Policy and Internet

Leaders or Brokers? Potential Influencers in Online Parliamentary Networks

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The use of social media by parliamentarians is opening up a new communication arena. In Catalonia, where 85 percent of parliamentarians have a Twitter account, two questions emerge from this new social phenomenon. First, who are the opinion leaders of the parliamentarians' online political networks, and second, do the characteristics of the Members of Parliament' (MPs') Twitter networks and the attributes of the parliamentarians influence the likelihood of forming communication ties? This article seeks to ascertain whether social media are challenging party politics and leadership in communication flows in Parliament. We used a social network analysis of relationships among the Catalan parliamentarians with Twitter accounts (115 of the 135 members) to reveal the potential influencers of the following–follower network. Exponential Random Graph models were employed to determine the endogenous (network) and exogenous (node attributes) factors facilitating MPs' communication ties. We found evidence that Catalan MPs' communication ties arise from network dynamics (reciprocity and popularity) and from MPs' political position. We also discovered that new potential influencers, who are not official party leaders and do not play important roles in Parliament, are emerging as brokers within the Catalan parliamentary Twitter network.

KEY WORDS: social networks, Twitter, parliaments, influencers, brokers

Introduction

Members of Parliament' (MPs') use of Twitter has become part of their communication repertoire, triggering the appearance of new online parliamentary networks. In Catalonia, where 85 percent of parliamentarians have a Twitter account and the party system is highly fragmented and ideologically divided, the study of the Catalan MPs' relations on Twitter allows us to test whether Twitter is creating new communication leaderships and to ascertain the characteristics and the network behavior of these leaders.

A growing body of research has examined issues related to leadership (González-Bailón & Wang, 2016) and influence (Dubois & Gaffney, 2014) in online political networks, yet few studies have analyzed the effects of Twitter on the functioning of parliaments and the relationships among its members (Hsu &

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Park, 2012; Yoon & Park, 2014). This research attempts to study online political influence in parliamentary networks by answering three questions related to parties' and politicians' use of Twitter: Who are the political influentials (Gruzd & Wellman, 2014) of the Catalan parliamentary Twitter network? What mechanisms explain MPs' following–follower relations on Twitter? And, in a broader sense, are social media challenging politics in parliaments?

To answer these questions, the study examines the characteristics of parliamentarians' Twitter networks and the mechanisms facilitating the appearance of new Internet-mediated forms of parliamentary political communication leaderships. We collected data on Catalan parliamentarians' Twitter network longitudinally (01-13-2014; 02-24-2014; 03-24-2014). We used the Girvan–Newman algorithm to find the communities of the following–follower Twitter network. We then employed Exponential Random Graph (ERG) models (p^* models) to discover the network mechanisms (reciprocity, popularity, and brokerage) and the MPs' attributes (leadership, Parliament activity, Internet behavior, sociodemographic characteristics) facilitating communication ties among Catalan parliamentarians. Additionally, we compared the political status of the MPs occupying leadership positions in the network, either by their central role in terms of followers (indegree) or their brokerage position (betweenness centrality).

The time span of the analysis is not long, but it will be sufficient to shed light on some of the current controversies surrounding parliaments, social media, and the appearance of new potential influencers.

This study provides empirical evidence for understanding social media networks and how they are challenging party politics and parliamentarians' communication. The analytical tools used in this investigation could also be applied to the analysis of other parliamentary and political networks. Furthermore, we seek to explain parliamentarians' communication ties through a set of network parameters and MP characteristics. As far as we know, this is the first time that a study has aimed to explain online parliamentary networks by means of network dynamics and MP attributes.

In the next section, we review related works on parliamentary networks, MPs' adoption and use of Twitter and opinion leadership, and state the research hypotheses to be tested. By doing so, we aim to tackle a gap that exists in the research when it comes to understanding opinion leadership in online parliamentary networks in the age of social media. We continue by providing details on the data, research design, and the construction of variables. Specifically, we describe the ERG models' methodological approach, which allows us to pinpoint the communication mechanisms of the Catalan MPs' Twitter network and the potential influencers in this milieu. We then introduce the political and network characteristics of the Catalan case to contextualize the research. Last, we outline the results and discuss the characteristics of these potential influencers and their role in the communication flows of online parliamentary networks.

