tweet in our dataset is thus taken into account in exactly two retweet graphs. As shown below, this choice allows transformations within political communities and their semantic space to be followed in a reasonably continuous manner.

4 Results

4.1 Political communities as a basis for the propagation of political tweets

The aim of our study is to demonstrate that by analysing Twitter exchanges it is possible to qualify and quantify activity within political communities. The first result is related to patterns of propagation and the diversity of political information on Twitter, which the reconstruction of political communities allows to be analysed at the meso level.

We first of all validated hypothesis H_0 , which is an intuitive outcome of our reconstruction method, in which the propagation of retweets is strongly constrained by the structure of the computed communities (see SI 10). By analysing a sub-corpus of tweets that were retweeted at least 50 times by the communities⁴, we have shown that over the full set of time periods, in the case of 92% of propagations, H_0 is true with a p -value of less than 10^{-16} . By considering a p -value threshold of 1%, 99.8% of tweets sent by the communities have a retweet propagation that is very different to that of random propagation within communities.

In order to have a more accurate view of the manner in which the communities structure this propagation, we computed, for each day j and each tweet $tw \in \mathcal{D}_{50}^j$, the entropy \mathcal{H} of its propagation as a function of the communities \mathcal{C}^j , as well as, for the purposes of comparison, the entropy of propagation throughout the full set \mathcal{D}_{50}^j : $\mathcal{H}(P^j(tw)) = -\sum_i P^j(tw)_i \log(P^j(tw)_i)$.

As shown in Fig. 3, the entropy of the retweet distribution within the communities is very weak, with a mean value less than 1, which indicates that most retweets occur in one or two communities⁵ whereas for the full corpus of tweets, the distribution of retweets covers a much greater set of communities (mean entropy of 2.707, corresponding to propagation in 6.532 communities).

The analysis of retweet propagation thus shows that the vast majority of tweets are retweeted within their original community, as for example in the case of the tweet of François Fillon shown in Fig. 3 : “A Rexecode study has shown that my program would allow 1.5 million jobs to be created. This is the program that we should implement.” (779 retweets, entropy=0.245).

We thus discover the role of *echo chambers* played by political communities [CRA14], which structure the propagation of information with, as in the case of our study, a multipolar configuration.

4.2 Thematic specificities of political communities

Beyond the phenomenon of preferential circulation of content inside their original political communities, those political communities reconstructed using our method also have thematic specificities that are

⁴These tweets captured 31% of all retweets.

⁵As an example, if a tweet propagates in just one community, then the entropy is 0. If it propagates uniformly in 4 communities, then the entropy is 2.

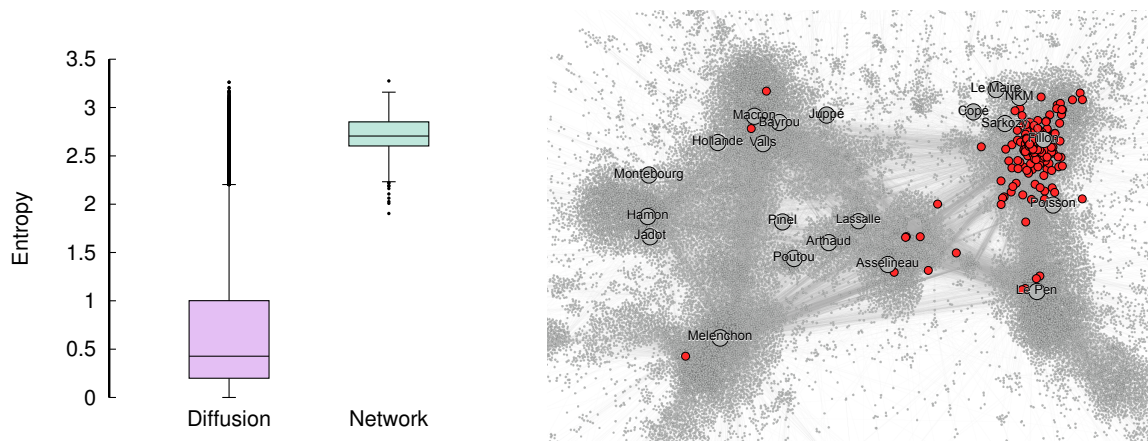


Figure 3: **Tweet propagation patterns.** (a) left: boxplot of the propagation entropy of each tweet within the communities, and within the entire network ; (b) centre: (c) right: example of a tweet from François Fillon: “A *Rexecode* study has shown that my program would allow 1.5 million jobs to be created. This is the program that we should implement.” (779 retweets, entropy=0.245) ; and its preferred propagation within certain communities.

coherent with specific anticipated particularities. Although an exhaustive characterisation of communities from the perspective of the topics they address is beyond the framework of this paper, we have shown that the topics and the manner in which they are addressed are diverse.

We analysed two representative corpuses of political discourse during this presidential election: a list of 980 political measures drawn from the programs of the 11 presidential candidates, and a corpus of 25 883 tweets published between August 2016 and January 2017 by these candidates and a small number of other important political figures.

We analysed these two corpuses using the Gargantext text-mining software (<https://gargantext.org>) and identified a vocabulary of nearly 1500 groups of expressions, qualifying the themes of the presidential campaign. We then used Gargantext to cluster these expressions into themes, thereby producing a thematic map of the subjects discussed by the candidates and their political communities during the campaign (see Fig. 16 in SI 12).

Using this map, we defined 11 major themes in this presidential campaign, defined by a set of keywords, with which we associated 11 corpuses of tweets by applying a request, based on the theme keywords, to our tweet database (see SI 12).

The analysis of the specificity of a political discourse, as a function of theme, can thus be carried out at several levels:

- Diversity of the political parties dealing with each theme,
- Diversity of the themes discussed by a given political party,
- Diversity of the expressions used by each political community.

For each theme, the computed value of entropy, based on the number of communities addressing this theme, shows that all of the latter are covered by an average of approximately six communities, with a lesser degree of diversity for the themes of *homeland security* and *immigration and multiculturalism*, which are strongly promoted by the extreme right (see Table 5 in SI 12.2).

For each political community, our computation of the diversity of the addressed themes (see Table 1 in SI 12.2) clearly reveals community heterogeneity in terms of the way in which they address selected themes⁶ and a differentiated positioning of themes on the political agenda, at different times during the campaign (see analysis of the dynamics of themes by community, Figs. 25 to 30). This heterogeneity can also be found at the level of the vocabulary used by the members of each political community (see Table 6).

The companion platform of this paper, the *Politoscope*⁷, makes it possible to explore, for each of the main candidates and each of the eleven themes, the changes in the 15 most significant keywords for each of the respective candidates. One can also observe, in addition to the semantic specificity of the communities with respect to these themes, a variation as a function of time for the different candidates, with the usage of certain keywords appearing, strengthening or disappearing over time (see SI 12.1 for details of the method and examples).

In conclusion, our analysis of the semantic profiles of the political communities retrieved using this method shows that these communities have highly specific profiles, which are fully coherent with what

⁶As this analysis does not search for all possible themes, the present study cannot be used to qualify the candidates with respect to the diversity of the themes they address.

⁷<https://presidentielle2017.politoscope.org/dashboard>

Name	Entropy	# themes	Dominant themes	%
Jean-Luc Mélenchon	3.10	8.6	democracy, foreign policy	37.3
François Asselineau	2.63	6.2	foreign policy, democracy	57.7
Marine Le Pen	2.78	6.9	immigration and multiculturalism, foreign policy	49.0
François Fillon	3.06	8.3	immigration and multiculturalism, democracy	33.5
Emmanuel Macron	3.03	8.2	foreign policy, democracy	44.2
Benoît Hamon	3.19	9.1	employment, foreign policy	39.3
Philippe Poutou	3.08	8.5	democracy, employment	38.8
Nathalie Arthaud	2.88	7.4	foreign policy, democracy	48.6
All candidates	3.08	8.4	foreign policy, democracy	36.9

Table 1: Table showing the entropy of the themes addressed by each candidate, and its 3-community. The two dominant themes as well as their associated percentages are also shown. The maximum entropy is 3.46, if the 11 themes are discussed in a uniform manner. With respect to the selected themes, Benoît Hamon is the candidate who uniformly addressed the greatest number of themes, whereas François Asselineau is the candidate who was the most focused on a subset of themes (including foreign policy and democracy). The variations in attention paid by the candidates to these themes are plotted in Figs. 25 to 30.

Name	# people present	Average time in days
Marine Le Pen	35 812	33.8
François Fillon	30 516	30.7
Jean-Luc Mélenchon	42 206	21.8
Emmanuel Macron	57 651	16.2
Benoît Hamon	37 748	17.7
François Asselineau	14 774	11.8
Philippe Poutou	51 908	11.6
Nicolas Dupont-Aignan	30 366	5.6
Nathalie Arthaud	45 450	4.5
Jacque Cheminade	29 153	4.4
Global	187 619	55.8

Table 2: Table showing, for each candidate, the number of persons present at least once in his/her community, as well as the average time spent inside the community. The communities of Le Pen and Fillon are clearly different to the others, in the sense that they are the most stable with a very high average time. The fact that the average time spent by an account within a community (last line) is very high indicates that a significant proportion of accounts change from one community to another, without disappearing from Twitter.

is already known about their political orientations. On Twitter, information circulates very efficiently inside these communities, and we are able to monitor the changes in their political agenda over time, by observing the changes in attention devoted to different themes.

4.3 Changes in communities and opinion dynamics

Political communities can evolve, by gaining or losing members who were not previously included among politicised accounts on Twitter, or by attracting the following of members from other communities. Indeed, there is a co-evolution between the structure of a community and its members' opinions. Communities govern the circulation of information, and the members of a given community are exposed to specific content. However, this exposure can contribute to changes in their opinion and eventually cause them to switch to another community, thus modifying the overall structure of the communities.

In order to qualify the communities' structure, we analysed their stability over \mathcal{G} . For each account, which belonged at least once to one of these communities, we computed the cumulative distribution of time spent within the community (see Table 2 and Fig. 31 and 32 in SI 13).

Community cohesion is highly heterogeneous, with right-wing communities (Le Pen and Fillon) being those having the largest and most loyal cores (10% of accounts remained in the community for more than 100 days, between February 6 and April 23, 2017), and those communities of political figures who did not pass the primaries being, unsurprisingly, the least well-structured and long-lasting (except for the special case of the former President Nicolas Sarkozy).

Our analysis of the cumulative distribution of time spent in a given community shows that for most communities, more than 20% of accounts were present for less than 4 days, and more than 20% of accounts were involved for more than 40 days.

There is thus a general political community structure on Twitter, comprising a core of activists who remain for several weeks within the community, a considerably more volatile peripheral membership, and an intermediate set of accounts covering a broad spectrum of participation.

Furthermore, it can be seen (see Table 2) that the average time spent in a community, when all communities are considered, is much greater (55.8 days) than the average time spent within any same community (≤ 33.8 j). This indicates that a significant proportion of accounts change from one community to another over time, which can be indicative of any change or instability in their political opinions.

4.4 Changes in communities and in the dynamics of opinion

Opinions and political communities vary together. Political campaigns involve reversals, bombshells, and reconfigurations of political support. Commentators do their best to anticipate and analyse these changes, whereas the political parties strive to mask what is going on behind the scenes, in order to catch their adversaries off guard. The main result of our study is that the automatic analysis of retweet patterns is able to measure, sometimes before the media can make any announcement, the changes taking place inside political communities in response to these events and, in some cases, in response to anticipated events.

In an effort to monitor political community reconfigurations over periods of time, when changes are perceptible, we compared the communities pairwise, over consecutive intervals of time. This approach allows transformations in the political communities to be followed without interruption.

Between each period, for each community we computed the number of community-changing accounts, and generated an alluvial graph to represent these changes (Fig. 4). This visualisation summarises the reconfigurations of the political space over a period of 11 months, with sufficient resolution to reveal the main actors of this presidential election. It can be seen that whereas most of the major political events can be interpreted on this view, it also shows more subtle relationships between communities (see the analyses shown in Figs. 5, 6, 7, 8 and 9), for example the distancing of the Sarkozy community from that of Fillon, shortly before the Penelopegate affair, followed by the rallying of a considerable number of Sarkozy activists to Dupont-Aignan. This effect lasted for only a short time, since most of these accounts ceased to follow Dupont-Aignan when he himself rallied to Le Pen between the two rounds of elections. The behaviour of the various right-wing currents during *Les Républicains* primaries is highly indicative of the fault lines present in this party.

The value of this reconstruction of communities and its visualisation is that it is positioned at an intermediate level between political leaders and their electoral base. By observing the behaviour of a set of activists, corresponding to a wide spectrum of political affiliations, this approach provides access to a level of observation that is rarely observed in the framework of sociological studies or in political science. In total, nearly 190 000 individual accounts could be identified, as having been affiliated with a political community, with most communities involving several tens of thousands of activists (see Table 2). These communities are made up from a large number of opinion leaders and political outlets. From these results, we can safely assume that the political tribulations of sub-populations within this set of individuals are indicators, and in some instance the precursors, of political change and reconfiguration.

5 Conclusions

Starting from the definition of a social group given by Gabriel Tarde, we have shown that methods involving the analysis of exchanges of political content on social networks such as Twitter allow automatic reconstruction of political communities which, thanks to their semantic profile and patterns of development, provide a realistic picture of the dynamics at play inside the space of political activism.

By applying these methods to data from the French presidential election in 2017, we thus reconstructed the multipolar French political space, retrieved the main events which occurred during the campaign, and revealed the multiple reconfigurations of political communities, some of which took place under relatively confidential circumstances. By using interaction data only, our approach has the advantage of being independent from the language used during these exchanges, provided the studied social activity involves a certain level of commitment from the participants, as is the case in politics.

As a consequence of its 11-month duration, its temporal resolution (real-time capture of data, once every second), and its scale (≥ 2.4 million Twitter accounts of which ≥ 180000 had a sufficient degree of interaction with the *Politoscope* to be catalogued into a political community), this study establishes the basis for a series of analyses providing unprecedented insight into the dynamics of opinion and the reconfiguration of political communities (see for example [CGP17]). It provides access to an intermediate level of resolution between sociological surveys in the field and global statistical studies (such as those

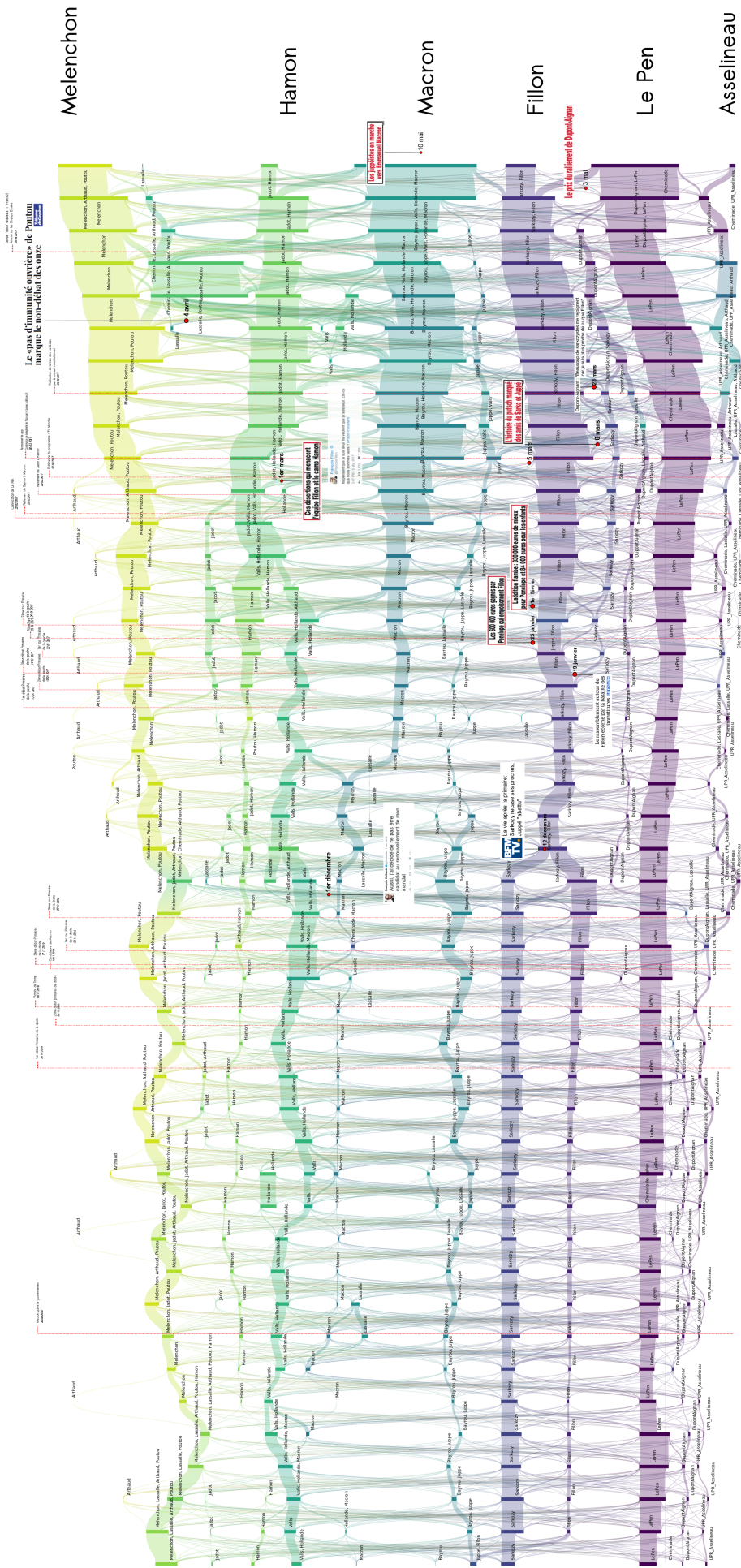


Figure 4: Reconfigurations of political communities between June 2016 and April 2017. Several major newspaper headlines have been added to shed light on the observed bifurcations. The labels of communities that were still active during the second round have been added in large characters to improve their readability. Each vertical bar corresponds to a political community on Twitter, labelled with the accounts of candidates who were active in the community. The bar's height is proportional to the number of Twitter accounts belonging to this community. These are computed every Monday.

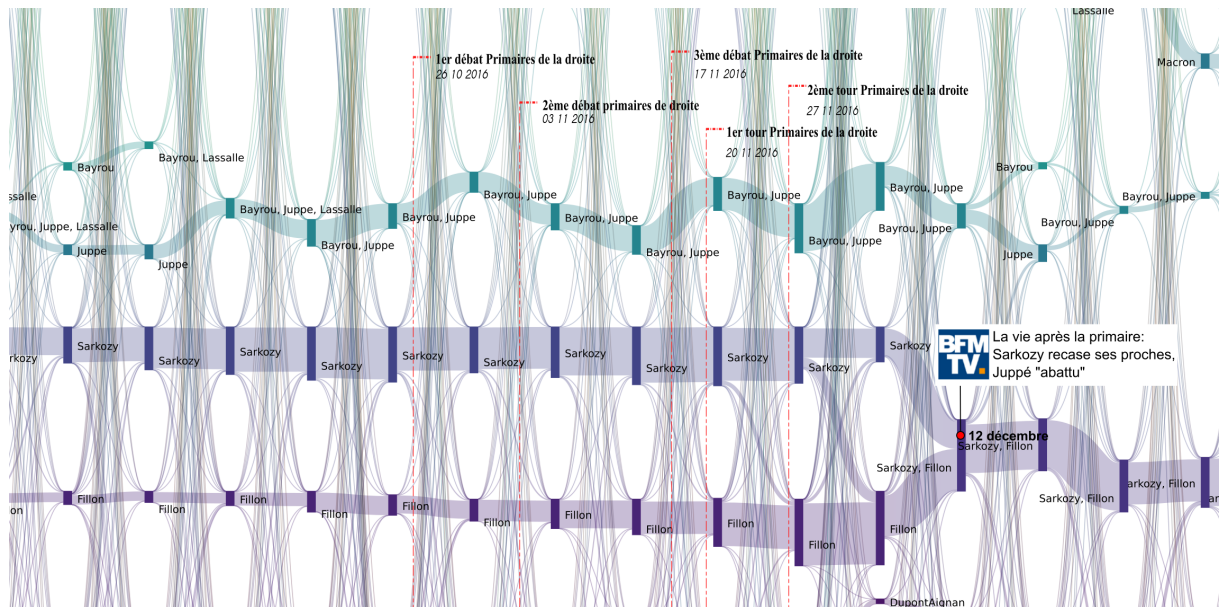


Figure 5: Reconfiguration of political communities at the time of the primaries held by the right-wing party. These primaries were marked by three debates and two votes. One can observe the progressive and regular reinforcement of the Fillon community, week after week, although no-one was predicting his victory in the second round, since Juppé was tipped by the polls to win. As a result of the first round, following the surprise victory of Fillon and the equally surprising elimination of Sarkozy (president of the *Les Républicains* party and ex-President of France), only a minute portion of the Sarkozy community moved to that of Fillon. The Sarkozy community was reluctant to join the Fillon community, and Sarkozy spent several days negotiating positions for his members within the Fillon structure. The Juppé community, however, immediately distanced itself from the new political orientations adopted by the party. This right-wing split was apparent in the pre-electoral environment (see Fig. 15). Following the failed return of Juppé in March 2017 (see Fig. 8), part of his community moved to join Macron. The bifurcations observed here are clearly summarised by an article published by BFMTV on 12 December 2016: “*Life after the primary: Sarkozy relocates his close allies, Juppé is ‘demolished’*”. Each vertical bar corresponds to a political community on Twitter, labelled with the accounts of candidates who were active in the community. The bar’s height is proportional to the number of Twitter accounts belonging to this community. These are computed every Monday.

conducted by the French INSEE) from which we expect that, in the future, it will represent a major source of political and sociological knowledge, which will supplement the more traditional approaches.

We conclude this paper with a comment concerning the political and ethical implications of the development of these methods. In recent years, the boundary between private and public life has become increasingly thin, as the digital trails left by citizens have been systematically analysed, by combining an ever increasing number of databases (purchase history, web navigation history, votes, loyalty cards, public transport, GPS location, etc.), and by considering an increasingly significant history based on population sample sizes that tend to be of the order of magnitude of the population itself. Marketing and the economic sector were the first areas of activity to seize these new opportunities, in the interests of financial gain. More recently, the political sphere has adopted these new opportunities and has tried to take advantage of them to gain greater insight into the preferences and political persuasion of voters.

A perfect example of this tendency can be found in the leak of sensitive personal data concerning nearly 200 million Americans, compiled for the Republican party ($\approx 99\%$ of the electorate), which occurred in July 2017⁸. We took considerable care during the entire Politoscope project to anonymize the processed data and to produce aggregate data only, thus making it impossible to identify specific individuals, with the exception of a small number of well-known political figures. However, the research presented in this paper shows that it is possible, using the conspicuous trails left in the public digital domain, and with relatively accessible computational means, to catalogue a significant proportion of a country’s electorate, according to their political orientations, even though, as we have pointed out, there is still a certain margin of uncertainty. From this observation, it is important for citizens to realise that they can be accountable for any trace they leave on the web. The open platform politoscope.org is, in particular, designed to promote this awareness. We can only count on the honesty and good faith of current and future political leaders to refrain from using, as has happened so often in the past and continues to be the case in certain countries, data of this type for the purposes of manipulation, discrimination, or even repression and persecution.