Theoretical Background and Hypotheses

Social networks are created whenever people interact, either directly or indirectly, with other people, institutions, and bodies (Hansen, Shneiderman, & Smith, 2011). Simply put, a "network is a set of nodes (such as people, organizations, web pages, or nation states) and a set of relations (or ties) between these nodes" (Hogan, 2007, p. 2).

Network-based research has been conducted in political science to analyze parliamentarians' relationships in the legislation process. This is relevant to our research aims because Twitter following–follower networks are relationship networks. For example, Patterson's (1952, 1972) investigation discovered that geographical location, length of tenure, political leadership, earlier political alliances, and seating arrangements on the floor of the Congress were determinants for the parliamentarians' choice of friends. Along these lines, the study conducted by Caldeira and Patterson (1987, p. 965) on the interpersonal choices recorded by state legislators in Iowa demonstrated that "Partisanship, legislative activism, experience in government, and leadership role" determined relations of political friendship in the legislature. These studies seem to corroborate an idea that was previously revealed by Routt's analysis (1938, p. 132) of the Illinois Senate throughout 1937: contacts among senators "tended to centre on individuals who by other indices were shown to play important roles in the process of legislation." Furthermore, Arnold, Deen, and Patterson (2000) provided evidence that, in the Ohio House of Representatives, friendship ties had an impact on which members voted together. As these authors pointed out, "because knowledge and information are dispersed through the social network, location within a network influences the information that a person receives and, as a result, may influence how the information is processed" (Arnold et al., 2000, p. 143). Thus, friendship ties are important because they influence the kind of information a member might receive.

More recently, increasing computational capabilities and the dawn of the Internet and social media have given place to the appearance of online parliamentary networks. Some authors have employed an individualistic perspective to study MPs' use and adoption of social media, while others have adopted a network approach to analyze the characteristics of online parliamentary networks. Among the first group, Lassen and Brown (2011) found that while sociodemographic factors did matter with regard to the adoption of Twitter, Internet usage, and the number of years the members had been in Congress had no influence. On the contrary, Chi and Yang (2014) found that sociodemographic factors had no effect on Twitter adoption by parliamentarians. Furthermore, Williams and Gulati (2010) stated that party pertinence and campaign resources were drivers of Twitter adoption.

From a network approach, researchers have highlighted that different relations among parliamentarians emerge on Twitter depending on the layer of interaction. Several investigations in different countries reach similar conclusions: the following–follower and retweet networks follow a partisan logic and are very much concentrated on popular parliamentarians or politicians. However, the

mention network shows interconnections among opposed ideologies and a more personalized pattern. For instance, Conover et al. (2011) analyzed political hashtags some weeks before U.S. congressional midterm elections and observed that retweets reproduce the known partisan split in the online world, while the mention network shows that ideologically opposed individuals interact with each other. By studying the following relations on Twitter of the members of the Bundestag, the German Federal Assembly, Thamm and Bleier (2013) demonstrated that retweets have a professional use, while mentions have a personal connotation. The study of the Korean politicians on Twitter carried out by Yoon and Park (2014) showed that, while the following–follower network was a social ritual network (with high reciprocated vertex pair ratio figures), the mention network was a network of political support that frequently crossed ideologies. Moreover, the research carried out by Hsu and Park (2012) on members of the Korean National Assembly revealed that several politicians were far more popular than others in the following–follower network.

It is in this new online parliamentary network framework that the concepts of influentials and network centrality become relevant in uncovering MPs' communication leaderships. Opinion leadership, or being an "influential" (Dubois & Gaffney, 2014, p. 1262), is at the base of political leadership. More specifically, an opinion leader could be defined as someone able to "influence his or her close personal ties by exerting social pressure and social support" (Dubois & Gaffney, 2014, p. 1262). The concept comes from the two-step flow theory (Lazarsfeld, Berelson, & Gaudet, 1948). This theory states that the influence of mass media first reaches opinion leaders and they then transmit the information to the others (Katz, 1957). Katz (1957, p. 73) elaborated on the concept of opinion leadership as being related to "(1) the personification of certain values (who one is); (2) to competence (what one knows); (3) to strategic social location (whom one knows)." Diffusion studies have identified several characteristics of opinion leaders, including high social status, innovative behavior, vast social connections, and high levels of involvement (Rogers, 2010; Vishwanath & Barnett, 2011). According to Dubois and Gaffney (2014, p. 1262), this definition of an opinion leader reveals four core facets of influence in Twitter political networks: "having a following, seen as an expert, knowledgeable/have expertise and in a position within their local community to exert social pressure, and social support/social embeddedness."

But how can we measure the facets of influence in online political networks? Freeman's cornerstone study (Freeman, 1978/1979, p. 221) discussed measuring centrality in networks by using the indegree or number of followers, or by analyzing "the frequency with which a point falls between pairs of other points on the shortest or geodesic paths connecting them." That is, betweenness centrality.

Indegree is a basic yet illuminating measure of the degree centrality. It measures the number of ties directed to a node. For instance, the number of citations a paper receives is an indegree measure of its influence. This metric allows us to discover the influence that MPs' popularity has over the formation of communication ties between parliamentarians. Furthermore, by measuring the MPs' betweenness centrality,[1] we expect to capture another dimension of MPs'

network leadership, that is their brokerage role. Brokers are network entrepreneurs who build bridges between people on opposite sides of the structural holes of the network (Burt, 2005, p. 18). In political settings, brokers help to establish communication between the different clusters of a network, which might remain disconnected without their bridging role. This bridging position gives brokers the ability to control the flows of information (González-Bailón & Wang, 2016). In Newman's words (2010, p. 186), "vertices with high betweenness centrality may have considerable influence within a network by virtue of their control over information passing between others."

Centrality in online political networks has recently been studied using both the indegree and betweenness measures. Choi's (2015, p. 701) of online political discussion groups in South Korea operationalized the concept of opinion leaders as those "who had a high share both of degree and flow betweenness centralities." Borge and Esteve Del Valle (2015) and Esteve Del Valle (2015) showed the relevance of using the betweenness centrality measure to detect brokers in online parliamentary networks, and Mai, Liu, & González-Bailón (2015) the relevance of using the indegree network parameter to study hiring and placement dynamics across PhD programs in Communication. Dubois and Gaffney (2014) discovered that indegree and eigenvector centrality are similar measures and identified the traditional political elite as influentials. The study of the recall elections in the state of Wisconsin by Xu, Sang, Blasiola, and Park (2014) discovered that betweenness centrality was positively related to the number of retweets. And González-Bailón and Wang (2016) used, among other network metrics, the Max (Kin)—maximum indegree—of the follower Twitter network to identify bridges and the structural brokers in the "United for Global Change" international protest campaign. Their findings revealed that "a minority of users concentrates most of the connections and (...) attracts and sends most of the messages" (González-Bailón & Wang, 2016, p. 99). Hence, only a few nodes of the network had the ability to play a bridging role.

Nevertheless, very few studies have attempted to explain centrality differences in online political networks through the analysis of the attributes and their network behavior. Dubois and Gaffney (2014) discovered that for the main parties' Twitter communities in Canada, the highest indegrees were concentrated among the traditional political elite (media outlets, journalists, and politicians). In the case of the environmental movement in Milan, Diani (2003, p. 112) found that the distribution of indegree and brokerage scores differed remarkably. Brokerage was mainly concentrated in a few organizations, while a higher frequency of followings was much more spread out all across the nodes. Having a clear public profile and access to the national media, a long tradition of campaigning and access to political institutions were also related to a high indegree, but not to a brokerage position (Diani, 2003, pp. 113–115). On the contrary, the capacity to cover a variety of issues was a significant predictor of brokerage, but not of a high number of followers. These results indicated that highly different functions were being performed by the nodes with some popularity and those with some brokerage capacity. The most important function of a broker was within the

network itself: Establishing communication among different subgroups and facilitating the integration of the network as a whole (Diani, 2003, p. 113). However, the following metrics usually identified traditionally important and highly visible political or social players (Dubois & Gaffney, 2014, p. 1269).