⁸see <https://www.upguard.com/breaches/the-rnc-files>

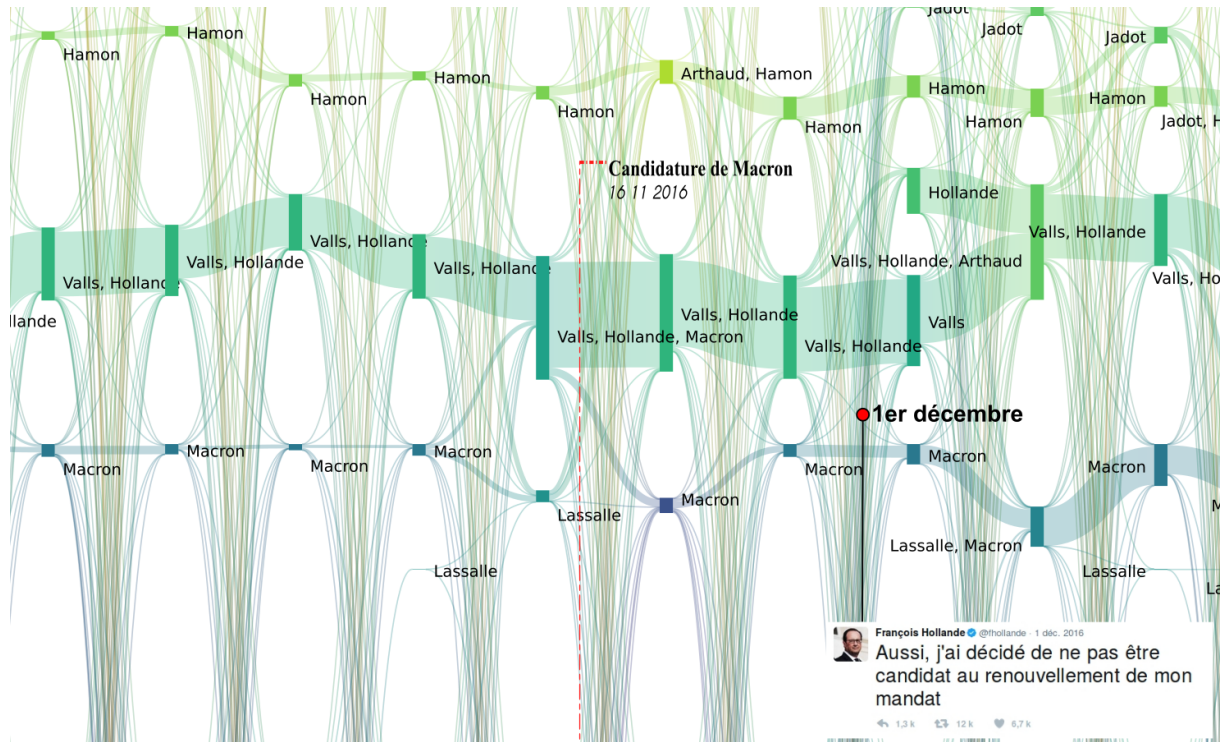


Figure 6: Reconfiguration of political parties at the time when the incumbent president François Hollande announced that he would not stand for a second term in office. This declaration was made shortly after Macron had announced his own candidacy. The alluvial graph clearly shows that Hollande’s announcement revitalised the Macron community, at the expense of Valls. Whereas the size of the Macron community had remained stable at the time when he announced his candidacy (427 accounts the previous week, 561 the week of the announcement, 472 the following week), it jumped to 749 accounts during the week when Hollande renounced standing for a second term, and then to 1479 accounts the following week. From that time onwards, this community continued to grow regularly until the elections. This change coincides with a slowdown in the Valls-Hollande community, the right-wing section of the *Parti Socialiste* that was ideologically closest to Macron. However, the Hamon community, which is further to the left, remained relatively stable during this period. Each vertical bar corresponds to a political community on Twitter, labelled with the accounts of candidates who were active in the community. The bar’s height is proportional to the number of Twitter accounts belonging to this community. These are computed every Monday.

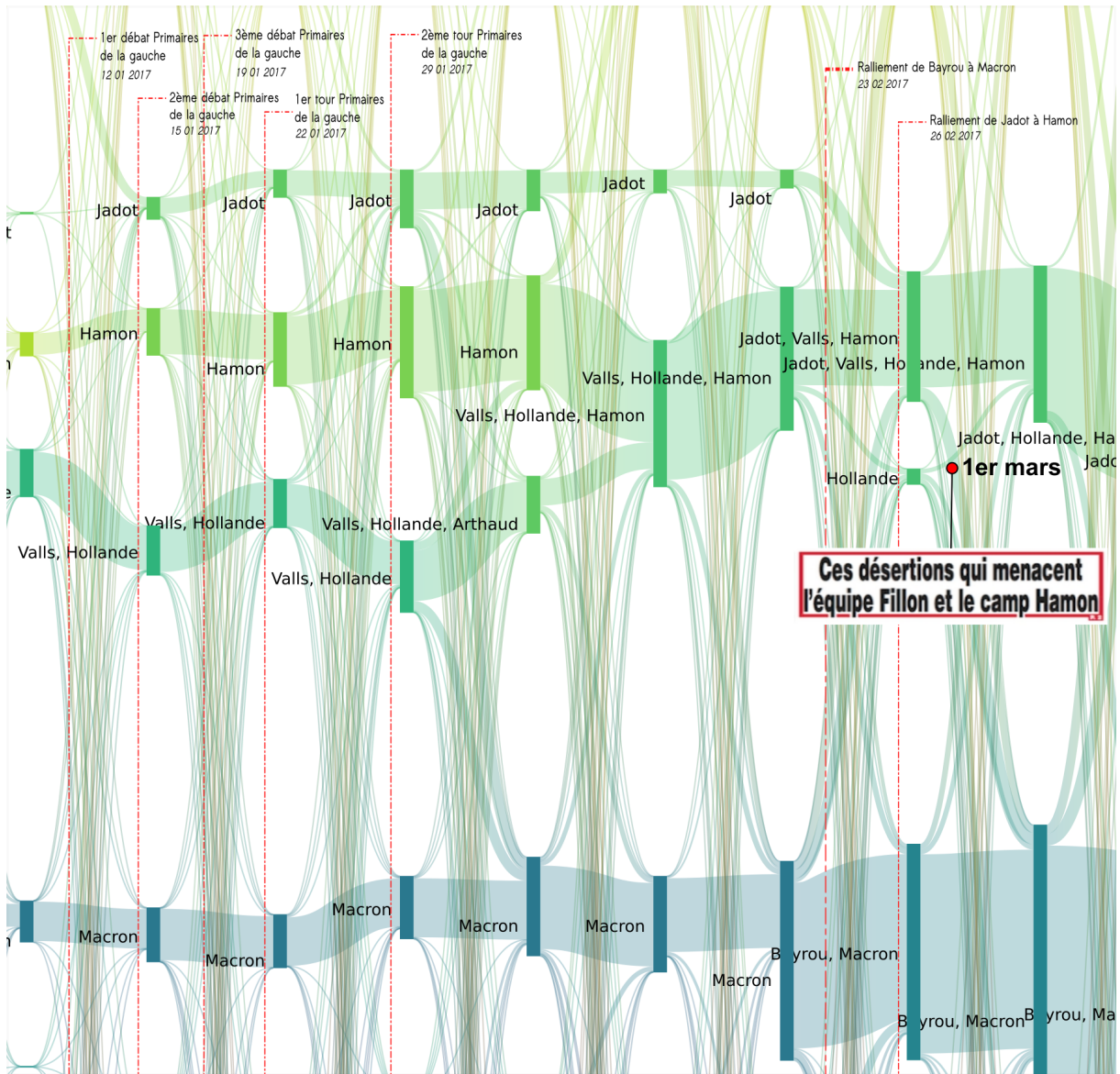


Figure 7: Reconfiguration of political parties at the time of the primaries of the left-wing party. Benoît Hamon (36.03% in the first round and 58.69% in the second round) and Manuel Valls (31.48% in the first round and 41.31% in the second round) were the two favourites of the primaries and represented two different currents in the Parti Socialiste, referred to by Valls as the “irreconcilable lefts” during his campaign. Although François Hollande did not officially state his preference for one particular candidate, Valls declared that he had his support (see for example in *Le Monde* on 4 January, 2017: “According to Valls, he has Hollande’s support”). Indeed, in our reconstruction, during the full period of observation, the Hamon community remains quite separate from the Valls community. For most of the time, the latter community is also the Hollande community, in particular at the time of the primaries, thus revealing the ideological proximity between these two political figures. Following Hamon’s victory, a controversy broke out concerning the commitment made by the primary candidates to align themselves with the winner, whereas some were already clearly indicating their preference for Macron. This indecision is clearly visible on the alluvial graph, with significant movements of activists from the Valls-Hollande community towards the Macron community immediately following the second round of the primary. From the 2075 accounts making up the Valls-Hollande community shortly before its fusion with the Hamon community on February 13 (Valls also joined the Hamon community), only 959 accounts remained. Significant movements of activists continued to take place between these two communities, until the time of the first round of the presidential election. Although Valls finally gave his official support to Macron on March 29, he was no longer present in the Hamon community after March 13. He started appearing in the Macron community on April 17, and remained until the second round, thus indicating his active support. One can also note in this zoom the rallying of the ecologist Jadot to Hamon on February 23, 2017, which is immediately revealed by the fusion of his community with that of Hamon. Each vertical bar corresponds to a political community on Twitter, labelled with the accounts of candidates who were active in the community. The bar’s height is proportional to the number of Twitter accounts belonging to this community. These are computed every Monday.

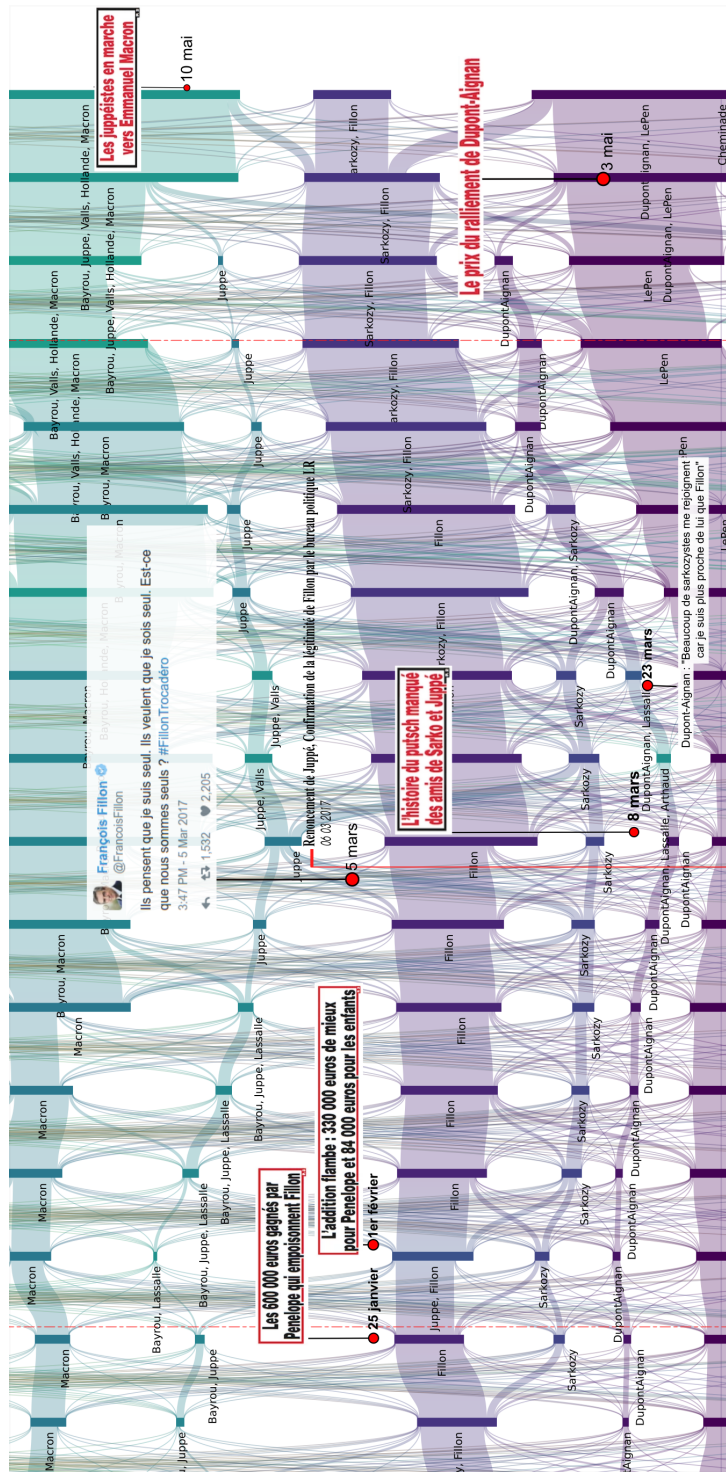


Figure 8: Reconfiguration of political communities at the time of Penelopegate. Penelopegate arrived at a time when Fillon’s following was weakening as a consequence of a controversy surrounding the investiture for parliamentary elections, which was badly received by Sarkozy supporters. Some of these individuals had already started to move away from the *Les Républicains* community, as early as January 23, 2017, and had formed a separate community throughout the full duration of this controversy. Various revelations made by the *Canard Enchaîné* led to major movements of activists between different communities, with the communities supporting Juppé (a potential alternative, i.e. a “plan B”, for Fillon’s candidacy) and Sarkozy being progressively reinforced. On March 1st, the day when Fillon was summoned in the context of his investigation, a large proportion of Sarkozy supporters were in support of Juppé’s return, in a final attempt to push Fillon to resign, which was revealed by an unusual flow of accounts from the Sarkozy community towards that of Juppé. The public gathering that took place on March 5th at the Trocadéro Square (Paris) brought an end to the perspectives of Plan B. Although the Fillon community gained a large number of new activists following this takeover, some of the Sarkozy and Juppé followers kept their distance, and finally joined, respectively, Dupont-Aignan and Macron. Sarkozy himself withdrew for several weeks, which led to his absence from most of the Fillon communities between January 16th and April 10th. It was only from April 7th, that he actively gave his renewed support to Fillon’s candidacy, as was for example mentioned in the *Parisien* headline on that day “*Presidential elections: Sarkozy (finally) supports Fillon*”, and could be seen by his constant presence within the Fillon community starting on April 10th 2017. As can be seen, the bifurcations observed in the *Politoscope* take place at the same time, or in some cases even anticipate comments in the press concerning the activity of political communities. Each vertical bar corresponds to a political community on Twitter, labelled with the accounts of candidates who were active in the community. The bar’s height is proportional to the number of Twitter accounts belonging to this community. These are computed every Monday.

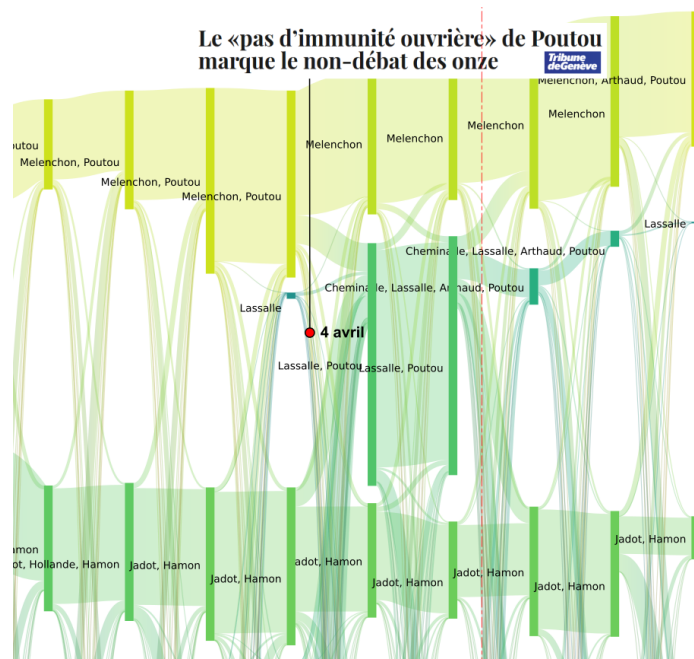


Figure 9: Reconfiguration of political communities at the time of the televised “*Le Grand Débat*” on April 4th, 2017. Philippe Poutou created a buzz during this confrontation when he openly condemned the trickery and corruption of candidates Fillon and Le Pen, by criticising their anti-system attitudes: “*When we are summoned by the police, we have no working-class immunity, we go to the police station.*” His remarks were relayed by most of the media, and received more than 1 million online consultations on YouTube. Following this intervention his Twitter community, which until that time had been almost inexistent, and often overlapped with that of Mélenchon, developed considerably (to more than 13.000 accounts) over a short period of time.

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SUPPLEMENTARY INFORMATION

Methods for the reconstruction of the socio-semantic dynamics of political activist Twitter networks Application to the 2017 French Presidential elections

NOÉ GAUMONT, MAZIYAR PANAHİ & DAVID CHAVALARIAS

Note : Some figures are available in high resolution or in interactive versions at <https://iscpif.fr/projects/politoscope>.

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6 Main political events of the 2017 French presidential campaign

In the spring of 2016, many anticipated a left-right alternation with Alain Juppé being the favorite of all polls. But the 2017 French presidential election were exceptionally eventful with many major upheavals in very short periods and the collapse of the two main candidates (Fillon and Hamon) and parties that had dominated the political scene for more than forty years. Here we present the main milestones of the campaign. Two major international events also took place concurrently, which surprised all analysts and opened possibilities for future elections: Brexit and the election of Donald Trump.

- **2017/06/12:** Interview with Juppé on TF1 deploring his nickname "Ali Juppé" (a defamatory action launched by the extreme right and then taken up by some members of the Sarkozy and Fillon communities during the right-wing primary),
- **2017/06/23:** The United Kingdom votes Brexit,
- **2016/07/14:** Terrorist attack in Nice (86 people killed and 458 injured),
- **2016/08/28:** François Fillon, a candidate for the right-wing primary, attacked his rival Nicolas Sarkozy by asking "Who imagines for a single moment the General de Gaulle put under indictment?". This sentence will be repeated several times during the Penelope Gate when Fillon himself was indicted,
- **2016/08/30:** Macron leaves the government as Minister of Economy and Finance,
- **2016/10/13:** 1st debate of the right-wing primary, Sarkozy and Juppé are the favorites of the polls,
- **2016/11/08:** Election of Donald Trump ,
- **2016/11/03:** 2nd debate of the right-wing primary,
- **2016/11/16:** Macron announces his candidacy announcement,
- **2016/11/17:** 3rd debate of the right-wing primary,
- **2016/11/20:** First round of the right-wing primary lead by Fillon and Juppé,
- **2016/11/27:** Second round of the right-wing primary won by Fillon,
- **2016/12/01:** The incumbent president François Hollande announces that he would not stand for a second term in office,
- **2017/01/12:** 1st debate of the left-wing primary,
- **2017/01/15:** 2sd debate of the left-wing primary,
- **2017/01/17:** Frictions among *les Républicains* after disputed legislative investitures, including that of Nathalie Kosciusko-Morizet (NKM), to whom Fillon offered an easy-to-win district,
- **2017/01/19:** 3rd debate of the left-wing primary. Marine Le Pen, president of the *Front National*, is credited with 25% to 26% of voting intentions in the first round, according to an Ipsos poll published by Le Monde. As for Emmanuel Macron, he is close to François Fillon who becomes less popular in the polls,
- **2017/01/20:** Trump's presidential inauguration. Attack of Rachida Dati (ex. former Minister of Justice of Sarkozy) against NKM investiture,
- **2017/01/21:** Maurice Leroy (UDI and support of Sarkozy during the primary) warns François Fillon,
- **2017/01/22:** First round of the left-wing primary lead by Hamon and Valls,
- **2017/01/25:** The *Canard Enchaîné* unveils the first piece of information on the *Penelope Gate*, which raises suspicions of misappropriation of public funds by Fillon,
- **2017/01/29:** Second round of the left-wing primary won by Hamon,
- **2017/02/21:** Fillon announces its health plan, which differs from previous statements,
- **2017/02/22:** Announcement of Le Pen summon by the anti-corruption office ; she will not attend the summons by the judge,

- **2017/02/23:** Bayrou rallies to Macron,
- **2017/02/26:** Jadot rallies to Hamon,
- **2017/03/01:** Summon of Fillon for an indictment ; several leader of *les Républicains* call for another candidate. Juppé is considered as a possible replacement for Fillon,
- **2017/03/02:** Publication of the political program of *En Marche !*,
- **2017/03/03:** Summon of Le Pen for a possible indictment (parliamentary assistants),
- **2017/03/05:** François Fillon organizes a rally in Trocadéro (Paris). He announces 200 000 attendees (including leading supports of Sarkozy) and presented this as a support to the upholding of his candidacy,
- **2017/03/06:** Juppé publicly renounces all prospect of presidential candidacy. Confirmation of the legitimacy of Fillon by the political bureau of *les Républicains*, which was originally convened to ask that he be dismissed,
- **2017/03/20:** Publication of the official list of candidates by the Constitutional Council,
- **2017/03/20:** Debate on TF1 between five *big* candidates (Mélenchon, Hamon, Macron, Fillon and Le Pen),
- **2017/03/29:** Valls announces that he will vote for Macron,
- **2017/04/04:** Debate on BFMTV with all 11 candidates. Poutou stands out with his commentaries on Le Pen and Fillon judicial troubles,
- **2017/04/16:** European Parliament committee could convene Marine Le Pen before second round of presidential elections,
- **2017/04/20:** Champs élysées terrorist attack during the political show on France 2 in which all candidates were invited to speak. Le Pen radicalises her discourse with a polemic: "colonization has brought a lot [of benefit], especially to Algeria",
- **2017/04/23:** First round of the presidential election lead by Macron and Le Pen. Mélenchon refuses to give voting instruction to his supports, in contradiction to what he did in 2002 (he called to vote against the *Front national*),
- **2017/04/28:** Dupont-Aignan rallies to Le Pen,
- **2017/05/03:** Le Pen's counter-performance during the Macron-Le Pen TV debate between the two rounds.
- **2017/05/07:** Second round of the presidential election won by Macron.

7 Data collection platform

As we aim to analyse how the political space organized during the 2017 French presidential election, we chose to collect data from Twitter and by two complementary methods.

7.1 Collection focused on main political accounts

We established a list of more than 3 700 accounts of French political figures (candidates, deputies, senators, persons with a significant party mandate). We gather informations from these accounts with the follow API of Twitter (see the inset).

The documentation describes exactly the data collected for a followed user account:

From Twitter **follow** API documentation^a. For each user specified, the stream will contain:

- Tweets created by the user.
- Tweets which are retweeted by the user.
- Replies to any Tweet created by the user.
- Retweets of any Tweet created by the user.
- Manual replies, created without pressing a reply button (e.g. “@twitterapi I agree”).

The stream will not contain:

- Tweets mentioning the user (e.g. “Hello @twitterapi!”).
- Manual Retweets created without pressing a Retweet button (e.g. “RT @twitterapi The API is great”).
- Tweets by protected users.

^a<https://dev.twitter.com/streaming/overview/request-parameters>

Given an account X , a content A and $T(X, A)$ a tweet published by X containing A , we collected, within the Twitter API volume limit, for each followed account X and any account Y the tweets $T(X, A)$, $T(Y, T(X, A))$ (e.g. retweet), and if A is a response to X (“@X ...”), all $T(Y, A)$ (see the Fig. 10).

7.2 Collection focused on political terms

The collection of tweets from accounts that are not followed is limited by the follow API limits. To overcome this limitation and get the tweets that cite an important candidate in text, we have compiled a list of candidate related terms (screenname, party name, etc.) and used the track API, which allows to capture all tweets mentioning a given expression (see the inset). Several hashtags have been created specifically for the presidential election to categorize the tweets relevant for this event. We have identified most of them and added them to the list of expressions followed in order to collect tweets mentioning them (e.g; #legranddebat [1 360 502 mentions], #2017ledebat [761 400 mentions]).

From Twitter **track** API documentation^a.

A comma-separated list of phrases which will be used to determine what Tweets will be delivered on the stream. A phrase may be one or more terms separated by spaces, and a phrase will match if all of the terms in the phrase are present in the Tweet, regardless of order and ignoring case. By this model, you can think of commas as logical ORs, while spaces are equivalent to logical ANDs (e.g. ‘the twitter’ is the AND twitter, and ‘the,twitter’ is the OR twitter). The text of the Tweet and some entity fields are considered for matches. Specifically, the text attribute of the Tweet, expanded_url and display_url for links and media, text for hashtags, and screen_name for user mentions are checked for matches.

^a<https://dev.twitter.com/streaming/overview/request-parameters>

This is the list of terms followed with track API:

- | | | |
|-----------------------|-------------------------|-----------------------|
| • presidentielle2017 | • #Marine2017 | • EmmanuelMacron |
| • présidentielle2017 | • #Fillon2017 | • yjadot |
| • #presidentielle2017 | • #Peillon2017 | • n_arthaud |
| • primaires2016 | • #Asselineau2017 | • montebourg |
| • loitravail | • #Macron2017 | • UPR_Asselineau |
| • frexit | • #Marinelepen2017 | • jfpoisson78 |
| • Nuit Debout | • #Mlp2017 MLP_officiel | • JLM2017 |
| • nuitdebout | • FrancoisFillon | • #NDA2017 |
| • #nuitdebout | • fhollande | • dupontaignan |
| • #Fillon | • manuelvalls | • jeanlassalle |
| • #Macron | • alainjuppe | • PhilippePoutou |
| • #PenelopeGate | • nk_m | • n_arthaud |
| • #Hamon2017 | • JLMelenchon | • manuelvalls |
| • #Valls2017 | • NicolasSarkozy | • #legranddebat |
| • #Montebourg2017 | • benoithamon | • presidentielles2017 |

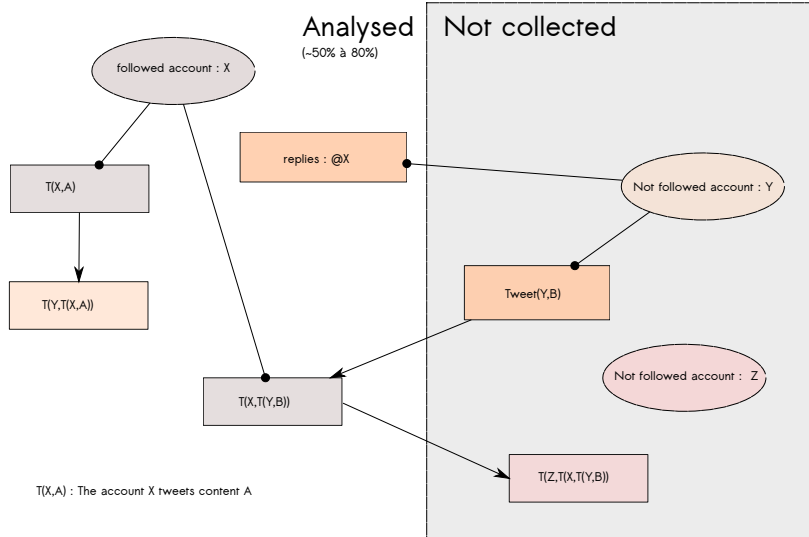


Figure 10: Description of the capture protocol centred on political leaders. This is complemented by a keyword-centric capture protocol (Twitter track API).

- présidentielle2017
- présidentielle
- presidentielle
- jevote
- avote
- avoté
- sansmoiLe7mai
- Debat2017
- 2017LeDebat
- jamaismacron
- jamaislepen
- jamaismarine
- jamaislefn
- JeVoteMarine
- JeVoteMacron
- ChoisirLaFrance
- Dupont-Aignan
- enmarche
- frontnational
- #mfga

The Twitter API is, in its free version, only a sample of the Twitter traffic. We estimated the proportion of retweet captured by comparing the amount of retweets actually captured by our platform to the number of retweets reported by Twitter in the meta-data stored in the last retweet.

For each day t and each original tweet Tw in this day, we denote the number of retweets captured by $n_t^c(Tw)$ and by $n_t^m(Tw)$ the maximum number of retweets reported by Twitter. We define the proportion of captured retweets by:

$$\nu(t) = \frac{\sum_{\{Tw\}} n_t^c(Tw)}{\sum_{\{Tw\}} n_t^m(Tw)}$$

Fig. 11 presents the evolution of the daily proportion of captured retweets as well as the total number of Tweet captured. This proportion is variable through the days and depends on Twitter in an unspecified way. On average, we captured 34% of retweets.

As Twitter does not publish the code for its API, we do not know the sampling process used by the API. In particular, we don't know if the number of retweets mentioned in the meta-data is one the feature used to select which retweet is sampled. Nevertheless, we can reasonably believe that the proportion of tweets captured (mention, quotations, etc.) by our platform is in the order of 34% of the total tweets corresponding to our capture criteria.

However, our results show that this sampling uncertainty imposed by the Twitter APIs is not a hindrance to analysing the dynamics of political communities.

7.3 List of the followed political figures

For the French presidential election, they were two primaries organized by the two main parties: the *Parti Socialiste* (left) and *Les républicains* (right). The presidential election candidates and the main candidates of the primaries were followed by the *track* and *follow* API.

We followed the following political figures:

- | | |
|--|---|
| <p>Presidential election candidates (sorted by score)</p> <ol style="list-style-type: none"> 1. Emmanuel Macron (EM) 2. Marine Le Pen (FN) 3. François Fillon (LR) 4. Jean-Luc Mélenchon (FI) | <ol style="list-style-type: none"> 5. Benoît Hamon (PS) 6. Nicolas Dupont-Aignan (DF) (UPR) 7. Jean Lassalle 8. Philippe Poutou (NPA) 9. François Asselineau |
|--|---|

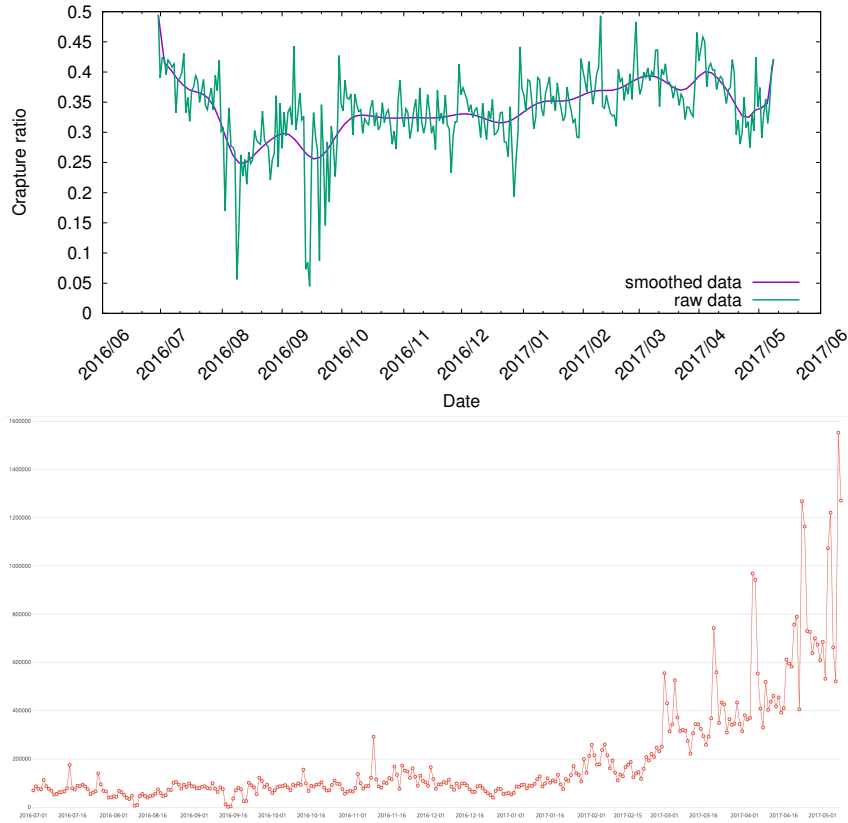


Figure 11: *Up*: Evolution of retweet capture rate over time. Some low points correspond to server failures. *Bottom*: Daily number of tweets collected.

10. Nathalie Arthaud (LO)

Main candidates of the primaries

- Yves Jadot (EEV - rallied to Hamon)
- Emmanuel Valls (former prime minister and candidate to the left-wing primary)
- Arnaud Montebourg (former minister and candidate to the left primary)
- Vincent Peillon (former minister and candidate to the left-wing primary)
- François Hollande (Outgoing president)
- Alain Juppé (former prime minister, poll favourite for the right-wing primary)
- Nathalie Kosciusko-Morizet (former minister and candidate to the right-wing primary)
- Nicolas Sarkozy (Former president and candidate to the right-wing primary)
- Jean-Frédéric Poisson (candidate to the right-wing primary)

7.4 Platform architecture

The crawling device was set up on 1 June 2016 using the CNRS/ISC-PIF Multivac infrastructure (<https://multivac.iscpif.fr> see Fig. 12). It operated continuously until the day after the presidential election, with the exception of rare interruptions for maintenance of our servers (between 13-09-2016 and 15-09-2016 and between 21-09-2016 and 22-09-2016). Between June 1st 2016 and May 7 2017 (the second round of the presidential election), we collected 60 326 216 tweets created by 2 477 910 unique accounts.

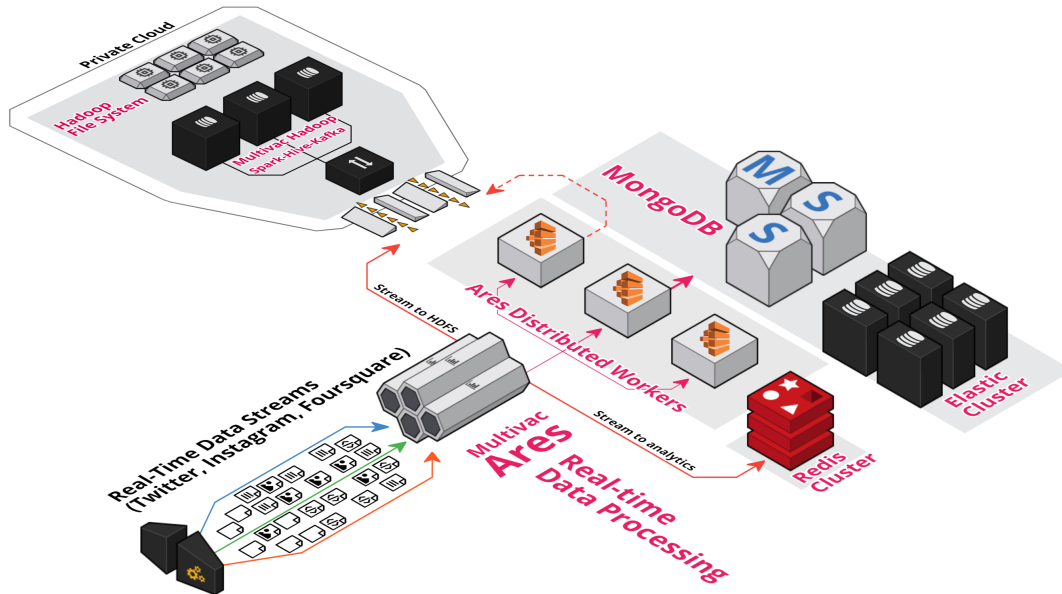


Figure 12: A synthetic description of the Multivac infrastructure used to set up the real-time analysis system of the tweets. This infrastructure leverages technologies such as Elasticsearch, Apache Hadoop, RabbitMQ, MongoDB ou Redis.

TWITTER DATA ANALYTICS ARCHITECTURE (see also Fig. 12)

Real-time data processing and micro services

- Elasticsearch Cluster (highly available and distributed)
 - Primary database with over 4 billion indexed documents
 - Full-text search
 - Indexing keywords
 - Data aggregation (date histogram, significant, terms, nested, etc.)
- MongoDB
 - Secondary database with over 8 billions of data
- RabbitMQ
 - Distributing Tweets to workers for parallel computations
- Node.js
 - Streaming Tweets by tracking and following Twitter accounts
 - Scalable workers: annotating and tagging Tweets in realtime
 - Extracting Tweets content
- Redis
 - Caching
 - In-memory analysis

Offline and batch processing: Hadoop cluster

- HDFS (Hadoop distributed file system)
- Apache Hadoop YARN: Managing cluster resources
- Apache kafka: Streaming data for batch processing
- Apache Spark
 - ETL
 - Pre-processing data
- Apache Hive: Run SQL queries in Hadoop

8 Bots detection

Robots or *bots* are often used to control a Twitter account and increase its online presence. If this usage were too massive, it could prevent us to analyse the behaviour of political activists. To ensure that the proportion of bots animated accounts is at a reasonable level, we use the BotOrNot API to detect

accounts that might not be animated by "real" users.

The API returns for each account its probability to be a bot. With the same threshold of 0.5 used by the API designer to classify an account as a bot, there are around 5.3% of the accounts that belonged to a community that are bots. These accounts produced less than 5% of the retweets registered in the communities (see tables 3 and 4).

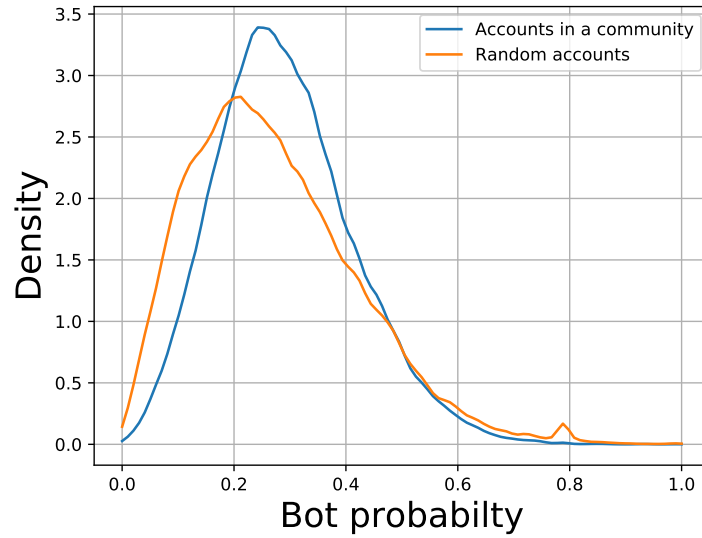


Figure 13: Distribution of bot probability for accounts that have been at least once in a community (blue curve) and randomly taken accounts (orange curve). This detection was carried out in June 2016.

Name	< <i>accounts</i> >	< <i>bots</i> >	% de bot
Jean-Luc Mélenchon	804	30	3.7 %
Emmanuel Macron	994	44	4.4 %
Nathalie arthaud	192	10	5.4 %
Marine Le Pen	1560	70	4.5 %
François Asselineau	213	14	6.5 %
Nicolas Dupont-Aignan	210	9	4.1 %
Manuel Valls	890	46	5.1 %
Yan Jadot	528	30	5.6 %
alainjuppe	432	23	5.4 %
Benoit Hamon	561	31	5.6 %
Jacque Cheminade	109	7	6.1 %
Nicolas Sarkozy	959	46	4.8 %
Philippe Poutou	478	20	4.2 %
François Fillon	1340	68	5.1 %
François Hollande	904	45	5.0 %
François Bayrou	932	40	4.3 %

Table 3: Table showing the average number of accounts per period and per community (< *accounts* >) as well as the average number of bots detected per period per community (< *bots* >).

9 Lifetime of tweet and Twitter activity patterns

Political activity on Twitter has a certain regularity which is the coupling between an endogenous activity (day/night, week/w.e.) and exogenous activity that depends on current political events. The average over the whole corpus clearly shows a weekly regularity (see Fig. 14).

Regarding the typical retweet time, 89.005% of the retweets take place within 24h after the release of the original tweet and 98.977% take place within 14 days.

Tweet type	Political bots	Random bots
Original	7.2%	7.4%
Retweet sec	4.8%	3.7%
Response	0.9%	1.8%
Quote	3.4%	1.5%
Total	4.7%	3.9%
Account proportion	5.1%	6.8%

Table 4: Proportion of tweets posted by bots among political communities and by bots among randomly selected accounts. For example, bots in political communities emitted 7.2% of the original tweets issued by all accounts being in a political community.

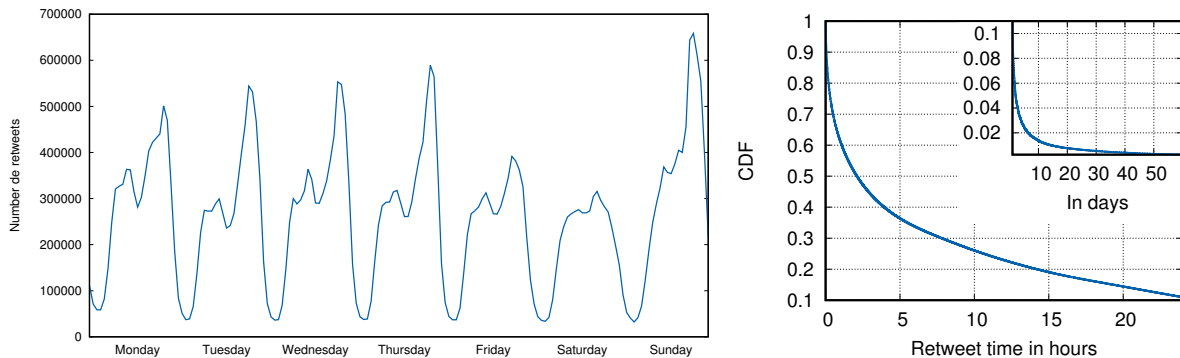


Figure 14: *On the left*: Number of retweets observed per day and hour between 1 July 2016 and 2 May 2016; *on the right*: Cumulative distribution of retweet time.

10 Correlation between community structure and retweets patterns

We analysed the detail of the retweets patterns to validate the H_0 hypothesis, intuitive according to our reconstruction method, that the diffusion of retweets is strongly constrained by the calculated community structure. We checked that the retweets motives by communities are very different from what they would be if they were randomly distributed across communities by analysing the diffusion patterns for tweets with a sufficient number of retweets (≥ 50). Through our device, we have captured 4,124,888 original tweets that totalled 39,284,569 retweets. Of these 4 million tweets, only 118,967 had 50 retweets or more but they totalled 21,288,537 of retweets (54% of all retweets). By requiring that retweets come from accounts affiliated to a community, we get 82,112 original tweets totalling 12,076,600 retweets (31% of all retweets). Between June 1st 2016 and May 7th 2017, we processed for each day j , the N^j political communities provided by our methodology, $\mathcal{C}^j = \{C_i^j\}_{1 \leq i \leq N^j}$, and created a sub-corpus of original tweets \mathcal{D}_{50}^j composed of tweets that have been retweeted at least 50 times by people whose communities are known within the next 14 days after j , *i.e.* on a dataset independent of the dataset used to calculate the communities.

Over this period, we calculated the number q_i^j of retweets from \mathcal{D}_{50}^j produced by all the C_i^j . We get the distribution $Q^j = \{q_i^j\}_{1 \leq i \leq N^j}$ of the retweets from \mathcal{D}_{50}^j by the C_i^j communities. From this, we process the χ^2 distance between this distribution and the distribution of retweets $\mathcal{P}^j(tw) = \{p(tw)_i^j\}_{1 \leq i \leq N^j}$ from each tweets tw from \mathcal{D}_{50}^j :

$$\chi^2(P(tw), Q) = \sum_i \frac{(P(tw)_i - Q_i)^2}{Q_i}$$

Based on this analysis over all periods, H_0 is true for 92% of diffusions with a p -value less than 10^{-16} . Considering a threshold of p -value of 1%, 99.8% of tweets emitted by communities have a very different retweets diffusion pattern compared to a random diffusion in the communities.

11 State of the political landscape before the start of the 2017 presidential campaign

In order to propose a visualization of the state of the political twittosphere before the presidential campaign, we calculated the retweet graph over the period August 2016 - December 2017, highlighted the

5—communities (dense and colored parts of the map) and spatialized the resulting graph with Gephi software (cf. Fig. 15). Although the right-wing primary could have begun to change the political landscape over this period, this map, which we published on the Politoscope website and which was used as the image of the week in the newspaper *Le Monde* (Supplement *Science and Medicine*) offers an accurate representation of the political landscape. Its relevance was confirmed by the subsequent alliances that took place while respecting the personalities' proximities within this map.

12 Characterization of the themes of the 2017 presidential campaign

In order to characterize the different debates and stakes of this presidential campaign, we have carried out an analysis of the political discourse in order to extract the main key expressions. This was done using two types of sources: policy measures reported in campaign programs, written in developed language, and candidate tweets, written in frequently spoken language.

For the analysis of candidates' programmes, we first contacted all the campaign teams on 1 March 2017 that were about to achieve to collect the 500 signatures from French mayors (these signatures were required to be able to become an official candidate ; the Constitutional Council published the official list of candidates only on 20 March 2017). We invite them to provide us with their programme elements and key expressions that they would consider characteristic of their program. Unsurprisingly, we had almost no response, only the team of a "small" candidate indicated to us that given the size of the campaign team, she was not sure she could participate.

We then used the programs of the eleven candidates found on their websites (downloaded between February 14 and March 24, 2017) from which we manually extracted 980 policy measures.

To complement this corpus, we extracted from the Politoscope database 25,883 tweets published by the eleven candidates and few other important political figures (see 7) between August 2016 and January 2017. This second corpus has the advantage of highlighting the themes that emerged during the political debates, independently of the candidates' programmatic orientations.

We analysed these two corpus using the Gargantext text-mining software (<https://gargantext.org>) and identified a vocabulary of nearly 1500 groups of expressions qualifying the themes of the presidential campaign (see section 13.1 for the list of expressions). Gargantext is a free text-mining analysis software developed by the CNRS at the Institute of Complex Systems of Paris Île-de-France. It allows the user to interact with advanced text-mining algorithms and visualizations synthesizing the contents of corpora in order to bring her own expertise and provide a multi-scale representation of its contents (important expressions, important documents, themes, articulation of themes and their evolution).

Using the thematic map produced by Gargantext (see Fig. 16), we were able to identify the main themes discussed by the candidates and their audience during this campaign.

We relied on this map to select eleven themes that we felt were particularly important and representative of the debates (see description in 12.2). Our objective was not to be exhaustive but to highlight the thematic heterogeneities of the political communities and their respective specializations on certain major themes.