To sum up, previous research has shown that the number of followers a Twitter account has depends on traditional functions of leadership, popularity, and prestige (Diani, 2003; Dubois & Gaffney, 2014; Yoon & Park, 2014). We can hypothesize then that in the Catalan parliamentarians' Twitter network, MPs' probability of establishing communication ties will increase when the parliamentarian holds a relevant political position. Other explanatory factors that have been studied in the literature on friendship ties among parliamentarians and on MPs' adoption of Twitter, such as sociodemographic characteristics (age and gender), Internet use (having a blog and a Facebook account), and the legislative involvement (number of interventions in the commissions and in the plenary), can also be included as control variables in our analysis (Caldeira & Patterson, 1987; Chi & Yang, 2014; Lassen & Brown, 2011; Patterson, 1952, 1972; Routt, 1938; Williams & Gulati, 2010). Hence, given the characteristics of parliamentary networks, the factors behind MPs' adoption and use of Twitter and the different roles performed by the opinion leaders in online political networks, the following hypotheses are proposed:

H1: *Catalan MPs with a high number of followers (indegree) will have a propensity for establishing communication ties.*

H2: *Catalan MPs with brokerage positions (betweenness centrality) will have a propensity for establishing communication ties.*

H3: *Catalan MPs' probability of establishing communication ties will increase if the parliamentarian is an official party leader.*

Moreover, as previous studies have revealed, social or political brokers are for the most part not the official and more visible political elites or social organizations, but the more average actors performing a bridging function between the different communities within a network (Diani, 2003; Dubois & Gaffney, 2014). Along these lines, we expect to find a large number of brokers who are not official party leaders or who hold important positions in Parliament but who achieve a central location through their bridging position in the network. Taking all these factors into account, the following hypothesis is proposed:

H4: *Political leaders (who hold an official political position in the party or Parliament) do not occupy relevant (high betweenness centrality) brokerage positions.*

Data

We used NodeXL, an open-source network analysis and visualization software package for Microsoft Excel created by the Social Media Research

Foundation, to collect data on the 115 MPs' relations on Twitter with a longitudinal perspective (01-13-2014; 02-24-2014; 03-24-2014). Furthermore, we collected information about the 115 parliamentarians listed on the Catalan Parliament's website, the MPs' Twitter accounts, the parliamentarians' blogs, the MPs' Facebook pages, and the Catalan parties' websites. For each MP we recorded information on the following attributes: age, gender, political position (party president or mayors), position at the Parliament (role in the parliamentarian group—Spokesperson and President, and the Parliament-Secretary, Vice-President, and President) and role in parliamentary commissions (Secretary, Vice-President, and President), Facebook account (having a Facebook account), blog (having a blog), interventions in parliamentary commissions (number of interventions in these commissions), and interventions in the Parliament plenary (number of interventions in the plenary).

Methods

NodeXL used three clustering algorithms to detect the communities of the Catalan MPs' Twitter network, or in Newman's words (2010, p. 371), "separate the network into groups of vertices that have few connections between them:" the Clauset–Newman–Moore algorithm, the Wakita and Tsurumi algorithm and the Girvan–Newman algorithm. These algorithms generally divide the network based on the ways some nodes connect to one another more than to other groups. We opted for the Girvan–Newman clustering algorithm. This algorithm identifies edges in a network that lie between communities by employing the betweenness centrality measure and then removes them, leaving behind just the communities themselves (see Girvan & Newman, 2002). We employed the Girvan–Newman algorithm because, as stated by González-Bailón and Wang (2016, p. 100), "this method finds the best partition to classify nodes in dense groups," and our assumption was that Catalan MPs will be grouped around their political parties.

To discover the network characteristics and Catalan MP attributes that were facilitating communication ties among the parliamentarians in the three time periods of our study (January, February, and March), we employed ERG models (p*models). ERG models are "tie-based models for understanding how and why social network ties arise" (Lusher, Koskinen, & Robins, 2012, p. 9). The idea behind ERG models is to "generate a large set of random networks based on a chosen set of network properties and node attributes from the observed network. To determine the quality of the resulting model, randomly generated networks are then compared to the observed network" (Gruzd & Tsyganova, 2015). This procedure allowed us to test whether the presence of communication ties in the network was based more on the network properties and the nodes' attributes than by chance alone. We employed ERG models by using the "statnet" package in R (Goodreau, Handcock, Hunter, Butts, & Morris, 2008; Hunter, Handcock, Butts, Goodreau, & Morris, 2008).