12.1 Evolution of community vocabulary

The companion platform of this article, the *Politoscope* (<https://presidentielle2017.politoscope.org/dashboard>) proposes to monitor the use of the 15 keywords most specific to each of the main political communities when they deal with each of the eleven selected themes. These keywords were identified using the aggregation algorithm based on the χ^2 test implemented in Elasticsearch⁹.

It can be observed that, in addition to local semantic specificities at the level of the communities, the use of the vocabulary evolves over time for the different communities, with certain terms appearing, strengthening or disappearing along the way.

Here are a few examples, the reader can refer to the platform for an exhaustive exploration.

12.2 Definition of the themes through queries

With the help of the map presented in Fig. 16, we selected eleven themes that we felt were particularly important and representative of the political debates. Our objective was not to be exhaustive but to highlight the heterogeneity of attention of the political communities toward themes and their respective specializations on certain major themes. For each theme, the groups of terms identified by Gargantext on policy measures have been reworked to remove overly polysemic terms and add expressions from the

⁹See <https://www.elastic.co/guide/en/elasticsearch/reference/current/search-aggregations-bucket-significantterms-aggregation.html> et Manning et al., Chapter 13.5.2 - <https://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf>

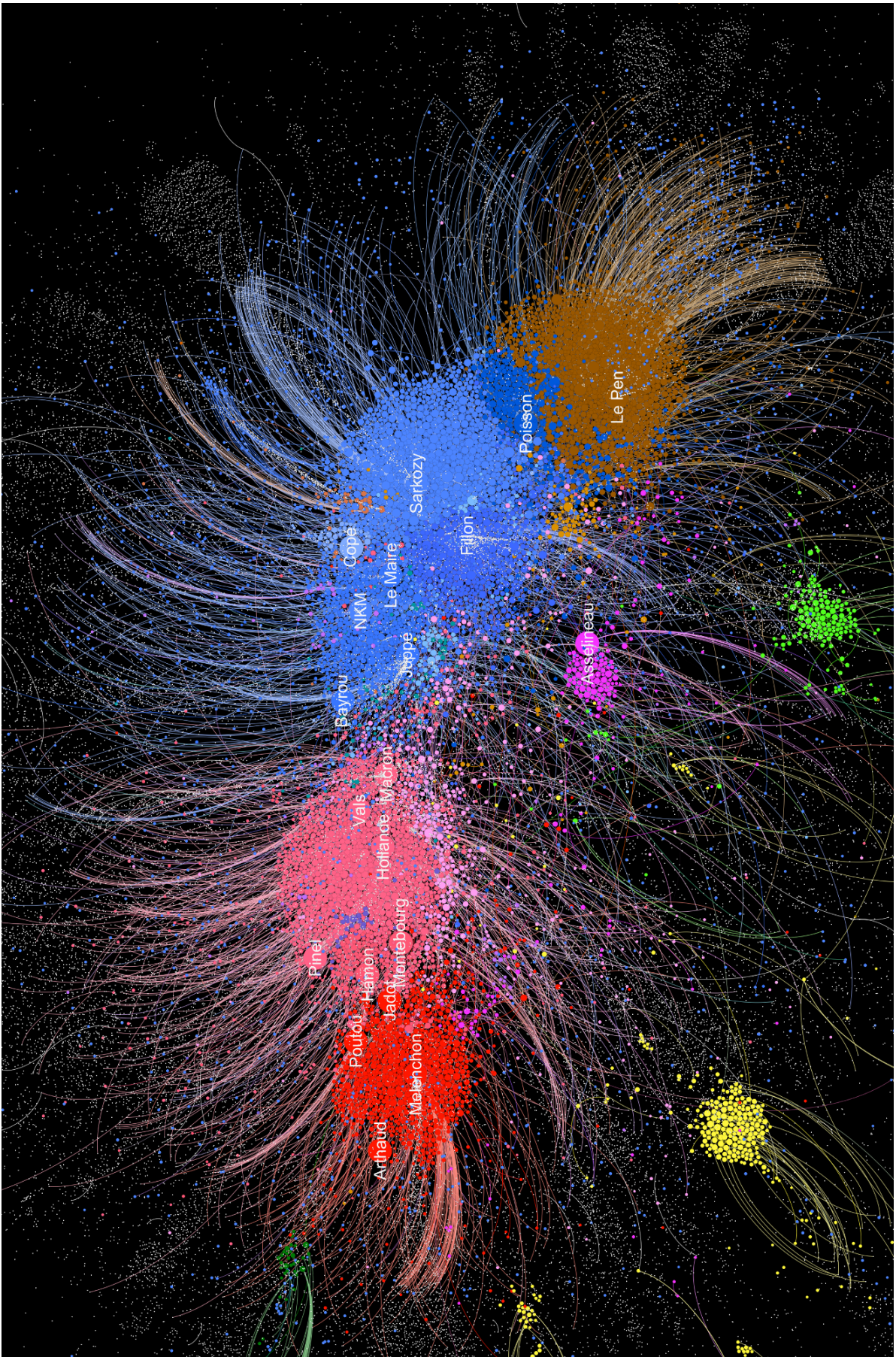


Figure 15: Graph of the 5–communities of the French political twittosphere calculated over the period August 1st 2016 - December 31th 2016. The multipolar political landscape is clearly visible with a position on a left-right axis for most political parties. It should be noted that the alliances observed during the political campaign took place between political personalities that were close on this map : Hamon-Jadot and Macron-Bayrou. The right-wing (*Republicans*, blue) is divided into several currents which are reflected by different communities. The Juppé community is at the left of the right-wing while the Fillon and Sarkozy communities are close from each other and much more at the right. The latter two will merge after the right-wing primary while the Juppé community will gradually migrates to the Maron community. The Socialist Party is also made up of a "left-wing" (Community with Hamon, Montebourg and Pinel community) and a "right-wing" (Holland, Valls). Source: Chavalarias D., Gaumont G. & Panahi M., La Drôle de Galaxie Politique sur Twitter, *Le Monde* (Supplement *Science and Medicine*, Apr. 28 2017.

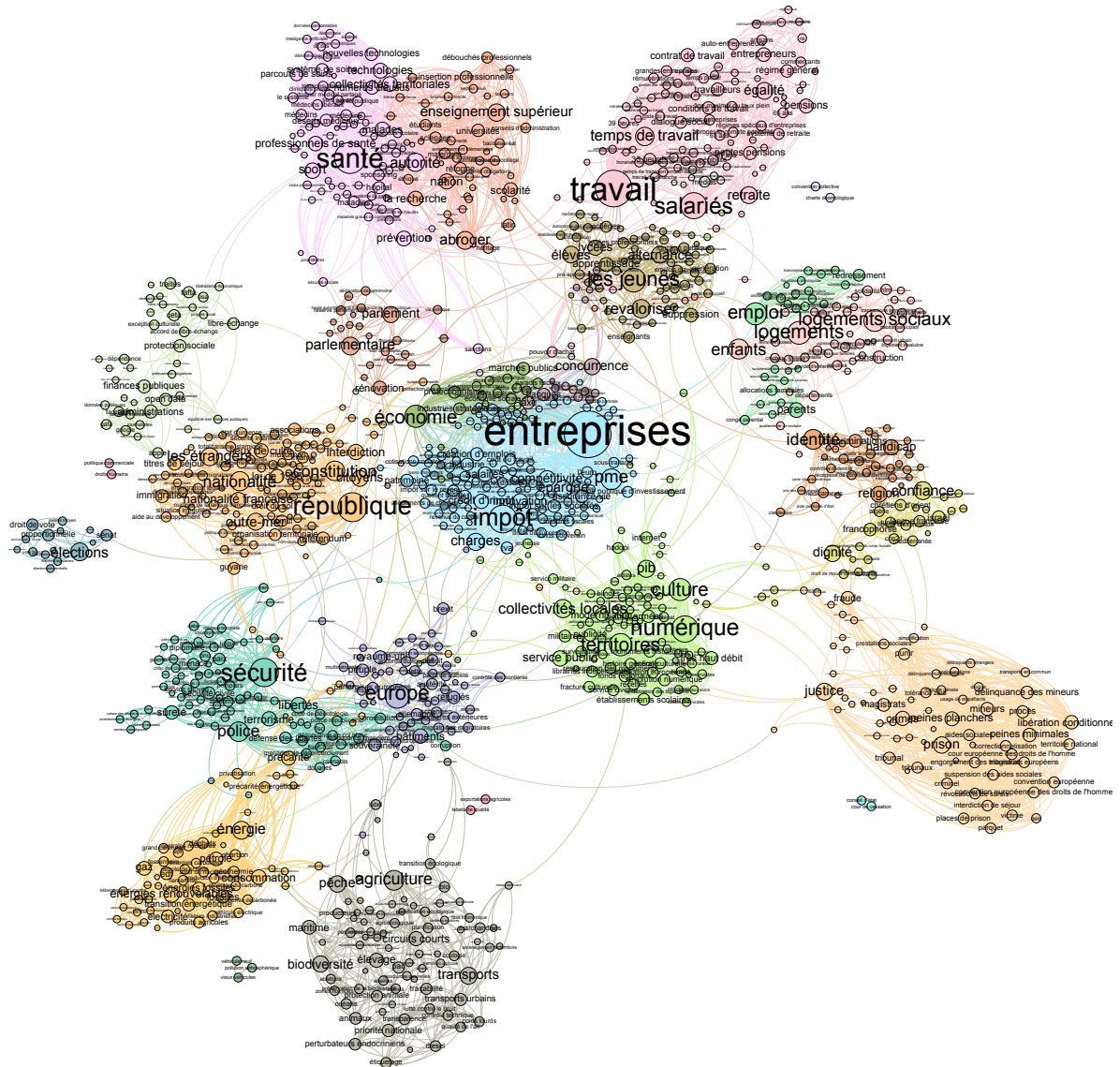


Figure 16: Map of the themes covered in the 2017 presidential programs, drawn up using Gargantext from the set of policy measures taken from the candidates' programs. The nodes of the map are labels for groups of terms deemed equivalent in political discourse. The links between a label *A* and a label *B* indicate that the probability that *A* and *B* are jointly mobilized in the same political measure is high. Gargantext applies the Louvain algorithm to identify clusters of labels with strong interaction between them and displays them in the same colour. To improve visibility, the map was edited in the Gephi software (<https://gephi.org>) to set the size of nodes and labels according to a monotonous function of their PageRank (Page, L., Brin, S., Motwani, R., & Winograd, T. (1999). The PageRank citation ranking: Bringing order to the web. Stanford InfoLab.

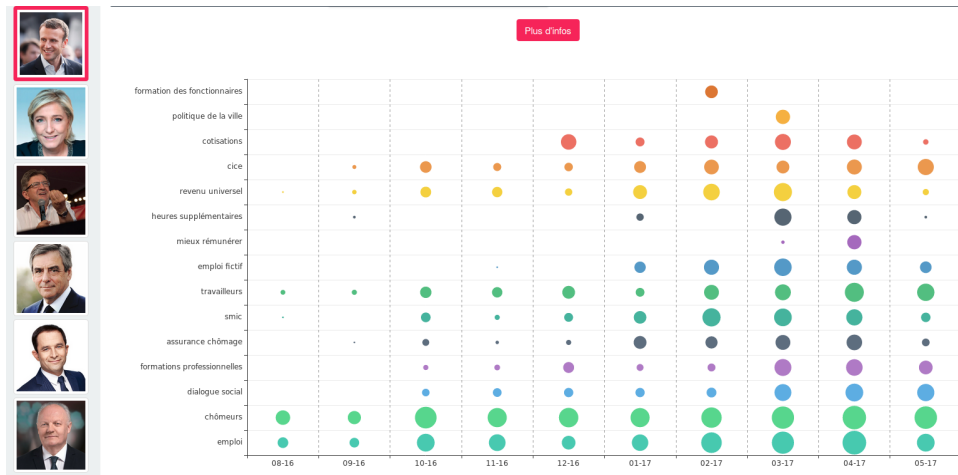


Figure 17: Monthly evolution of the use of the 15 most specific terms in the Macron community for the topic *employment*.

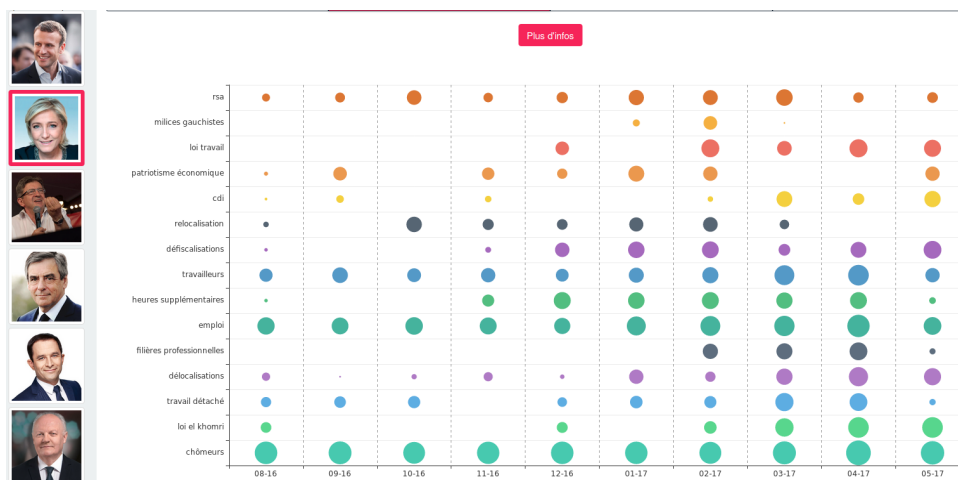


Figure 18: Monthly evolution of the use of the 15 most specific terms in the Le Pen community for the topic *employment*.

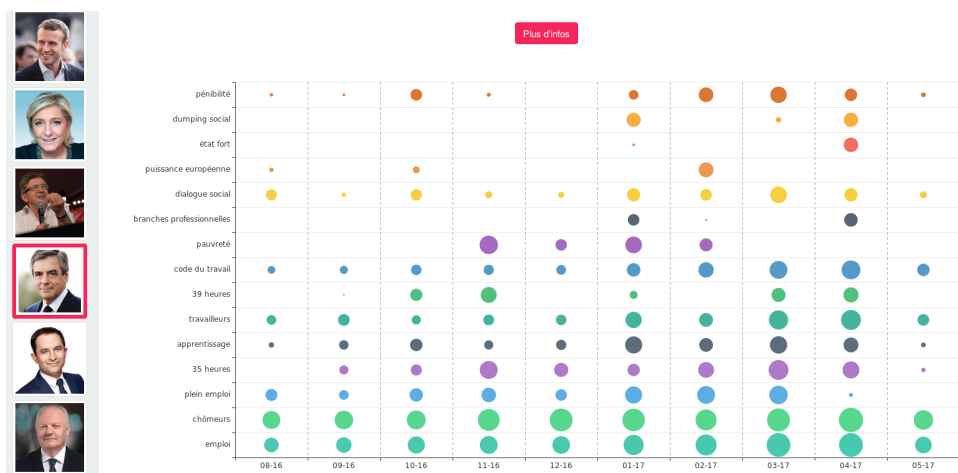


Figure 19: Monthly evolution of the use of the 15 most specific terms in the Fillon community for the topic *employment*.

analysis of tweets. The objective was to obtain a query able to extract from the Politoscope database a set of coherent tweets related to this theme.

By way of example, the translation of the first query defining *employment* is:

- **Employment:** worker * OR "employment" OR "apprenticeship" OR "unemployment" OR unemployed OR "rsa" OR "smic" OR "flexisecurity" OR "vocational training" OR "professional integration" OR "vocational school" OR "initial training" OR "overtime hours" OR "part-time work" OR "professionalisation contract" OR "work conditions" OR "precarious jobs" OR "vocational and technological education" OR "vocational and technological education" OR

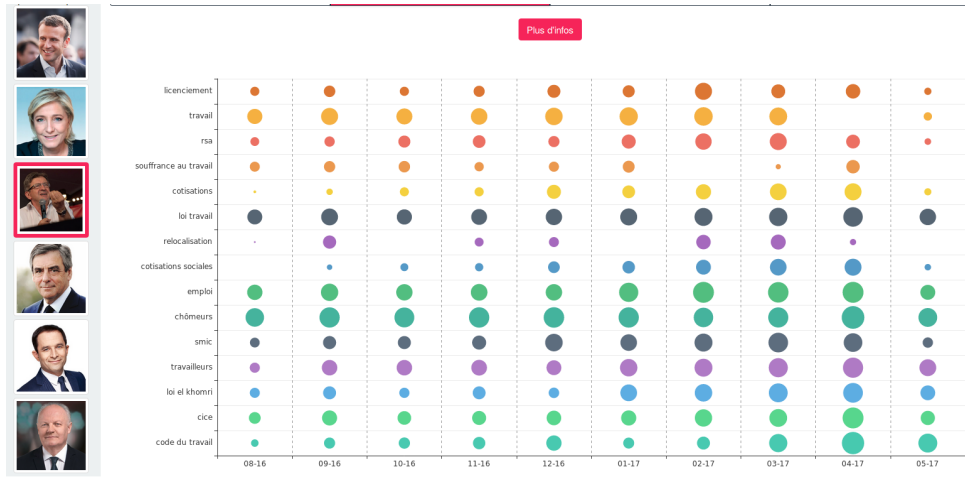


Figure 20: Monthly evolution of the use of the 15 most specific terms in the Mélenchon community for the topic *employment*.

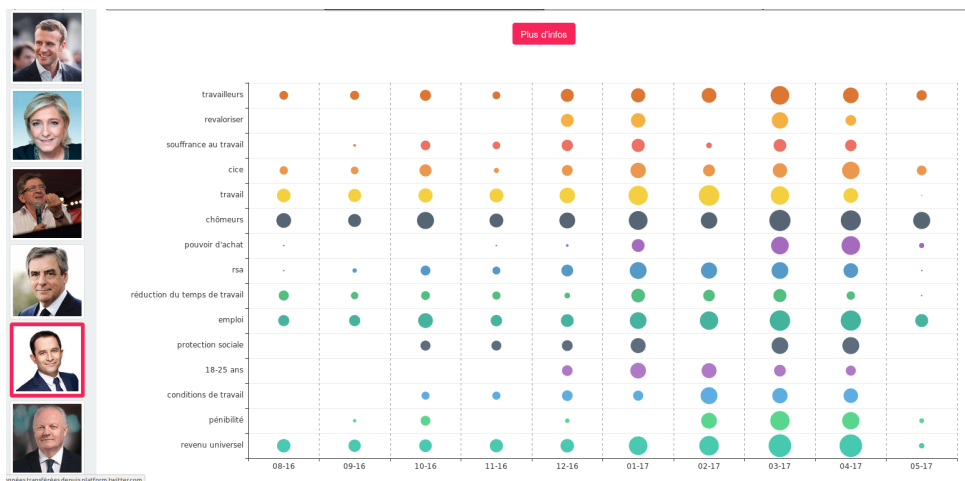


Figure 21: Monthly evolution of the use of the 15 most specific terms in the Hamon community for the topic *employment*.

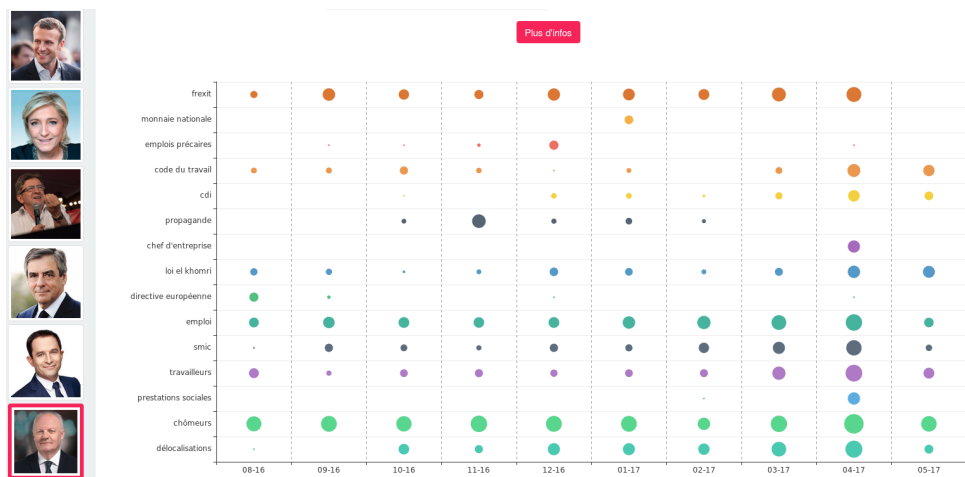


Figure 22: Monthly evolution of the use of the 15 most specific terms in the Asselineau community for the topic *employment*.

"wage compensation" OR "39 hours" OR "social security contributions" OR "employers" OR "vocational training" OR "35 hours" OR "tutoring" OR "Pole employment" OR "entrepreneurship" OR "hourly wage" OR "wage negotiation" OR "social contribution exemptions" OR "integration of young people" OR "career path" OR "dismissal" OR "compulsory work" OR "37 hours" OR "contrat de génération" OR "loi travail" OR "increase salary" OR "bonus for employment" OR "labour code" OR "training of government officials" OR "social dialogue" OR "salary of government officials" OR "law El Khomri" OR "subcontractors" OR "become entrepreneurs" OR "suffering at work" OR "freeze of wages" OR "obligation for them to accept a job" OR "control of the wage mass" OR "no replacement of one government official in two" OR "job suppression" OR "handicraft" OR "reduction of working time" OR "RTT"

OR "cice" OR "occupational mobility" OR "legal retirement age" OR "solidary retirement" OR "solidary pension" OR "hardship" OR "average salary" OR "cdd" OR "cdd" OR "relocation" OR "universal income" OR "revenu universel" OR "employment contract" OR "unionisation" OR "social security contributions" OR "posting of workers" OR "posted workers" OR "delocalization" OR "relocation" OR "social plans"

The elven themes were defined by the following queries:

- Employment:** travailleur* OR emploi* OR "apprentissage" OR "chômage" OR "chômeur*" OR "rsa" OR "smic" OR "flexisécurité" OR "formation professionnelle" OR "insertion professionnelle" OR "lycées professionnels" OR "formation initiale" OR "heures supplémentaires" OR "temps partiel" OR "contrat de professionnalisation" OR "conditions de travail" OR "emplois précaires" OR "enseignement professionnel et technologique" OR "compensation salariale" OR "39 heures" OR "charges sociales salariales" OR "employeurs" OR "filères professionnelles" OR "35 heures" OR "tutorat" OR "pôle emploi" OR "création d'entreprise" OR "salaire horaire" OR "négociation salariale" OR "exonérations de cotisation sociale" OR "insertion des jeunes" OR "parcours professionnels" OR "licencement*" OR "travail obligatoires" OR "jeune en alternance" OR "37 heures" OR "contrat de génération" OR "loi travail" OR "augmenter le salaire" OR "prime pour l'emploi" OR "code du travail" OR "formation des fonctionnaires" OR "dialogue social" OR "salaire des fonctionnaires" OR "loi el khomri" OR "sous-traitants" OR "devenir entrepreneurs" OR "souffrance au travail" OR "gel des traitements" OR "obligation pour eux d'accepter un emploi" OR "maîtrise de la masse salariale" OR "non remplacement d'un fonctionnaire sur deux" OR "suppressions de postes" OR "artisanat" OR "réduction du temps de travail" OR "RTT" OR "cice" OR "mobilité professionnelle" OR "âge légal de départ à la retraite" OR "retraite solidaire" OR "pénibilité" OR "salaire moyen" OR "cdd" OR "cdd" OR "délocalisations" OR "relocalisation" OR "revenu universel" OR "revenu universel" OR "contrat de travail" OR "syndicalisation" OR "cotisations sociales" OR "détachement des travailleurs" OR "travailleurs détachés" OR "délocalisation" OR "relocalisation" OR "plans sociaux"
- Economy & Taxation** "révolution fiscale" OR "coût de la vie" OR "pouvoir d'achat" OR "libre échange" OR "libéralisme économique" OR "économie sociale et solidaire" OR "entreprise*" OR "pme" OR "pmi" OR "actionnaire*" OR "relocalisation*" OR "crédit impôt" OR "nationalisation*" OR "commerçant*" OR "plus-values" OR "délocalisation*" OR "scop" OR "niches fiscales" OR "gafa" OR "cice" OR "taux d'imposition" OR "retenue à la source" OR "crédit impôt-recherche" OR "impôt sur les sociétés" OR "services innovants" OR "marchés publics" OR "livret d'épargne industrie" OR "exportation" OR "impôt sur la fortune" OR "conseils d'administration" OR "small business act" OR "surplus" OR "capital-risque" OR "comités de rémunération" OR "représentants des salariés" OR "harmonisation fiscale" OR "complexité administrative" OR "reprise d'entreprises" OR "stock options" OR "start-ups" OR "pme européennes" OR "commandes publiques" OR "fiscalité européenne" OR "impôt minimal" OR "chiffre d'affaires mondial" OR "prélèvement à la source" OR "échanges commerciaux" OR "travailleurs handicapés" OR "commerce indépendant" OR "politique commerciale" OR "développement économique" OR "politique commerciale" OR "charges patronales" OR "tva anti-délocalisations" OR "allègements de charges" OR "cice" OR "alléger les charges patronales" OR "allègement des charges patronales" OR "centrales d'achat" OR "concurrence internationale" OR "exploitations familiales" OR "financiarisation" OR "travailleurs indépendants" OR "liberté syndicale" OR "austérité" OR "fisc*" OR "impôt" OR "imposition" OR "cotisations sociales" OR "retenue à la source" OR "tranche supplémentaire" OR "isf" OR "prélèvement à la source" OR "cotisations chômage" OR "exonérations de cotisation sociale" OR "tva" OR "charges patronales" OR "tva" OR "csg" OR "taxe" OR "allègements de charges" OR "cice" OR "trésor public" OR "droits de mutation" OR "dette des états" OR "dette de l'états" OR "dette publique" OR "banque*" OR "financi*" OR "subprimes" OR "bancaire*" OR "épargne" OR "spécul*" OR "livret A" OR "agios" OR "taux d'usure" OR "emprunt*" OR "agence de notation" OR "crédit à la consommation" OR "surendettement" OR "assurance-vie" OR "loi sapin" OR "banque centrale européenne" OR "euro-obligations" OR "pacte de responsabilité" OR "taxe mondiale sur les transactions financières" OR "taxe Tobin" OR "dépôts des particuliers" OR "crise bancaire" OR "crise financière" OR "trader*" OR "ras-le-bol fiscal"
- Democracy** "front républicain" OR "ni-ni" OR "non-cumul des mandats" OR "conseil constitutionnel" OR "ve république" OR "6e république" OR "6eme république" OR "5e république" OR "vie politique" OR "données publiques" OR "%penelope%" OR "%pénélope%" OR "%pénélope%" OR "démocratie sociale" OR "cour des comptes" OR "proportionnelle" OR "parité" OR "assemblée nationale" OR "élections législatives" OR "fonction publique territoriale" OR "formation des fonctionnaires" OR "durée du quinquennat" OR "préfet" OR "établissements publics" OR "cour européenne des droits de l'Homme" OR "préférence nationale" OR "nationalistes" OR "patriotes" OR "progressistes" OR "%penelope%" OR "parlement*" OR "élu*" OR "corruption" OR "ena" OR "révisions constitutionnelles" OR "réserve parlementaire" OR "statut pénal du chef de l'état" OR "scandale" OR (marine AND 300000) OR (marine AND "300 000") OR ("Le Pen" AND 300000) OR ("le pen" AND "300 000") OR "inéligibilité" OR "fonction présidentielle" OR "e-démocratie" OR "49.3" OR "déclaration de patrimoine" OR "égalité républicaine"
- Research & Education:** lycé* OR "pisa" OR "éducation" OR "apprentissage*" OR "maternelle" OR "décrochage scolaire" OR "scolarité" OR "scolaire" OR "service civique" OR "savoirs fondamentaux" OR "méthodes pédagogiques" OR "enseignement professionnel et technologique" OR "établissements scolaires" OR "tutorat" OR "échec scolaire" OR "écoles d'ingénieurs" OR "financer leurs études" OR "banque de la jeunesse" OR "écoles de commerce" OR "e-learning" OR "éducation artistique" OR "enseignement primaire" OR "universit*" OR "la recherche" OR "chercheur*" OR "R&D" science* OR scientifique* OR enseignant* OR professeur* OR "loi lru" OR "enseignants-chercheurs" OR "enseignement supérieur" OR "grandes écoles" OR "investissements d'avenir" OR "loi fioraso" OR "crédit impôt-recherche" OR "conseil national des universités" OR "CNU" OR "autonomie des universités" OR "universités" OR "ZEP"
- Immigration & Multiculturalism:** migr* OR immigr* OR "nationalité" OR "clandest*" OR "droit de séjour" OR "schengen" OR "pays d'origine" OR "contrôle des frontières" OR "réadmission" OR "régularisations" OR "regroupement familial" OR "naturalisation*" OR "reconduites à la frontière" OR "titres de séjour" OR "procédures d'expulsion" OR "séjour des étrangers" OR "libre circulation des personnes" OR "connaissance préalable de la langue française" OR "intégration des étrangers" OR "citoyenneté française" OR "droit du sol" OR "droit du sang" OR "islam*" OR "musul*" OR "muzz*" OR "salaf*" OR "burkini" OR "barbarie" OR "laïcité" OR "juif" OR "juive" OR "chrétien*" OR "communautarisme" OR "multiculturalisme" OR "modèle républicain" OR "identité nationale" OR "civilisation française" OR "port du voile" OR "préférence raciale" OR "race" OR "demande d'asile" OR "submersion migratoire"
- Health:** "santé" OR "médecin*" OR "médic*" OR "hôpital*" OR "sécurité sociale" OR "autisme" OR "handicap*" OR "mdph" OR "désamiantage" OR "cancer" OR "assurance-maladie" OR "hébergement en établissement" OR "maintien à domicile" OR "soins d'urgence" OR "urgences sanitaires" OR "maladies" OR "perturbateurs endocriniens"

OR "accès aux soins" OR "hospitalisation" OR "soins dispensés" OR "parcours de soins" OR "centre de soin"
 OR "malentendants" OR "malvoyants" OR "dépassements d'honoraires" OR "transports sanitaires" OR "arrêt de
 travail" OR "numerus clausus" OR "carte vitale" OR "perte d'autonomie" OR "ehpad" OR "agences de sécurité
 sanitaire et alimentaire" OR "tiers payant" OR "recours aux génériques" OR "lunettes"

- **Ecology & Environment:** écolo* OR "biodiversité" OR "protection environnementale" OR "protection de l'environnement"
 OR pollution* OR "diesel" OR "ogm" OR "changement climatique" OR "fessenheim" OR "flamanville" OR "gaz
 de schiste" OR "pesticides" OR "gaz à effet de serre" OR "ressources naturelles" OR "quotas de pêche" OR
 "agroécologique" OR "énergies marines renouvelables" OR "pêche illégale" OR "performance énergétique" OR
 "rénovation thermique" OR "isolation de l'habitat" OR "précarité énergétique" OR "isolation de l'habitat" OR
 "forêts" OR "sylvicultures" OR "changements environnementaux" OR "services écosystémiques" OR "déforestation"
 OR "aires protégées" OR "émissions de carbone" OR "émission de CO2" OR "empreinte carbone" OR "gaz à effet
 de serre" OR "politique climatique" OR "durabilité" OR "obsolescence programmée" OR "niveau des mers" OR
 "niveau de la mer" OR "vagues de chaleur"
- **Energy Policy:** "politique énergétique" OR "électricité" OR "nucléaire" OR "énergies renouvelables" OR "éolien"
 OR "énergies marines renouvelables" OR "énergie renouvelable" OR "énergie solaire" OR "epr" OR "flamanville"
 OR "charbon" OR "centrales thermiques" OR "diesel" OR "fessenheim" OR "flamanville" OR éol* OR "performance
 énergétique" OR "fukushima" OR "rénovation thermique" OR "isolation de l'habitat" OR "précarité énergétique"
 OR "gaz de schiste" OR "énergies marines renouvelables" OR "isolation de l'habitat" OR "sources d'énergie" OR
 "transition énergétique" OR "conversion écologique" OR "énergies alternatives" OR "dépendance énergétique" OR
 "combustibles fossiles" OR "énergies fossiles" OR "efficacité énergétique"
- **Foreign Policy:** europ* OR souverain* OR "CETA" OR "TAFTA" OR "bruxelles" OR "russie" OR "Poutine"
 OR "les russes" OR "pacte de stabilité" OR "directive européenne" OR "traité franco-allemand" OR "trump" OR
 "washington" OR "maison blanche" OR "moscou" OR "crise syrienne" OR "libye" OR "iran" OR "irak" OR "syrie"
 OR "OTAN" OR "traité transatlantique" OR "traités internationaux"
- **Homeland security:** terror* OR "attentat" OR "cyber-sécurité" OR "guerre civile" OR "surveillance" OR délinqu*
 OR espion* OR "loi taubira" OR "vidéo-surveillance" OR "vidéo-protection" OR "sécurité des français" OR "laxisme
 judiciaire" OR "prescription" OR "peines planchers" OR "remises de peine" OR "Daech" OR "cyber-attaques"
 OR "cyber-attaque" OR "#cyberthreats" OR "#cyberthreat" OR "cyber-guerre" OR "cyber guerre" OR "cyber-
 menace" OR "#cybersecurity" OR "cyber-sécurité" OR "cyber sécurité" OR "cybersécurité" OR "cyberdéfense"
 OR "cyberarmée" OR "daech" OR "daesh"
- **Agriculture:** agricult* OR agro* OR "pac" OR "alimentation" OR "engrais" OR "circuits courts" OR "transition
 agricole" OR "surplus" OR intrant* OR "bio" OR "pesticides"

12.3 Distribution of topics by political communities

We studied the diversity of communities discussing each theme. We calculated the entropy of the communities speaking on a theme (see table 5).

Although most of the themes have a fairly similar entropy, it appears that the theme *immigration and multiculturalism* and *homeland security* are discussed by a smaller number of communities because their entropy is low. Conversely, the theme *employment* is the one most uniformly discussed by all communities. In addition to entropy, we also show for each theme the two communities taking special account of this theme. As communities are very diverse in size, we show the communities with the highest score of *tf-idf* on a theme instead of the most present communities.

Thus, if a small community only speaks of one theme, it can still be part of the main communities on this theme even if in absolute value it participates less than others. The *tf-idf* score of a c_j community for a th_i theme is calculated as follows:

$$tf-idf(c_j, th_i) = \frac{tweets(c_j, th_i)}{\sum_k tweets(c_k, th_i)} \log \left(\frac{\sum_{k,l} tweets(c_k, th_l)}{\sum_l tweets(c_j, th_l)} \right),$$

where $tweets(c_j, th_i)$ is the number of tweets from the community c_j on theme th_i .

We also studied the diversity of themes discussed in each community by calculating the entropy of themes in each community (see table 1).

On this point, there are disparities between the candidates. However, the themes that we have defined are not exhaustive and do not allow us to conclude on the diversity of themes addressed by the candidates.

In order to better understand the representativeness of these themes and the presence of each candidate, the proportion of tweets belonging to a theme and the proportions of each theme are presented in Figs. 23 to 30.

Theme	Entropy	# communities	Main communities
<i>Agriculture</i>	2.63	6.2	François Fillon, Marine Le Pen
<i>Economy & Taxation</i>	2.63	6.2	François Fillon, Jean-Luc Mélenchon
<i>Employment</i>	2.74	6.7	Jean-Luc Mélenchon, Benoît Hamon
<i>Democracy</i>	2.63	6.2	Emmanuel Macron, Marine Le Pen
<i>Ecology & Environment</i>	2.52	5.7	Benoît Hamon, Jean-Luc Mélenchon
<i>Immigration & Multiculturalism</i>	1.77	3.4	Marine Le Pen, François Fillon
<i>Research & Education</i>	2.70	6.5	François Fillon, Emmanuel Macron
<i>Health</i>	2.68	6.4	François Fillon, Benoît Hamon
<i>Homeland security</i>	2.30	4.9	Marine Le Pen, François Fillon
<i>Energy Policy</i>	2.56	5.9	Jean-Luc Mélenchon, Benoît Hamon
<i>Foreign Policy</i>	2.69	6.4	Marine Le Pen, Emmanuel Macron
Tous thèmes	2.61	6.1	Marine Le Pen, François Fillon

Table 5: Entropy table of 3–communities discussing each theme. The 2 main communities according to the $TF - IDF$ score are also displayed for each theme. The maximum entropy is 3 when the 8 communities have the same volume of tweets on this theme.

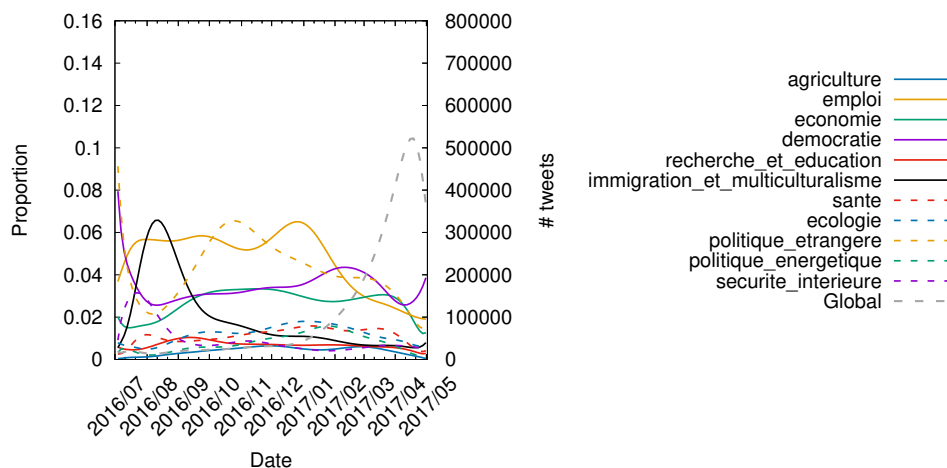


Figure 23: Evolution of the topics discussed by community Jean-Luc Mélenchon between June 01, 2016 and May 08, 2017.

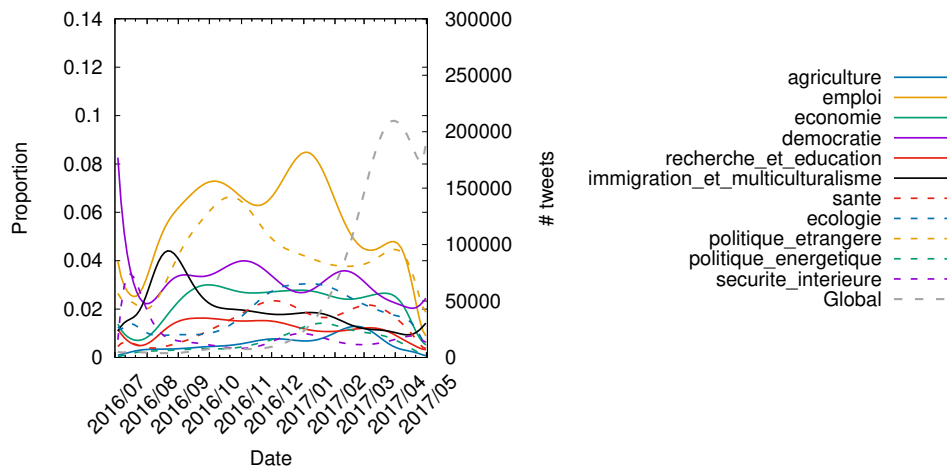


Figure 24: Evolution of the topics discussed by community Benoit Hamon between June 01, 2016 and May 08, 2017.

Name	Entropy	N^0 keywords	Dominant keyword	%
Jean-Luc Mélenchon	7.53	184.8	French labor law, nation, work, republic, nuitdebout, poll, elected officials, media, Penelope Fillon, unemployed	24.3
François Asselineau	5.98	63.2	Frexit, Europe, poll, media, Brexit, nation, elected officials, democracy, treaties, the Euro	48.7
Marine Le Pen	7.82	226.2	nation, islamists, patriotism, police, media, poll, unemployed, migrants, elected officials, terrorism	20.7
François Fillon	7.75	215.8	media, poll, republic, upturn, elected officials, unemployed, police, nation, work, security	19.6
Emmanuel Macron	7.71	209.1	Penelope Fillon, republic, elected officials, work, poll, justice, unemployed, Europe, police, indictment	19.8
Benoît Hamon	7.77	218.6	republic, youth employment, universal income, democracy, Europe, elected officials, ecology, nation, children	21.1
Philippe Poutou	7.55	187.5	nuitdebout, French labor law, republic, work, Penelope Fillon, elected officials, nation, poll, unemployed, media	26.1
Nathalie Arthaud	7.32	159.2	Frexit, poll, Europe, elected officials, unemployed, media, work, nation, nuitdebout, republic	29.8
All	8.23	301.23	nation, republic, poll, elected officials, media, unemployed, work, Frexit, police, Europe	17.5

Table 6: Table showing the entropy of the keywords used by each candidate and its 3-community. The 10 dominant keywords as well as their percentage are also shown. The maximum entropy is 10.73, when the 1700 keywords are discussed uniformly.

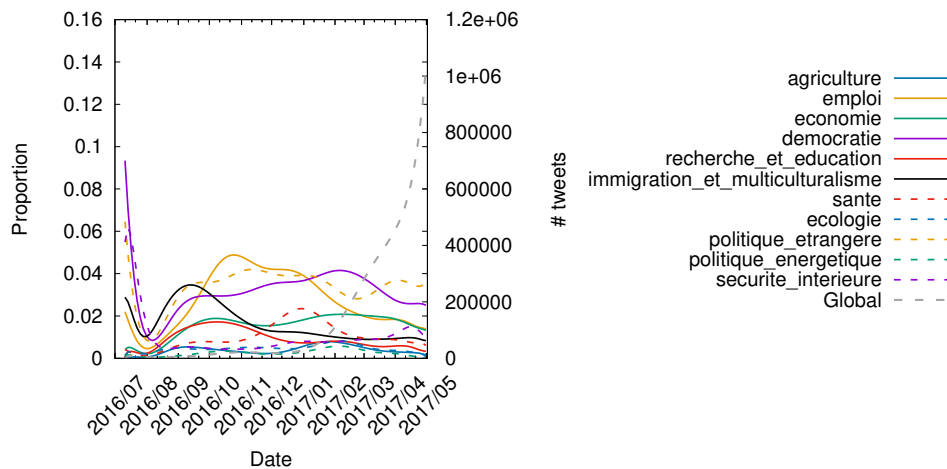


Figure 25: Evolution of the topics discussed by community Emmanuel Macron between June 01, 2016 and May 08, 2017.

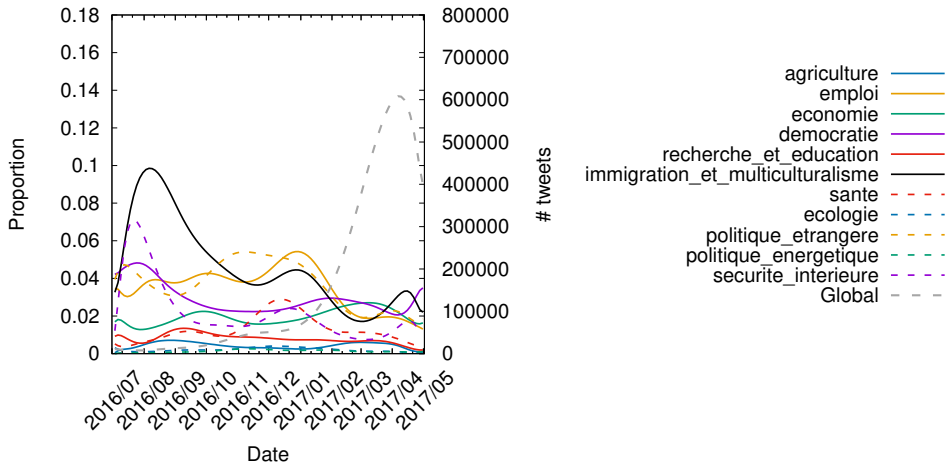


Figure 26: Evolution of the topics discussed by community François Fillon between June 01, 2016 and May 08, 2017.

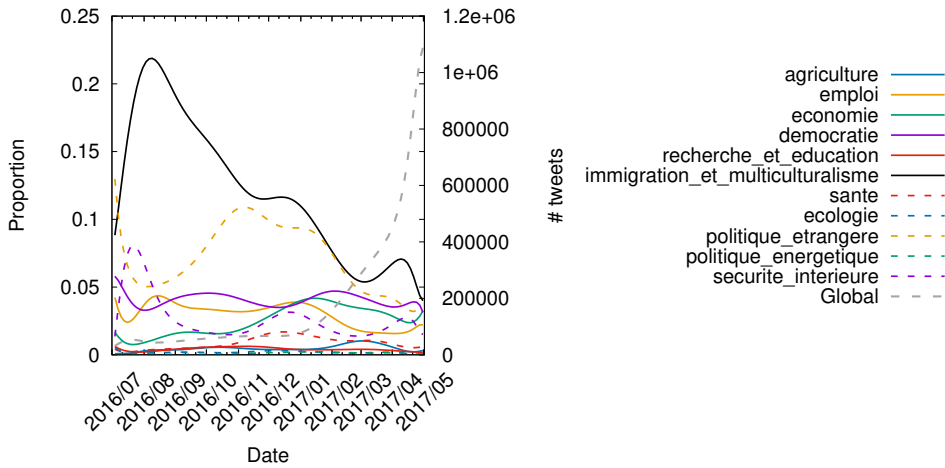


Figure 27: Evolution of the topics discussed by community Marine Le Pen between June 01, 2016 and May 08, 2017.