We started by building a null model without any predictors (*net ~ edges*), followed by Model 1. This model was created using the two network parameters most examined in the previous literature as indicators of influence (popularity by number of followers—*net ~ edges + idegreepopularity*—and brokerage position by betweenness centrality—*m2star*) jointly with two parameters (reciprocity—*mutual*—and edges) that are basic estimators (cf. Shumate & Palazzolo, 2010) of communication tie formation in online networks (*net ~ edges + idegreepopularity + m2star + mutual*). We then added different attributes of the Catalan parliamentarians to Model 1 (see Appendix for a definition of the network parameters and a codification of node attributes). The individual MP attributes included in the models were selected because, as the previous studies examined in the theoretical section have shown, they clearly affect MPs' online interactions. In our hypotheses, we consider that the MP's political responsibility is the principal factor that increases the density of his or her communication ties, because we are analyzing a parliamentary network. Therefore, the MPs' political position ($M = 1.30$; $SD = 0.47$) was the first node attribute to be added (*net ~ edges + idegreepopularity + m2star + mutual + nodefactor ['Polpos']*), leading to Model 2. We then added two characteristics of the parliamentarians' behavior in the chamber, their interventions in the commissions ($M = 102.87$; $SD = 95.79$) and their interventions in the plenary ($M = 47.09$; $SD = 48.73$) (*net ~ edges + idegreepopularity + m2star + reciprocity+ nodefactor ['Polpos'] + nodecov ['IntCom'] + nodecov ['IntPlen']*), which was Model 3. We followed by adding two MP attributes regarding their Internet behavior, that is, having a blog ($M = 0.6$, $SD = 0.492$) and having a Facebook account ($M = 1.29$; $SD = 0.45$) (*net ~ edges + idegreepopularity + m2star + reciprocity + nodefactor ['Polpos'] + nodecov ['IntCom'] + nodecov ['IntPlen'] + nodefactor ['Blog'] + nodefactor ['Facebook']*), creating Model 4. At the final iteration we added the age ($M = 45.46$; $SD = 9.01$) and gender ($M = 1.41$; $SD = 0.494$) of the parliamentarians (*net ~ edges + idegreepopularity + m2star + reciprocity + nodefactor ['Polpos'] + nodecov ['IntCom'] + nodecov ['IntPlen'] + nodefactor ['Blog'] + nodefactor ['Facebook'] + nodefactor ['Age'] + nodefactor ['Gender']*), namely Model 5. To determine the quality of the resulting model, randomly generated networks were compared to the observed networks by assessing the goodness of fit of the ERG models in plots (Hunter, Goodreau, & Handcock, 2008; Li & Carriere, 2013). Following Hunter, Goodreau et al. (2008), to assess the goodness of fit of the models, we chose to include the indegree statistic and the geodesic distance statistic, as they are the basis for two of the common measures of centrality and directly linked to our research goals.

Political and Network Characteristics of the Catalan Parliamentarians' Twitter Network

Political Characteristics

The Catalan Parliament makes a good case study for several reasons. The first is the early adoption of social networking sites by the Catalan Parliament

and its members. On March 17, 2009, the Catalan Parliament launched the "Parliament 2.0′ Project, which consisted in 'adapting the Parliament to the new active role of users with social media" (Benach, 2010, p. 38). As a result, the Parliament created a YouTube channel in addition to Facebook and Twitter profiles. Furthermore, in October 2013, the Catalan Parliament started the project *Escó 136*,[2] consisting of a web page on which Catalan citizenry could leave comments and suggestions regarding projects and laws proposed by the Catalan Parliament.[3] Furthermore, in 2013, the ratio of Catalan parliamentarians with Twitter accounts was 84.5 percent,[4] greater than in the Spanish Parliament (52.6 percent),[5] the Spanish Senate (33.06 percent),[6] the German Bundestag (31.61 percent) (Thamm & Bleier, 2013), and the U.K. House of Commons (72.3 percent),[7] but lagging somewhat behind the U.S. Senate (100 percent) and House of Representatives (90 percent).[8]