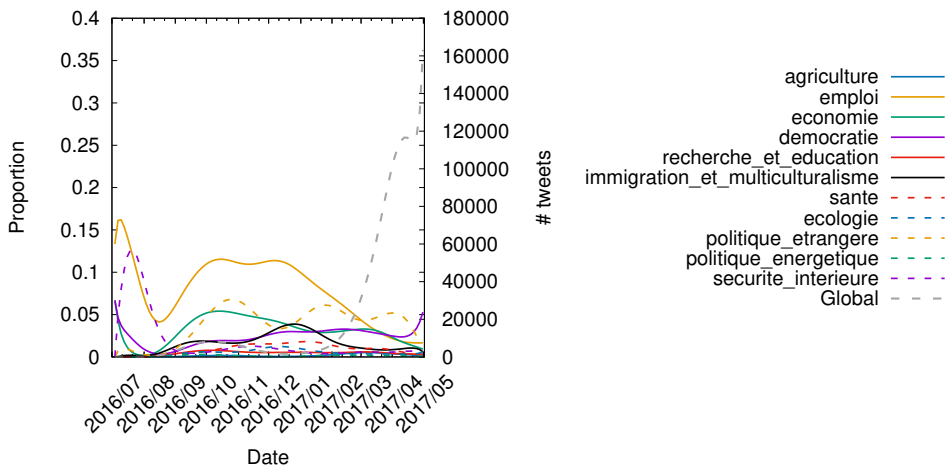


Figure 28: Evolution of the topics discussed by community Nathalie Arthaud between June 01, 2016 and May 08, 2017.

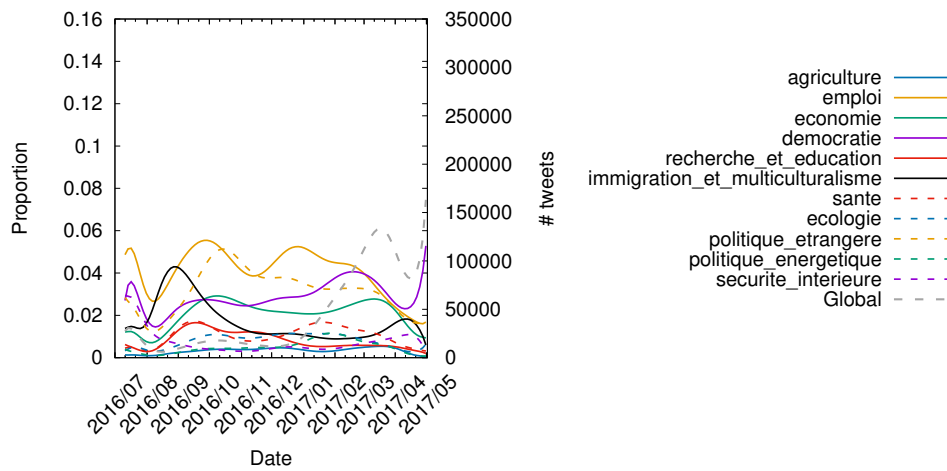


Figure 29: Evolution of the topics discussed by community Philippe Poutou between June 01, 2016 and May 08, 2017.

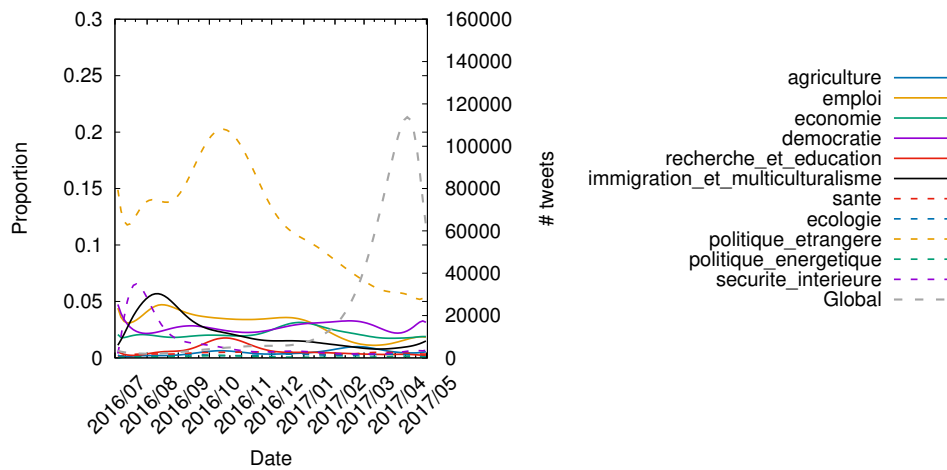


Figure 30: Evolution of the topics discussed by community François Asselineau between June 01, 2016 and May 08, 2017.

13 Community stability

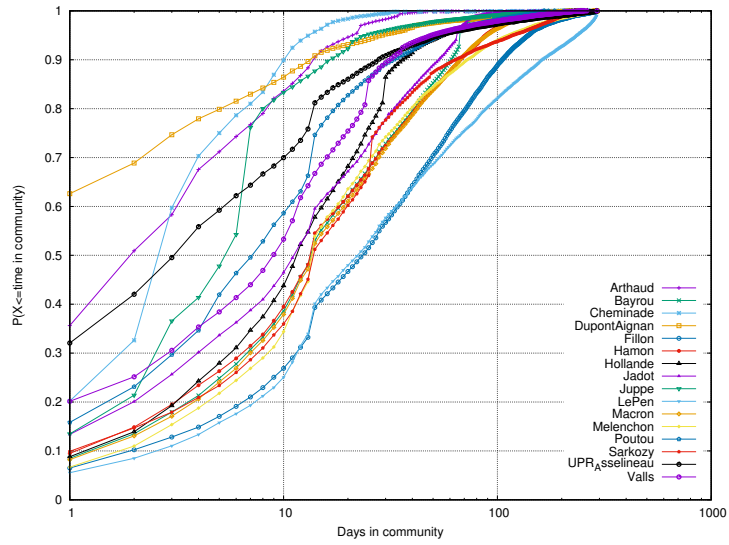


Figure 31: Cumulative distribution of time spent in a community between July and the 1st round.

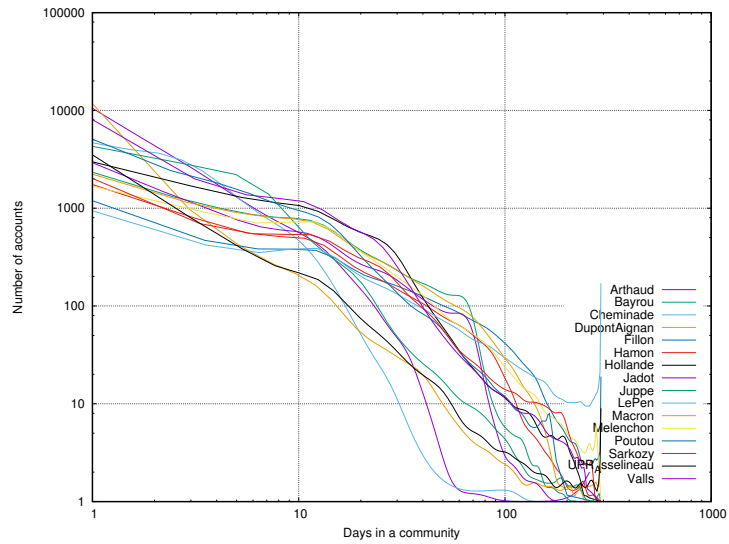


Figure 32: Smooth distribution of time spent in a community between July and the 1st round.

13.1 Vocabulary of the political discourse of the presidential election 2017

The terms considered equivalent have been grouped together and appear in the following analyses under a label which is the first term of the group.

List of term groups extracted with the help of the Gargantext software (<https://gargantext.org>)

- #frexit OR frexit
- 18-25 ans
- 300 000 euros OR 300 000 € OR 300 000€
- 35 heures OR 35h
- 37 heures
- 39 heures
- 6ème république OR 6emerepublique OR 6erepublique OR 6erépublique
- abattements fiscaux
- abattoirs
- abroger OR abrogation
- abus de position dominante
- accès à la propriété
- accès aux soins
- accessibilité des personnes handicapées
- accord de libre-échange
- accords bilatéraux
- accords de schengen
- accords du touquet
- accueil des réfugiés
- accusé
- actifs
- action économique
- action publique
- actionnaires
- actionnariat salarié
- actions d'entreprises
- activités de conseil
- administration centrale
- administration fiscale
- administration pénitentiaire
- administratives OR administration OR administrations
- aéroports
- affaires criminelles
- afghanistan
- afp
- afrique
- âge légal de départ à la retraite
- agence publique européenne de notation
- agences de sécurité sanitaire et alimentaire
- agents publics
- agglomération
- agios
- agriculture OR agriculteurs OR agricole OR agricoles OR agriculteur
- agriculture biologique OR agriculture bio
- agroécologique
- aide à la construction
- aide médicale d'état OR aide médicale d'état
- aide sociale à l'enfance
- aides publiques
- aides sociales OR aide sociale
- airfrance
- algérie
- alimentation
- allègement
- allègements de charges
- allègements fiscaux
- alléger les charges patronales
- allemagne
- allocation adulte handicapé OR aah
- allocation aux adultes handicapés
- allocations OR allocs
- allocations chômage
- allocations familiales OR allocation familiale
- allocations sociales
- alpes-maritimes
- alstom
- alternance
- alternance forte
- aluminium
- alzheimer
- aménagement du territoire
- amendes
- anciens combattants
- animaux
- ankara
- apa
- apl
- apologie du terrorisme
- apologie du terrorisme
- apple
- apprentis
- apprentissage OR apprentissages
- l'arabie saoudite OR l'arabie saoudit
- argent public
- armée d'afrique
- armées OR armée
- arrangements fiscaux
- arrêt de travail
- artisanat local
- artisans OR artisanat
- artistes OR artiste
- aspa
- assange
- assassinat politique
- assassiner OR assassins
- assemblée constituante
- assemblée nationale
- assimilation
- assistance médicalisée
- assistant parlementaire OR assistante parlementaire
- associations OR association
- assurance-chômage
- assurance-maladie OR assurance maladie
- assurance-vie
- atteindre l'équilibre budgétaire
- attentatnice
- attentats OR attentat
- augmenter
- augmenter le salaire
- austérité
- autisme
- autonomie aux communes
- autonomie fiscale
- autorité
- autorité de l'état
- autorité hiérarchique
- autorité indépendante
- autorités françaises
- autoroutes
- auxiliaire de vie scolaire
- avions ravitailleurs
- avocats
- avortement
- avs
- ayant-droits
- baccalauréat
- bachar al-assad
- baisse d'impôts OR baisses d'impôts OR baisse d'impôt
- baisse des dépenses interventions de l'état
- baisser
- baisser les prix
- balkany
- banlieues OR banlieue
- banque centrale
- banque centrale européenne OR bce
- banque de détail
- banque de données
- banque de la jeunesse
- banque postale
- banque publique d'investissement
- banques OR banque
- banques d'affaires
- banques de dépôt OR banques de dépôts
- barbarie OR barbare OR barbares
- barbarie terroriste

- bas revenus
- bâtiments
- bâtiments publics OR bâtiments nationaux
- bayrou
- bénéficiaires du rsa
- bénévoles
- benoît hamon
- bi-langues
- bibliothèques
- bien-être animal
- bien-être des animaux
- biens communs
- bio
- biodiversité
- biogaz
- blessés
- blindés
- blocages
- bois
- bonus
- bonus-malus
- bonus/malus
- branches professionnelles
- brexit OR #brexit
- bricolage
- bruxelles
- budget européen
- budgets participatifs
- bureaucratie
- burkini OR #burkini
- burnout
- burqa
- buy european act
- bygmalion
- cadeaux fiscaux
- caf
- caisse des dépôts et consignations
- caissière
- calais
- cancers OR cancer
- cannabis
- cantine
- cantines bio
- cantines scolaires
- capital-risque
- caricature OR caricatures
- carnées
- carrières judiciaires
- carte de séjour
- carte vitale biométrique
- casier judiciaire
- caution solidaire
- caution universelle
- cavous
- cdd
- cdi OR contrat à durée indéterminée
- censure
- centrales OR central OR centrale
- centrales d'achat
- centrales nucléaires
- centres éducatifs fermés
- ceseda
- ceta
- chaînes publiques de télévision
- chambres régionales des comptes
- champ d'honneur
- changement climatique
- charges OR charge
- charges patronales
- charges salariales
- charges sociales salariales
- chef d'entreprise OR chefs d'entreprise OR chefs d'entreprises
- chef de l'état
- chefs d'état OR chef d'état OR chef d'état OR chefs d'état
- chiffre d'affaires mondial
- chine
- chirurgie ambulatoire
- chômeur de longue durée
- chômeurs OR chômeur OR chômage
- chrétiens d'orient OR chretiens-dorient
- cice
- circuits courts
- citoyenneté française
- citoyens
- civilisation européenne
- civilisation française
- civilisations OR civilisation
- clandestine
- clandestins OR clandestin
- classe politique
- classes moyennes
- clause générale de compétence
- clients des banques
- climat
- clubs professionnels
- cnspf
- cocaïne
- code civil
- code de l'entrée et du séjour des étrangers
- code de la nationalité française
- code du travail
- cohésion nationale
- cohésion sociale
- collectivités OR collectivité
- collectivités d'outre-mer
- collectivités locales
- collectivités territoriales OR collectivité territorial
- collègues OR collègue
- combattants
- comités de rémunération
- commandes publiques OR commande publique
- commerçants
- commerçants indépendants
- commerce
- commerce indépendant
- commission européenne
- communautarisme OR communautarismes
- communautés urbaines
- communiste OR communistes
- compassion
- compensation salariale
- compétitivité
- complexité administrative
- complot OR complotiste
- compte bancaire
- compte individuel de formation
- comptes publics
- concertation
- concurrence OR concurrents
- concurrence déloyale
- concurrence internationale
- concurrence loyale
- concurrence sociale déloyale
- condamnations OR condamnation OR condamnés
- conditions de travail
- confession juive OR juif OR juifs
- confiance confiance
- conflits d'intérêt
- congé parental
- conjoints survivants
- connaissance préalable de la langue française
- conseil constitutionnel
- conseil de sécurité
- conseil national des universités
- conseil supérieur de l'audiovisuel
- conseil supérieur de la magistrature OR csm
- conseiller territorial
- conseils d'administration
- conseils généraux
- conseils régionaux
- consommations OR consommer OR consommation OR consommateurs
- consommation responsable
- constitution
- construction
- construction européenne
- contrat de génération
- contrat de professionnalisation
- contrats d'assurance
- contribution fiscale
- contrôle de légalité a priori
- contrôle des frontières OR contrôle de ses frontières
- contrôles d'identité

- convention de dublin
- convention européenne des droits de l'homme
- conventions citoyennes
- conversion écologique
- conversion écologique et énergétique
- convocation
- convocation judiciaire OR convocation des juges
- cop21
- corporatisme
- correctionnalisation
- corruption
- cotisation vieillesse
- cotisations OR cotisation OR cotiser
- cotisations chômage
- cotisations sociales
- coup d'État institutionnel
- coupables
- couples homosexuels
- cour des comptes
- cours d'assises
- coût de la vie
- coût du travail
- couverture mobile
- création artistique
- création d'entreprise
- crèches
- crédit à la consommation
- crédit impôt OR crédit d'impôt
- crédit impôt réparation
- crédit impôt-recherche OR crédit d'impôt recherche OR crédit impôt recherche
- crédits OR crédit
- crimes OR crime
- criminel OR criminels
- crise
- crise bancaire
- crise bancaire économique
- croissance
- csg
- culture OR cultures
- culture française
- cumul
- cyber-attaques OR cyber-attaque OR #cyberthreats OR #cyberthreat OR cyber-guerre OR cyber-guerre OR cyber guerre OR cyber-menace
- #cybersecurity OR cyber-sécurité OR cyber sécurité OR cybersécurité
- cyberdéfense OR cyberarmée
- daech OR daesh
- décentralisation
- déchets
- décisions de remise en liberté
- déclassement
- découverts bancaires
- décrochage scolaire OR déscolarisé
- décrocheurs
- déductibilité fiscale des dons
- défense de la laïcité
- défense européenne commune
- défense nationale
- déficit
- défiscalisations OR défiscaliser OR défiscalisation OR défiscalisées
- dégradation du mobilier urbain
- délais de jugement
- délinquants étrangers
- délit OR délits OR délinquance OR délinquante OR délinquants
- délocalisations OR délocalisent OR delocalisees OR délocalisé
- demandes d'asile OR demandeurs d'asile
- dématérialisation OR dématérialisée
- démocratie OR démocraties OR democracy OR democracies
- démocratie sociale
- dentaires
- départements OR département
- dépassements d'honoraires
- dépendance
- dépendance au pétrole
- dépenses administratives
- dépenses culturelles
- dépenses d'investissement
- dépenses de l'état OR dépenses publiques OR dépenses de fonctionnement et d'intervention de l'état OR dépense publique
- dépôts des particuliers
- dérives jurisprudentielles
- désamiantage
- désendettement
- désengorger les urgences
- déserts médicaux
- déserts universitaires
- détachement des travailleurs
- détourné d'argent public OR détournement d'argent public
- dette OR dettes
- dette des états OR dette des états OR dette publique
- développement durable
- développement économique
- devenir entrepreneurs
- dialogue social
- dictatures OR dictature
- diesel
- dieu
- diffusion de l'art
- dignité
- diplomatie
- directive européenne
- directives de libéralisation
- discrimination
- discrimination positive
- discriminations
- dislocation
- dispositif de renseignement
- dissuasion nucléaire
- distribution d'électricité
- diversité culturelle
- dividendes
- djihadistes OR djihad
- dmto
- doctorants
- documents officiels
- donald trump OR d.trump OR donaldtrump OR d..trump OR d trump
- donations
- données publiques
- dons
- dotations de l'état OR dotations de l'etat
- double nationalité
- drapeau français
- drogue OR drogues
- droit à l'oubli
- droit d'auteur OR droits des créateurs
- droit d'être syndiqué
- droit de faire appel des décisions
- droit de mourir dans la dignité
- droit de séjour
- droit de veto
- droit de vote
- droit de vote des étrangers
- droit du sol
- droit européen
- droit français
- droits à construire
- droits civiques
- droits culturels
- droits de douane
- droits de mutation OR droit de mutation
- droits de succession
- droits humains
- drones
- dumping social
- durée du quinquennat
- e-learning
- eau OR eaux
- eaux
- échanges commerciaux
- échec scolaire
- éco-conception
- école OR écoles
- école nationale de la magistrature OR école nationale de la magistrature OR ENM
- écoles d'ingénieurs
- écoles de commerce

- écoles primaires OR école primaire
- écologie OR écologique OR écologiques OR ecologie
- écologistes
- économie OR économies OR économie
- économie maritime OR economiedelamer
- économie numérique
- économie réelle
- économie sociale et solidaire
- économies sur les dépenses
- économiste OR économistes
- edf
- éducatives OR éducation
- éducation artistique
- éducation nationale
- eelv
- effectifs de l'état OR effectifs de l'état
- effort de défense
- effort national
- égalité OR egalite
- égalité républicaine
- égalité salariale
- ehpad
- el khomri
- électeurs
- élection présidentielle OR élections présidentielles
- élections OR élection
- élections législatives
- élections locales
- électricité
- élevage
- élevage intensif
- élèves
- éleveur OR éleveurs
- élu
- élucidation des affaires
- élus condamnés
- élus locaux
- embaucher
- émissions de gaz à effet de serre
- emotion
- empêcher les abus
- emploi OR emplois OR embauches OR embauche
- emploi fictif
- emploi présumé fictif
- emploi stable
- emplois précaires
- employés
- employeurs
- emprunts
- ena OR école nationale d'administration
- endettement de l'état
- énergie OR énergies
- énergies marines renouvelables
- énergies renouvelables OR énergie renouvelable OR éolien OR énergie solaire
- éolien
- enfants OR enfant
- enfants récidivistes
- engrais
- enmarche
- enquêtes OR enquête
- enr
- enseignants OR enseignant
- enseignants-chercheurs
- enseignement élémentaire
- enseignement primaire
- enseignement professionnel et technologique
- enseignement supérieur
- enseignements OR enseignement OR enseigner
- ententes
- entrepreneuriat culturel
- entrepreneurs
- entreprises OR entreprise
- entreprises innovantes
- entreprises publiques
- épargne
- épargne bancaire
- épargne populaire
- epr
- équilibre budgétaire
- erasmus
- espaces maritimes
- espaces naturels protégés
- établissements hospitaliers
- établissements privés
- établissements publics
- établissements scolaires
- établissements universitaires
- etat de droit
- état fort
- état libre
- état palestinien
- état-major
- éthique OR éthiques
- étudiants
- étudiants étrangers
- euro-atlantistes
- euro-obligations
- europe OR union européenne OR ue
- exception culturelle
- exode des rapatriés
- exonérations OR exonération
- exonérations de cotisation sociale
- exonérer de charges patronales
- expérimentations animales
- expertise citoyenne
- exploitations familiales
- exportation
- exportations agricoles
- expulsions
- faceauxchrétiens
- facebook
- faciès
- falsification
- familles
- familles françaises
- fan-zones OR fan zone
- favoriser
- femme-homme OR femmes-hommes
- féodalités locales
- fermes-usines
- fessenheim
- fichés s
- fierté d'être français
- filières du travail clandestin
- filières industrielles
- filières professionnalisantes
- filières professionnelles
- fin de vie
- finance spéculative
- financement de la recherche
- financement étranger
- financement public
- financer leurs études
- finances publiques
- finances publiques locales
- financiarisation
- financiers
- fiscalité OR fiscal OR fiscales OR fiscale
- fiscalité européenne
- fiscalité locale
- fixation des tarifs
- flamanville
- florange
- flotte
- flux migratoires
- fnsea
- fonction présidentielle
- fonction publique OR fonctions publiques
- fonction publique hospitalière
- fonction publique territoriale
- fonctionnaires OR personnel de l'état
- fonds européen de défense
- fonds régionaux
- forces armées
- forêts
- formation OR formations
- formation de nos jeunes
- formation des fonctionnaires
- formation initiale
- formations politiques
- formations professionnelles OR formation professionnelle

- fossiles
- frais bancaires
- françafrrique
- france du désastre
- france métropolitaine
- franchises OR franchise
- françois asselineau
- françois hollande
- francophonie
- frapor
- fraternité
- fraude OR frauduleux OR fraudes
- fraude aux prestations sociales
- fraude fiscale
- fraude sociale
- fraudes commerciales
- frenchtech
- frères musulmans
- frontière OR frontières
- frontières extérieures
- frustration
- fuite des cerveaux
- g20
- gafa
- gains de productivité
- garde à vue
- garde d'enfants
- garde nationale
- garde-frontières
- gauche irréconciliable OR gauches irréconciliables
- gaulois OR gauloi
- gaz
- gaz à effet de serre
- gaz de schiste
- gel des traitements
- gel des transferts
- gendarmes OR gendarmerie
- général de gaulle
- génération
- gestion planifiée
- google
- gouvernement algérien
- gpa
- grand emprunt
- grand patronat
- grand remplacement
- grande bretagne OR grande-bretagne
- grande distribution OR grandes surfaces OR grands distributeurs
- grande guerre
- grande réforme fiscale
- grandes écoles
- grandes entreprises OR grands groupes OR grosses entreprises
- grèce
- gros patrimoines
- gros travaux
- guadeloupe
- guerre civile
- guerre mondiale
- guerres
- guyane
- gwada
- hacker
- hadopi
- harcèlement
- harki OR harkis
- harmonisation fiscale
- hébergement d'urgence
- hébergement en établissement
- héritage
- heures supplémentaires
- histoire nationale
- hlm
- hommage aux victimes
- hôpital OR hôpitaux hospital OR hopitaux
- hôpital public
- hôpitaux de proximité
- hospitalisation
- identité
- identité de genre
- identité nationale
- imams
- immigration de masse
- immigration illégale OR migrants clandestins OR immigration clandestine OR immigrés clandestins
- immigration légale
- immobilier
- importation OR importations
- impôt OR impôts OR imposition
- impôt minimal
- impôt sur la fortune
- impôt sur le revenu
- impôt sur les sociétés
- impôts locaux
- incivilités
- incubateurs
- indemnisation
- indemnités des élus locaux
- indemnités journalières
- indépendance de la justice
- indépendance stratégique
- industrie OR industriels
- industries stratégiques
- inéligibilité
- infirmières
- inflation
- ingénieurs OR ingénieur
- ingénence
- injustices OR injustice
- innovation OR innovations
- insertion des jeunes
- insertion professionnelle
- inspection générale de l'état
- inspections générales interministérielles
- insultes
- intégration des étrangers
- intercommunalités OR intercommunalité
- interdiction OR interdire
- intérêt général
- intérêts économique OR intérêts économiques
- intérêts nationaux OR intérêt national
- intermittent du spectacle
- internet
- intrants
- investissement privé
- investissement public
- investissements d'avenir
- investissements étrangers
- iran
- irlande
- isf
- islam OR l'islam
- islamistes OR islamiste OR islamique OR islamiques
- isolation de l'habitat
- israël
- istanbul
- ivg
- jaures OR jaurès
- jdd
- jean-luc mélenchon
- jeune en alternance
- jeunesse OR jeunesses
- journalistes
- juges OR juge
- jungle OR jungles
- juppé
- jury de cour d'assise
- jurys citoyens
- justice
- justice des mineurs
- justice fiscale
- justice sociale
- kinésithérapeutes
- égalité femmes-hommes OR égalité femmes/hommes
- etat islamique OR état islamique OR ei
- les étrangers
- excellence environnementale
- extrême-droite OR extrême droite
- identité heureuse
- immigration
- islam politique
- facho OR fachos OR fachisme OR fachistes OR fachiste
- l'union européenne
- la poste

- la recherche OR chercheurs
- la république
- la russie
- labels de qualité
- lagarde
- laïcité
- langue française
- langues régionales
- latin
- laxisme
- laxisme judiciaire
- le pen
- légitime défense
- les collectivités
- les étrangers
- les jeunes OR jeunes OR la jeunesse
- libéralisation des services
- libéralisme économique
- libération conditionnelle
- liberonsnosconvictions
- liberté d'expression
- liberté religieuse
- liberté syndicale
- librairies indépendantes
- libre circulation
- libre circulation des personnes
- libre-échange
- libye
- licence globale
- licences professionnelles
- licenciement OR licenciements
- licenciements collectifs OR licenciement collectif
- lieux de culte
- litiges
- livret a
- livret d'épargne industrie
- locataires
- logements OR logement
- logements sociaux OR logement social
- loi d'orientation
- loi de 1905
- loi de moralisation de la vie publique
- loi el khomri
- loi fioraso
- loi hadopi
- loi lru
- loi religieuse
- loi sapin
- loi sru
- loi sur la protection des sources
- loi sur le renforcement de la démocratie et des libertés locales
- loitaubira OR loi taubira
- loitravail OR loi travail
- loyers
- lunettes
- lutte antiterroriste
- lutte contre l'évasion fiscale
- lutte contre l'immigration clandestine
- lutte contre l'optimisation fiscale
- lutte contre la contrefaçon
- lutte contre la discrimination
- lutte contre la fraude sociale
- lutte contre la précarité OR lutterai contre la précarité
- lutte contre les discriminations
- lutte contre les fraudes
- lycéens
- lycées OR lycée
- lycées professionnels
- machines OR machine
- madeinfrance
- magistrats OR magistrat OR magistrature
- maintien à domicile
- maisons de santé
- maisons de soins
- maitrise de la langue française
- maitrise de la masse salariale
- majorité silencieuse
- malades OR malade
- maladies OR maladie
- maladies graves ou contagieuses
- malentendants
- malvoyants
- mandat
- manifpolice
- marché commun
- marché unique européen
- marchés publics
- marges des producteurs
- mariage
- marine nationale
- maritime
- marseillaise
- massacre
- maternelle
- mdph
- mécénat populaire
- médecine
- médecins
- médecins généralistes
- medef
- médias
- médicaments
- méditerranée
- membres du parquet
- menace OR menaces
- menace terroriste OR menace terroristes
- ménages
- mensonges OR mensonge
- méritocratie
- mesures emblématiques
- mesures fiscales
- méthodes pédagogiques
- métiers de l'entrepreneuriat
- métiers de la finance
- métiers du droit
- microentreprise
- mieux rémunérer
- migrants
- migratoires
- militaires
- millefeuille administratif
- mineurs
- minimum vieillesse
- ministère de l'intérieur, de l'immigration et de la laïcité
- ministère des souverainetés
- ministres du culte
- mis en examen
- mixité sociale
- mlp-officiel
- mobilisation OR mobilise
- mobilité professionnelle
- modèle républicain
- modem
- modernisation
- moins de 18 ans
- monde carcéral
- monde judiciaire
- monde rural
- mondialisation
- monnaie
- monnaie nationale
- montauban
- montée de la délinquance
- moraliser
- moratoire
- mosquées OR mosquée
- moyen-orient OR moyen orient
- moyenne européenne
- moyens de nos armées
- multiculturalisme
- multilatéralisme
- multinationales
- musique OR musiques
- musulman OR musulmans OR musulmanes
- mutation digitale
- mutuelles
- nation OR nations
- nationalisation OR nationaliser
- nationalité
- nationalité française
- naturalisations OR naturalisation
- négociation salariale
- neutralité
- niceattentat OR attentat de nice
- niches fiscales OR niche fiscale
- nicolassarkozy

- non remplacement de un fonctionnaire sur deux OR non-remplacement d'un fonctionnaire sur deux
- non-cumul des mandats
- norme nationale
- normes OR norme
- normes environnementales
- normes européennes
- nos soldats
- notation sociale
- notre sécurité
- notredémocratie
- nouvelle calédonie OR nouvelle-calédonie
- nouvelles technologies
- nucléaire OR industrie nucléaire OR filière nucléaire OR part du nucléaire
- nuitdebout
- nullité de procédure
- numérique OR numériques OR numérisation
- numerus clausus
- obligation pour eux d'accepter un emploi
- obligations légales
- officines
- offre de logements
- offres en ligne
- ogm
- omc
- onema
- ong
- onu OR nations unies
- opa
- open data OR open-data
- opérateurs téléphoniques
- opérations extérieures OR opex
- opérations spéculatives
- opinion publique
- optimisation fiscale
- ordonnances
- organisations syndicales
- orthophonistes
- otan OR l'otan
- outil de défense
- outre-mer OR outre-mers
- ouvriers
- pac OR politique agricole commune
- pacs
- pacte de confiance
- pacte de responsabilité
- pacte de stabilité
- paix
- palestine
- paradis fiscaux
- parcours de soins
- parcours européens
- parcours professionnels
- parcours scolaire
- parents
- parisiens OR parisien
- parité
- parlement
- parlement européen
- parlementaire
- partenaires européens
- partenaires sociaux
- partenariats public-privé
- patrimoine
- patriotisme OR patriotes
- patriotisme économique
- patrons OR patron
- pays d'afrique
- pays d'origine
- pays de l'union OR état membre
- paysans OR paysanne OR paysannes
- pêche
- pêche illégale
- peines OR peine
- bi-nationalité OR binationalité OR binationaux
- déchéance de nationalité
- peines de prison OR peines d'emprisonnement
- peines de réclusion criminelle
- peines planchers
- penelope fillon OR fillongate
- pénibilité
- pensions OR pension
- performance énergétique
- période de sûreté
- periscope
- perpétuité
- personnels soignant OR personnel soignant OR personnels soignants
- personnes âgées
- personnes de plus de 55 ans
- personnes handicapées OR handicap OR handicaps OR handicapés OR personnes handicapés
- perte d'autonomie
- perturbateurs endocriniens
- pesticides
- petite enfance
- petites retraite OR petites retraites
- pétrodollars
- peuple
- peurs OR peur
- pib
- pisa
- places de prison
- places en crèche
- plan carcéral
- plan d'investissement
- plan de rénovation
- planète
- planification
- planification écologique
- planification stratégique
- plein emploi OR plein-emploi
- plus de 45 ans
- plus-value des terrains à bâtir
- plus-values OR plus-value
- pma
- pme
- pme européennes
- pmi
- pnru
- pôle emploi
- pôles de santé de proximité
- police OR policiers
- politique agricole commune
- politique commerciale OR politiques commerciales
- politique d'application des peines
- politique de coopération
- politique de défense
- politique de la ville
- politique étrangère
- politique industrielle de défense
- politique nataliste
- politiques culturelles
- politiques publiques
- pollution atmosphérique
- pollutions OR pollution OR polluants OR polluant
- polynésie
- pompiers
- porte-avions
- position dominante
- postes supplémentaires
- poursuites disciplinaires
- poutine OR putin
- pouvoir d'achat
- pré-apprentissage
- précarité
- précarité énergétique
- préfet
- prélèvement à la source
- prélèvements indexés sur le revenu
- prélèvements obligatoires
- premier ministre
- prescription à 10 ans
- prescriptions OR prescription
- présomption d'innocence
- prestations sociales
- prêts aidés
- prévention
- primaire à droite
- primaires citoyennes OR primairescitoyennes
- prime à la détention longue de terrains constructibles

- prime annuelle
- prime pour l'emploi
- primes OR prime
- principe de précaution
- priorité d'accès
- priorité nationale
- prison OR prisons
- prison ferme
- prison supplémentaires
- privatisation OR privatiser OR privatisations
- privilège
- prix des médicaments
- prix planchers
- procédures d'expulsion
- procès
- processus judiciaire
- producteurs
- production OR productions
- production agricole
- production d'électricité
- produit intérieur
- produits agricoles
- produits agricoles et alimentaires
- produits de santé
- produits dérivés spéculatifs
- produits financiers
- professionnels de santé
- professions judiciaires
- professions libérales
- programmes jeunesse
- progrès social
- progressistes OR progressiste
- proportionnelle
- propriétaires
- protection animale
- protection du territoire national
- protection sociale
- protectionnisme
- prothèses auditives
- ptz
- publicité
- puissance européenne
- puissances d'argent
- pupilles de la nation
- qatar
- qualité alimentaire
- quartiers OR quartier
- quartiers populaires
- quartiers prioritaires
- quinoa
- quotas OR quota
- quotas d'importation
- quotient familial
- racines chrétiennes
- racisme OR racism OR raciste
- anti-sémite OR antisémite OR antisémites OR OR antisémitisme
- xenophobe OR xénophobe
- racisme anti-français
- radicalisation
- rationalisation
- reinformation OR réinformation OR ré-information
- réadmission
- réarmement
- recettes
- recettes publiques
- recherche agronomique
- recherche publique
- récidivistes
- reconduites à la frontière
- reconnaissance
- recours aux génériques
- rectorats
- redistributif citoyen
- redressement OR redresser
- réduction
- réduction de la déductibilité des dépenses de gros travaux en revenus fonciers
- réduction de la dépense
- réduction des déficits
- réduction du taux d'endettement public OR réduction de la dette publique
- réduction du temps de travail
- réduire de moitié l'immigration
- réduire le nombre de parlementaires
- réduire les surcoûts
- référendum
- réforme
- réforme de la dépendance
- réforme de la fiscalité
- réfugiés
- régalien
- régime dérogatoire
- régime fiscal
- régime général
- régime social des indépendants
- régions OR région
- réglementation européenne
- règles du détachement
- regroupement familial
- régularisations
- régulariser des clandestins
- réhabilitation des logements
- réindustrialisation OR réindustrialisation OR ré-industrialisation
- religion OR religions OR religieux
- relocalisation
- rembourser OR remboursements OR remboursable OR remboursement
- remises automatiques de peine
- remises de peine
- remplacement OR remplacer
- rémunération du président de la république
- rémunération forfaitaire
- rémunérations OR rémunération
- renégociation
- renouvelables OR renouvelable
- renouvellement urbain
- rénovation
- rénovation thermique
- rénovation urbaine
- renseignement intérieurs
- rentrées fiscales OR recettes fiscales
- représentants de l'état
- représentants des salariés
- reprise d'entreprises
- république
- république française OR république françaises
- réseaux sociaux
- réserve parlementaire
- réservée aux migrants clandestins
- réservistes
- résidences principales
- résistance OR résistances
- responsabilité pénale
- responsable politiques OR responsable politique OR responsables politiques
- ressources naturelles
- restaurants d'entreprise
- restauration collective OR restaurations collectives
- restauration scolaire
- rétention administrative
- retenue à la source
- retraite OR retraités OR retraites OR retrait
- retraite solidaire
- revalorisation OR revaloriser
- revenir à l'équilibre de nos comptes publics
- revenu universel
- revenus de l'assistance
- revenus du capital
- revenus modestes
- révisions constitutionnelles
- révolution citoyenne
- révolution fiscale
- révolution numérique
- rgpp OR révision générale des politiques publiques
- richesse nationale
- robots OR robotisation
- route migratoire
- royaume-uni
- rsa
- rsi
- ruralité

- russes OR russe
- russie
- rythmes scolaires
- sacrifices OR sacrifice
- salafisme OR salafiste OR salafistes
- salaire des fonctionnaires OR point d'indice
- salaire horaire
- salaire minimum
- salaire moyen
- salaires OR salaire
- salarié OR salariés OR salariées OR salarié.e.s
- sanctions
- santé
- santé publique
- savoirs fondamentaux
- schengen
- sciences OR science
- scolarité
- scolarité obligatoire
- scop
- secret de l'instruction
- secteur amateur
- secteur bancaire
- secteur privé
- secteur public
- secteurs régaliens
- secteurs stratégiques
- sécurité
- sécurité collective
- sécurité des français
- sécurité intérieure
- sécurité nationale
- sécurité sociale
- seniors OR senior OR séniors
- sens de l'état
- séparation des pouvoirs
- service civique
- service militaire
- service national
- service public OR services publics
- service sanitaire
- services de l'état
- services innovants
- services publics marchands
- simplification OR simplifier
- situation irrégulière
- small business act
- smart nation
- smic
- smicards
- sncf
- snowden
- société civile
- société du travail
- soins d'urgence
- soins dispensés
- solaire
- soldats
- solidarité OR solidarités OR solidaire OR solidaires
- sols
- solutions de garde
- sommetelevage
- sondage OR sondages
- sortir du nucléaire
- souffrance au travail
- souffrances OR souffrance
- sources d'énergie
- sous-traitants
- souveraineté
- souverainetés démocratiques
- souverainetés nationales OR souveraineté nationale
- spectacle vivant
- spéculation OR spéculateurs
- sport
- sportifs amateurs
- stages OR stage
- start-ups OR startups
- statut pénal du chef de l'état
- stock options OR stock-options
- stratégie de défense
- structures parapubliques
- subprimes
- subvention publique
- successions
- suicides OR suicide
- suppression
- suppression des cotisations minimales
- suppressions de postes
- supprimant OR supprimer
- surendettement
- sûreté
- surplus
- surveillance
- suspension des allocations
- sylvicultures
- syndicat OR syndicats OR syndicaliste OR syndical OR syndicalistes OR syndicalisation
- système de santé
- système scolaire
- système universel
- tafta
- tarification progressive
- tarifs réglementés
- taux d'élucidation
- taux d'imposition
- taux d'usage
- taux de chômage
- taxe OR taxes OR taxation OR taxer OR taxerai
- taxe d'habitation
- taxe foncière
- taxe mondiale sur les transactions financières
- technologies
- technologies numériques
- télé
- téléphones portables
- temps de travail
- temps partiel
- terrains constructibles
- territoire national
- territoires OR territoire
- territoires ruraux
- terrorisme
- terrorisme islamiste
- tgv
- thales
- théorie du complot
- tiers payant
- tisa
- titres de séjour
- tolérance zéro
- totalitarisme islamique
- tourisme
- toxiques
- tpe OR très petites entreprises
- traçabilité
- traité franco-allemand
- traités
- traités européens OR traité européen
- traités internationaux
- traités transatlantiques OR traité transatlantique
- tranche supplémentaire
- transactions financières
- mariage pour tous OR mariage gay
- transactions immobilières
- manif pour tous OR manifpourtous
- transformation économique
- transition agricole
- transition écologique
- transition énergétique
- transition numérique
- transparence
- transports OR transport
- transports régionaux
- transports sanitaires
- travail
- travail clandestin
- travail détaché OR travailleur détaché
- travail obligatoires
- travailleurs
- travailleurs handicapés
- travailleurs indépendants
- très haut débit
- trésor public
- tribunal OR tribune
- tribunal administratif

- tribunal de première instance
- tribunaux correctionnels
- tribunaux pénaux
- tribunaux pénaux de proximité
- tunisie
- turquie
- tutorat
- tva
- tva à 5,5
- tva anti-délocalisations
- uber
- ultra-marins
- souverainiste
- une france puissante
- une honte
- une nouvelle société
- une république forte
- une société du travail
- uniforme à l'école
- universités OR université
- urgences sanitaires
- urssaf
- usines
- vacances
- valeurs républicaines OR valeurs de la république
- valls OR vall
- ve république
- véhicule neuf
- vente à l'étranger
- victime OR victimes
- vidéo-surveillance
- vie politique
- vieux véhicules
- village OR villages
- violences faites aux femmes OR violences faites aux femmes
- vivre-ensemble OR vivre ensemble
- voile
- voitures OR voiture
- vote utile
- votées OR votés
- washington
- web
- zone euro
- zone inondable
- zone rurale
- zones de sécurité prioritaires
- zones désertifiées
- zones prioritaires OR zone prioritaire
- zones sans réseau

14 Analysis of late retweets

Several authors [MMW⁺15, GSAM17] have conjectured that retweets could be negative, in particular when there are published long after the original tweet.

We studied the retweet time of all the original tweets of the accounts we follow¹⁰. We consider that a retweet is “late” when it takes place more than 14 days after the original tweet.

We analysed the original tweets having at least 10% of late retweets and we kept the 100 tweets with the most retweets (109 retweets minimum). The list below shows for these 100 tweets the author name, the number of retweets, the amount of late retweets, the text of the tweet,¹¹ the date of the original retweet, the median date of the late retweets and finally the url of the tweet. The retweets that we categorized with certainty as negative are indicated by a red dot. The list is sorted by decreasing proportion of late retweets.

Of these 100 tweets, 30% generated negative or ironic retweets. This proportion of high negative retweets corroborates the link between negativity and retweet time. However, these seem to be limited to extreme cases of tweets having a lot of late retweets.

- ● **@Fillon2017_fr** 2848 RT (1): *”Moi, si j’étais mis en examen, je ne serais pas candidat à l’élection présidentielle. Question de morale.” @FrancoisFillon #BourdinDirect - 29/08/2016 01/03/2017*
https://twitter.com/Fillon2017_fr/status/770150054480998400
- ● **@bayrou** 5864 RT (1): *Emmanuel #Macron est le principal responsable de la politique économique de François #Hollande depuis quatre ans. Pour quel résultat ? #QDI - 21/09/2016 25/03/2017*
<https://twitter.com/bayrou/status/778677784184971265>
- ● **@bayrou** 297 RT (1): *La première mesure annoncée par E. #Macron est de proposer que les jeunes travaillent plus pour gagner moins. #le79inter - 07/12/2016 22/02/2017*
<https://twitter.com/bayrou/status/806405379605274624>
- ● **@bayrou** 1252 RT (1): *Je ne me reconnais pas ds ce qu’E. #Macron incarne. Son projet de société est proche de celui défendu par N. #Sarkozy en 2007. #QuestionsPol - 11/09/2016 22/02/2017*
<https://twitter.com/bayrou/status/774926260266999808>
- ● **@bayrou** 116 RT (0.99): *À propos d’Emmanuel #Macron : Il ne suffit pas de dire qu’on est ni de droite ni de gauche pour être centriste #E1soir - 22/09/2016 22/02/2017*
<https://twitter.com/bayrou/status/779008508423471104>
- ● **@BrunoLeRoux** 214 RT (0.97): *Il n’y a pas de complot, François #Fillon doit s’expliquer devant la justice #LaMatinaleInfo #cnews <https://t.co/SVdDDqT2OU> - 02/03/2017 21/03/2017*
<https://twitter.com/BrunoLeRoux/status/837201126332194816>
- ● **@Fillon2017_fr** 686 RT (0.96): *”Si j’étais mis en examen je ne me présenterais pas à l’élection présidentielle. C’est évident.” @FrancoisFillon #8h30Aphatie - 02/09/2016 01/03/2017*
https://twitter.com/Fillon2017_fr/status/771600966655234048
- ● **@bayrou** 2782 RT (0.96): *Derrière Emmanuel #Macron il y a des gds intérêts financiers incompatibles ac l’impartialité exigée par la fonction politique #BourdinDirect - 07/09/2016 21/04/2017*
<https://twitter.com/bayrou/status/773413492963573760>
- ● **@JeanLucRomero** 1046 RT (0.93): *Malgré les gesticulations de la #ManifPourTous, 65% des Français pour le maintien de la loi sur le #mariagepourtous L’amour triomphe tjrs! - 14/09/2016 12/12/2016*
<https://twitter.com/JeanLucRomero/status/776005126901424128>
- ● **@FrancoisFillon** 254 RT (0.93): *Pas d’autorité de l’Etat sans honnêteté ! Le pouvoir doit être exemplaire pour être vraiment légitime. #Fillon2017 - 21/09/2016 01/02/2017*

¹⁰We limit the study to these tweets because they are the only ones for which we collect the retweets, see SI. 7 on data collection

¹¹Some emoticons had to be removed from the text

- <https://twitter.com/FrancoisFillon/status/778684351013789696>
- **@benoithamon** 266 RT (0.92): *Triste pour @Cristiano Ronaldo et le Portugal. Énorme joueur. #PORFRA - 10/07/2016 22/01/2017*
<https://twitter.com/benoithamon/status/752222252909924353>
 - **@jeanlassalle** 384 RT (0.87): *Et si la France se remettait à marcher sur l'eau ? #Presidentielle2017 #Résistons16h34 - 07/11/2016 29/01/2017*
<https://twitter.com/jeanlassalle/status/814781999625936896>
 - **@ramayade** 207 RT (0.85): *Pour que les femmes ne soient pas représentées que par les extrêmes (Artaud, Le Pen), @ramayade, une candidature nécessaire #7novembre16h34 - 07/11/2016 29/01/2017*
<https://twitter.com/ramayade/status/795654465374195713>
 - **@VigierPhilippe** 327 RT (0.83): *#Macron en marche aux frais des contribuables. Il ne sert pas la Fr. , il se sert. Nous allons saisir la Haute Auto... https://t.co/auOhcikwV - 24/01/2017 07/03/2017*
<https://twitter.com/VigierPhilippe/status/823851682626990080>
 - **@manuelvalls** 419 RT (0.8): *La primaire est un formidable moyen pour recréer l'unité. #Ce-QuiNousRassemble - 05/12/2016 29/03/2017*
<https://twitter.com/manuelvalls/status/805830310155972608>
 - **@bayrou** 273 RT (0.78): *Je ne sais pas - à cette date - qui est E. #Macron, quels sont son projet et son positionnement, avec qui il veut gouverner. #BourdinDirect - 01/02/2017 22/02/2017*
<https://twitter.com/bayrou/status/826699689038905344>
 - **@FrancoisFillon** 460 RT (0.75): *Pour gouverner un pays, ma conviction est qu'il faut être irréprochable. Je pose le principe de l'exemplarité du Président et des ministres. - 18/09/2016 04/03/2017*
<https://twitter.com/FrancoisFillon/status/777431613923885056>
 - **@BrunoLeMaire** 625 RT (0.75): *Que les choses soient claires une bonne fois pour toutes : je ne me rallierai à AUCUN candidat au 2nd tour et je ga... https://t.co/yihPCmneMN - 02/10/2016 20/11/2016*
<https://twitter.com/BrunoLeMaire/status/782567180063813634>
 - **@bayrou** 532 RT (0.73): *J'ai lu avec beaucoup de soin le discours d'@EmmanuelMacron mais je n'y ai pas trouvé beaucoup de substance. #LeGrandJury - 05/02/2017 22/02/2017*
<https://twitter.com/bayrou/status/828208897261445121>
 - **@Bernard_Monot** 193 RT (0.72): *L'islamisme, ce cancer qui détruit tout. #Fillon, #Valls, #Sarkozy ne l'ont pas arrêté. @MLP_officiel le fera !... https://t.co/iCvszdKUKj - 04/01/2017 21/03/2017*
https://twitter.com/Bernard_Monot/status/816686129118375936
 - **@bayrou** 213 RT (0.72): *Je ne suis pas pour que le pouvoir de l'argent prenne le pas sur la politique.#Macron #BourdinDirect @BFMTV @RMCinfo https://t.co/DittqSBegJ - 07/09/2016 23/02/2017*
<https://twitter.com/bayrou/status/773515676711399425>
 - **@Marion_M_Le_Pen** 3706 RT (0.68): *En avant vers la victoire ! #AssisesMLP https://t.co/4SYKqNoI01 - 04/02/2017 23/04/2017*
https://twitter.com/Marion_M_Le_Pen/status/827991739327713280
 - **@EmmanuelMacron** 17669 RT (0.65): *I have a message for you guys. #ScienceMarch*
<https://t.co/ZnkFIkdx - 10/02/2017 08/05/2017>
<https://twitter.com/EmmanuelMacron/status/829849353867128832>
 - **@benoithamon** 660 RT (0.63): *Oui pour le moral j'écoute Still - Dr Dre https://t.co/oTSNCazk.J #Punchline #Hamon2017 - 23/10/2016 22/01/2017*
<https://twitter.com/benoithamon/status/790145245262544896>
 - **@MAZUEL_2017** 128 RT (0.62): *@KingSalman Sir, may Your Majesty pardon young #AliMohammedAlNimr. Philippe Mazuel, candidate to French Presidency https://t.co/RP3xShqLiB - 10/09/2016 26/11/2016*
https://twitter.com/MAZUEL_2017/status/774722675361087489
 - **@lepenjm** 496 RT (0.62): *Ni Droite, Ni Gauche : #Macron ! Droits d'auteur ! Mon pronostic : 3 à 4%. - 16/11/2016 07/05/2017*
<https://twitter.com/lepenjm/status/798846004556546049>
 - **@GLarrive** 112 RT (0.62): *La France n'a besoin, ni de la brutalité extrémiste de Marine Le Pen, ni de l'irréalité bougiste d'Emmanuel Macron... https://t.co/NlPqz1YSUB - 23/02/2017 10/04/2017*
<https://twitter.com/GLarrive/status/834761651383566337>
 - **@LydiaGuirous** 411 RT (0.61): *Retrouvez dans @Valeurs ma tribune face à l'islamisme, 2017 sera "Le quinquennat de la dernière chance" https://t.co/z1Au8CEkx9 - 09/12/2016 08/03/2017*
<https://twitter.com/LydiaGuirous/status/807204636641861632>
 - **@FrancoisFillon** 708 RT (0.61): *Beaucoup de Français ont l'impression de travailler pour ceux qui ne travaillent pas. #PrimaireLeDebat - 17/11/2016 01/02/2017*
<https://twitter.com/FrancoisFillon/status/799368039552708609>
 - **@Simonnet2** 377 RT (0.58): *En vidéo l'arnaque de l'ubérisation, paupérisation organisée par des multinationales hors-la-loi ! La vidéo complèt... https://t.co/sEKuPuXxr4 - 23/12/2016 04/03/2017*
<https://twitter.com/Simonnet2/status/812410976989564929>
 - **@ThomasScuderi** 110 RT (0.57): *#Jouer-Collectif pour éviter les extrêmes, tel est le défi #citoyen qui réinventera la #Politique ! Merci... https://t.co/MYeodTN1OH - 13/11/2016 20/12/2016*
<https://twitter.com/ThomasScuderi/status/797771376094564352>
 - **@marseille** 149 RT (0.57): *Suivez toute l'actualité de Marseille sur Twitter - 20/01/2017 09/02/2017*
<https://twitter.com/marseille/status/822396311722807296>
 - **@DamienObrador** 113 RT (0.57): *La #Patriosphere mobilisée pour la victoire de @MLP_officiel en 2017 ! #AvecMarine https://t.co/wmpzFFa35g - 16/10/2016 16/04/2017*
<https://twitter.com/DamienObrador/status/787727421898391553>
 - **@OuchikhKarim** 436 RT (0.54): *La République est laïque, mais la France est chrétienne. Une vérité qui s'impose à tous, y compris en politique https://t.co/jHpI0u6Izu - 04/09/2016 05/11/2016*
<https://twitter.com/OuchikhKarim/status/772411000637317121>
 - **@JLMelenchon** 349 RT (0.54): *@LiemHoangNgoc : Nous allons revaloriser les petites retraites et augmenter le minimum vieillesse. #JLMChiffage... https://t.co/HS2gubHopW - 19/02/2017 16/03/2017*
<https://twitter.com/JLMelenchon/status/833320688048099328>

- **@FrancoisFillon** 372 RT (0.54): *Il faut une justice rapide et ferme. L'impunité zéro doit être la règle ! #PalaisDesCongrès* <https://t.co/puyJLiyuLj> - **18/11/2016** 01/03/2017
<https://twitter.com/FrancoisFillon/status/799690695883657216>
- **@Simonnet2** 155 RT (0.53): *Pourquoi le Gvt n'engage pas d'enquête sur Lafarge après les révélations du Monde sur sa collaboration avec #Daech ?* <https://t.co/q6paaQz4uP> - **06/07/2016** 13/08/2016
<https://twitter.com/Simonnet2/status/750711159737741312>
- **@FrancoisFillon** 133 RT (0.53): *De nous, les Français attendent transparence et intégrité : pour rétablir ordre et confiance, l'exemple doit venir d'en haut. #CNLR* - **02/07/2016** 01/02/2017
<https://twitter.com/FrancoisFillon/status/749233025184108544>
- **@PhilippePoutou** 256 RT (0.52): *Vu sur un mur : "Pour une abstention utile, votez Poutou"* <https://t.co/UE3XKkODuh> - **24/11/2016** 04/04/2017
<https://twitter.com/PhilippePoutou/status/801892217803722752>
- **@EmmanuelMacron** 157 RT (0.52): *C'est un livre où j'explique la vision que j'ai du pays. #Révolution* <https://t.co/zwyXTULNaN> - **24/11/2016** 27/12/2016
<https://twitter.com/EmmanuelMacron/status/801850774594736128>
- **@Marion_M_Le_Pen** 663 RT (0.49): *"#Fillon est pour le droit du sol, le regroupement familial, contre la restauration des frontières, contre la prior..."* <https://t.co/uYH3mZxDtJ> - **15/12/2016** 13/03/2017
https://twitter.com/Marion_M_Le_Pen/status/809324258312781826
- **@PhdeVilliers** 151 RT (0.48): *Mathieu Bock-Côté : «Un certain catholicisme se mue en utopie multiculturaliste»* <https://t.co/pg5sXONbU7> - **24/01/2017** 05/03/2017
<https://twitter.com/PhdeVilliers/status/823894913678974976>
- **@manuelvalls** 234 RT (0.46): *Le revenu universel que je défends, c'est une grande innovation sociale : garantir un revenu à tous et à tout moment...* <https://t.co/zfbsZswUV> - **27/10/2016** 24/01/2017
<https://twitter.com/manuelvalls/status/791653817544826881>
- **@lesRepublicains** 155 RT (0.46): *Trouvez le bureau de vote le plus proche de chez vous pour voter à la #Primaires2016 des 20 & 27 novembre !* <https://t.co/Eb1SFDuU5e> - **13/10/2016** 09/11/2016
<https://twitter.com/lesRepublicains/status/786494987080990720>
- **@OuchikhKarim** 277 RT (0.45): *Pour #2017, je confirme ma position au #Scan : «J'appelle à voter pour #MarineLePen». «Mon cœur ne balance pas» !* <https://t.co/4Qv1vfodst> - **14/10/2016** 03/11/2016
<https://twitter.com/OuchikhKarim/status/786965898540220416>
- **@lepenjm** 1749 RT (0.44): *Un éléphant, ça TRUMP, ça TRUMP, un éléphant ça TRUMP énormément... (L'éléphant est l'animal emblème du Parti Républicain)* - **20/07/2016** 09/11/2016
<https://twitter.com/lepenjm/status/755809512649547776>
- **@alainhoupert** 503 RT (0.43): *«La seule activité continue de l'Élysée, c'est l'hostilité à Sarkozy» Jean d'Ormesson* <https://t.co/U3HBfMrze7> - **02/10/2016** 14/11/2016
<https://twitter.com/alainhoupert/status/782483601225113600>
- **@PhdeVilliers** 150 RT (0.41): *Alexandre Devechchio : «Derrière l'affaire Théo, les banlieues en sécession»* <https://t.co/mPmz4ZXqre> - **14/02/2017** 27/03/2017
<https://twitter.com/PhdeVilliers/status/831510972661641216>
- **@Paris** 118 RT (0.41): *.@RElementaires organise une collecte de tampons et serviettes pour la #JournéeInternationaleDesDroitsDesFemmes ...* <https://t.co/Mje4mQdWg3> - **08/03/2017** 25/03/2017
<https://twitter.com/Paris/status/839509879316443137>
- **@SIEL_Off** 146 RT (0.4): *Le #SIEL apporte son soutien à #MarineLePen aux #Présidentielle2017 et aux candidats SIEL aux législatives* <https://t.co/ELAHOyhjzY> - **26/02/2017** 29/03/2017
https://twitter.com/SIEL_Off/status/835950123855282176
- **@FrancoisFillon** 303 RT (0.4): *Au sommet de l'Etat, l'intégrité du Président et de ses ministres doit être irréprochable car il n'y a pas d'autorité sans exemplarité.* - **18/11/2016** 31/01/2017
<https://twitter.com/FrancoisFillon/status/799696415555551232>
- **@Paris** 552 RT (0.39): *Parc #RivesDe-Seine, venez admirer Paris au fil de l'eau* <https://t.co/9qfz5Uy1bn> <https://t.co/8e5jQFSFL1> - **22/03/2017** 20/04/2017
<https://twitter.com/Paris/status/844513445823303680>
- **@EmmanuelMacron** 1680 RT (0.39): *Non, nous ne devons pas accepter qu'en Tchétchénie des camps pour homosexuels soient réouverts. #MacronPrésident* <https://t.co/wriwoHdvoc> - **17/04/2017** 02/05/2017
<https://twitter.com/EmmanuelMacron/status/854021146924240896>
- **@DLF_Officiel** 113 RT (0.39): *.@dupontaignan "Je suis un gaulliste social. Chez DLF, il n'y a pas d'arrière boutique d'extrême droite comme au #FN" #LEntretienPolitique* - **15/03/2017** 29/04/2017
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- **@alainjuppe** 163 RT (0.39): *Je crois à l'esprit Bordelais. Une ville fidèle à son esprit girondin, à la tempérance, à la modération. Tout ne vient pas d'en haut.* - **12/01/2017** 06/02/2017
<https://twitter.com/alainjuppe/status/819500637083881473>
- **@FrancoisFillon** 146 RT (0.37): *Un délit : une sanction ! Voilà la règle qui doit être parfaitement claire pour les délinquants. #PalaisDesCongrès* - **18/11/2016** 31/01/2017
<https://twitter.com/FrancoisFillon/status/799690849311490048>
- **@OuchikhKarim** 206 RT (0.36): *L'#islam est incompatible avec la #République : il doit être mis sous tutelle ! Ma tribune sur @BVoltaire* <https://t.co/LvvLYDoclJ> - **16/11/2016** 10/12/2016
<https://twitter.com/OuchikhKarim/status/798787380496863232>
- **@FrancoisFillon** 196 RT (0.36): *Pour être Président de la République, il faut être soi-même irréprochable. #Bourdindirect* - **18/11/2016** 29/01/2017
<https://twitter.com/FrancoisFillon/status/799519082538209280>
- **@UPR_Asselineau** 482 RT (0.35): *Frédéric Robert, maire de Monétier-Allémont : «Non Mr @EmmanuelMacron, La commune, La France ne sont pas à vendre !...»* <https://t.co/DmQTXqqPDN> - **26/03/2017** 04/05/2017
https://twitter.com/UPR_Asselineau/status/846108489479000064

- **@FrancoisFillon** 249 RT (0.35): *Nous devons entendre les Français. Nous devons entendre leur demande d'honnêteté, de courage et de vérité. #CN-lesRépublicains - 14/01/2017 01/02/2017*
<https://twitter.com/FrancoisFillon/status/820233545046171648>
- **@FrancoisFillon** 152 RT (0.35): *C'est le cri de désespoir des Français lassés de travailler pour ceux qui ne travaillent pas qui a guidé la rédaction de mon programme. - 03/09/2016 25/01/2017*
<https://twitter.com/FrancoisFillon/status/772024442377670656>
- **@dupontaignan** 534 RT (0.35): *Retrouvez mon clip officiel de campagne pour la #présidentielle A découvrir et à partager ! #NDA2017 #DeboutLaFrance* <https://t.co/sffjfbkjc> - **28/03/2017 20/04/2017**
<https://twitter.com/dupontaignan/status/846759051505651712>
- **@RafikSmati** 155 RT (0.33): *Ce que cache vraiment la candidature Macron...* <https://t.co/RIwz4VnrU> - **15/01/2017 13/02/2017**
<https://twitter.com/RafikSmati/status/820611357456404480>
- **@LydiaGuirous** 166 RT (0.33): *Ce n'est pas à la République de s'adapter à l'islam mais à l'islam de s'adapter à la République. #Laïcité ne se négocie pas #Valls ! @leJDD - 31/07/2016 26/08/2016*
<https://twitter.com/LydiaGuirous/status/759687863072071680>
- **@LaurencePache** 269 RT (0.33): *Merci Mr #Vidalies, pour l'ouverture à la concurrence des #TER, pour l'augmentation des péages autoroutiers, pour l...* <https://t.co/orfp5jUWJm> - **19/09/2016 10/01/2017**
<https://twitter.com/LaurencePache/status/777993712546811904>
- **@LGRANDGUILLAUME** 131 RT (0.32): *#taxis #VTC #loti Je serai vers 18h Gare de Lyon pour commencer la distribution pour la loi* <https://t.co/ZOJA9GDXJe> - **23/10/2016 12/11/2016**
<https://twitter.com/LGRANDGUILLAUME/status/790191309764038657>
- **@LellouchePierre** 109 RT (0.32): *À libre absolument dans @lemondefr, le réquisitoire d'@Anne-Hidalgo contre @EmmanuelMacron. La meilleure attaque à...* <https://t.co/eGjmsRsa76> - **12/01/2017 02/05/2017**
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- **@JeanLucRomero** 1248 RT (0.32): *Tweetons tous cette campagne de prévention #VIH que fustigent tous les homophobes et bigots d'un autre temps !...* <https://t.co/vho592qDfu> - **18/11/2016 17/01/2017**
<https://twitter.com/JeanLucRomero/status/799681071214428160>
- **@FrancoisFillon** 130 RT (0.3): *Il n'y a pas d'autorité sans prestige, sans une certaine dignité et une intégrité certaine. #PalaisDesCongres - 18/11/2016 01/02/2017*
<https://twitter.com/FrancoisFillon/status/799684116941676544>
- **@benoithamon** 372 RT (0.3): *Saisissons la chance de ne pas subir le dérèglement climatique, les mutations de la société, de l'industrie, mais d'e...* <https://t.co/omCWDliNrA> - **19/03/2017 04/04/2017**
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- **@pierrezeniziot** 399 RT (0.29): *Ce moment gênant où tu vas sur le site de #Macron et où il n'y a pas d'onglet #projet...* <https://t.co/mHx0WJVzSn> - **21/01/2017 05/02/2017**
<https://twitter.com/pierrezeniziot/status/822908822608023552>
- **@PhdeVilliers** 776 RT (0.29): *Philippe de Villiers pense à s'afficher aux côtés de Marine Le Pen* <https://t.co/xUd3iVfdF> - **27/03/2017 29/04/2017**
<https://twitter.com/PhdeVilliers/status/846416458594832384>
- **@LellouchePierre** 125 RT (0.29): *Je le dis avec gravité, la question de l'application de l'art. 68 de la Constitution (destitution pour manquement à ses devoirs) est posée - 19/10/2016 07/11/2016*
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- **@Marion_M_Le_Pen** 771 RT (0.27): *#LesRépublicains : "Plutôt que de vous contenter d'un plan B, tournez-vous vers le plan M, le plan Marine" #Fillon* <https://t.co/r3rV34j7fB> - **06/02/2017 06/03/2017**
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- **@Fillon2017_fr** 434 RT (0.27): *"Je veux une classe politique exemplaire, avec des ministres qui ne sont pas mis en examen." @FrancoisFillon #Avec-FillonEleveonsLeDébat - 24/11/2016 01/03/2017*
https://twitter.com/Fillon2017_fr/status/801882003536805890
- **@najatvb** 137 RT (0.26): *Avec ce livre, "La vie a plus d'imagination que toi", j'ai voulu parler de la France telle que je la connais, telle...* <https://t.co/zLStE8DUCN> - **31/03/2017 30/04/2017**
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- **@JLMelenchon** 919 RT (0.26): *#Juppé et #Fillon ont parlé de l'ISF et des riches. Mais pas un mot sur les 9 millions de pauvres en France...* <https://t.co/0pJbZHRpxv> - **24/11/2016 01/04/2017**
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- **@DidierTauzin** 174 RT (0.26): *Exigeons un casier judiciaire vierge à nos hommes politiques ! Ils doivent être exemplaires.* <https://t.co/VrvvAui83D> - **05/11/2016 11/12/2016**
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- **@valerieboyer13** 163 RT (0.25): *Porter le voile est perçu comme un signe d'allégeance à notre ennemi. Je proposerai un texte pour y mettre un terme, luttons c/ le salafisme - 11/09/2016 22/11/2016*
<https://twitter.com/valerieboyer13/status/774908438417670144>
- **@NicolasSarkozy** 3203 RT (0.25): *Je souhaite le meilleur pour mon pays et pour celui qui aura à conduire la France que j'aime tant - NS* <https://t.co/xNYy61YUVV> - **20/11/2016 30/03/2017**
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- **@MLP_officiel** 248 RT (0.25): *"L'immense majorité des homosexuels ne demandent pas le mariage gay. Ils ne réclament qu'un PACS amélioré." #BFMPolitique - 16/10/2016 28/04/2017*
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- **@MLP_officiel** 648 RT (0.24): *"On doit renvoyer les clandestins chez eux et maîtriser nos frontières nationales, sinon les camps se reconstituero..."* <https://t.co/HEZ64kypQn> - **24/01/2017 25/03/2017**
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- **@manuelvalls** 1483 RT (0.24): *Je suis candidat à la présidence de la République. MV* - **05/12/2016**
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- **@LydiaGuirous** 562 RT (0.24): *Message aux "féministes" démissionnaires de gauche qui défendent #burkini voile burqa...au nom d'une fausse Liberté* <https://t.co/ku378P1PNf> - **07/09/2016**
<https://twitter.com/LydiaGuirous/status/77358642534222337>
- **@Simonnet2** 281 RT (0.23): *Il y a pas écrit La Poste, là ! Ne laissons pas les supérettes faire main basse sur la ville, et sur le service pub...* <https://t.co/9AJZgojfl4> - **20/11/2016** [16/12/2016](https://t.co/9AJZgojfl4)
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- **@MLP_officiel** 447 RT (0.23): *"Les pompiers et les policiers sont immobilisés chaque jour pour régler les problèmes liés aux jungles de #migrants..."* <https://t.co/ck0qUBXXhG> - **24/01/2017**
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- **@GilbertCollard** 223 RT (0.23): *Et vous demandez comment on peut faire des économies :* <https://t.co/5UtaUJDxLV> - **06/01/2017**
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- **@ECiotti** 1013 RT (0.23): *Je propose à @EliseLucet d'enquêter sur le financement de la campagne de M. #Macron, elle qui a enquêté sur M...* <https://t.co/ABahs9ombb> - **06/02/2017**
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- **@valerieboyer13** 245 RT (0.21): *L'assassinat de #ZhangChaolin passe sous silence ... !* <https://t.co/BbGwDjK86w> - **15/08/2016**
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- **@valerieboyer13** 184 RT (0.21): *Jamais nous ne laisserons prendre en otage ni la démocratie ni le destin de notre pays. Soutien à @FrancoisFillon* <https://t.co/VCbOpTfO6Q> - **02/02/2017**
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- **@Paris** 198 RT (0.21): *#ParisPlages revient du 20/07 au 04/09. Le programme complet* <https://t.co/hQoJzM430L>
<https://t.co/60ZVJhVPT2> - **19/07/2016**
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- **@OuchikhKarim** 308 RT (0.21): *Qui peut croire un seul instant que #Macron soit capable de garantir aux Français une majorité pour gouverner !* <https://t.co/nr4cDS3HpA> - **09/03/2017**
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- **@MLP_officiel** 476 RT (0.21): *"Il n'y a rien pour nous de plus beau que la France, il n'y a rien pour nous de plus grand que la France !"*... <https://t.co/1jeyJvAeka> - **05/02/2017** [21/03/2017](https://t.co/1jeyJvAeka)
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- **@GilAverous** 335 RT (0.21): *Si on me demande pourquoi je soutiens @NicolasSarkozy, la réponse est là ↓ #ToutPourLaFrance* <https://t.co/u2lSs9ohE9> - **16/09/2016** [15/10/2016](https://t.co/u2lSs9ohE9)
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- **@francoisbaroin** 163 RT (0.21): *Rassemblement total autour de @FrancoisFillon pour la présidentielle. 2/2* - **27/11/2016** [31/01/2017](https://t.co/31012017)
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- **@alainjuppe** 668 RT (0.21): *Je me sens plus proche du Pape François que de Sens Commun et de la #ManifPourTous #JuppéPrésidentCest sur @France2tv #20H* - **21/11/2016** [16/04/2017](https://t.co/16042017)
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- **@OuchikhKarim** 560 RT (0.2): *#Macron est aussi l'homme qui a vendu #Alstom aux Américains. La France bradée, c'est lui !* <https://t.co/B3H50PsoFH>
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- **@Marion_M_Le_Pen** 2499 RT (0.2): *"Tous les musulmans ne sont pas djihadistes, mais tous les djihadistes sont musulmans."* #BBRGrandSud <https://t.co/Kq7TfXxIJW> - **09/07/2016**
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