The second reason is that fragmentation and ideological divisions in the Catalan party system enable us to test in-depth hypotheses related to interaction and communication among and between parliamentary groups. The Catalan party system is fragmented into a wide variety of fringe and medium-sized parties. In fact, following the elections of November 25, 2012, there are seven parties in the Catalan Parliament: CiU[9] (50 seats), ERC[10] (21 seats), PSC[11] (20 seats), PP[12] (19 seats), C's[13] (9 seats), ICV[14] (13 seats), and CUP[15] (3 seats). Moreover, the Catalan party system is distributed along two main ideological cleavages (see Figure 1), the Left–Right and the Spanish Nationalist–Catalan Nationalist. Figure 1 places the Catalan parties on these two axes.

Furthermore, fragmentation and ideological divisions are very significant during our period of analysis, especially after the adoption of Resolution

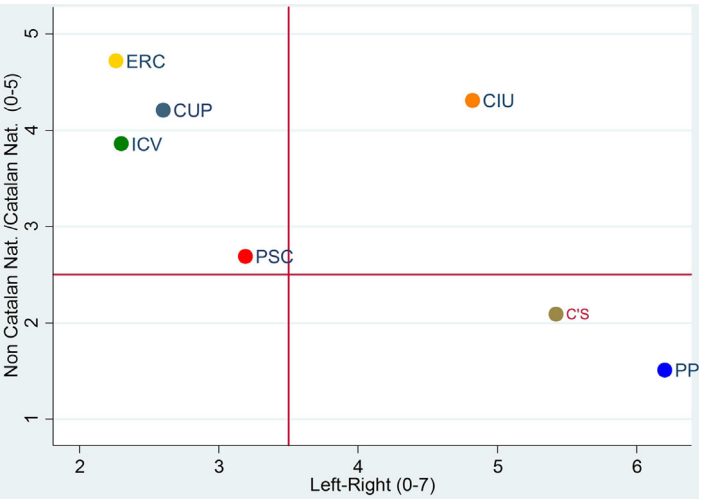

Figure 1. The Position of Catalan Parties on the Political Spectrum of Catalonia According to Catalan Respondents.

479/× by the Parliament of Catalonia in January 2014, by which it was agreed to submit the organic act delegating to the Government of Catalonia power to authorize, call and hold a referendum on the political future of Catalonia for approval by the Spanish Congress.

A third reason is that a significant part of Catalan citizenry uses the Internet (27.8 percent) and social networking sites (19.7 percent) to obtain political information (CEO[16] third wave, April 2014). In addition, 95 percent of Catalan households have a smartphone (Fundación Telefónica, 2013, p. 120). In fact, social media are playing a role in political communication and mobilization in the current troubled political environment, in which protests[17] against austerity measures as well as demands for independence[18] and a referendum[19] are widespread.

Last, several studies have already shown that social media are contributing to the equalization of opportunities for political communication among Catalan parties, as new, fringe, and medium-sized parties, in addition to parties from varied different political positions, are able to achieve greater online interaction and participation than larger and more institutionalized parties (Balcells & Cardenal, 2013; Esteve Del Valle & Borge, 2013).

Network Characteristics

The analysis of the three following–follower Twitter networks of the Catalan MPs with Twitter accounts allows us to highlight different aspects. First, in our case study, a selected group of 115 people created three Twitter networks with 4,447 (January 2014), 4,287 (February 2014), and 4,326 (March 2014) relationships, respectively. The maximum geodesic distance (diameter) of the three networks is three, which means that a maximum of three steps is needed to cross the network. The average distance of the three networks is 1.5, indicating that the average distance between the users is 1.5 steps. Moreover, the average density of the three networks is 0.32. This shows that 32 percent of the total possible relations actually occur. Although the density in all the networks is low, the short distances make it possible to connect easily to others.

Second, as can be seen from Figures 2–4, the three networks could be classified as being tight crowd and affiliation networks. They are tight crowd networks because they contain between two and six groups, a high level of interconnectivity (with modularity score values of 0.189 for the January and February periods and 0.184 for the March period) and few isolates (Hansen et al., 2011, p. 8). These characteristics belong to the so-called affiliation networks,[20] the typical network type to be expected in the Catalan Parliament given its partisan structure, particular working milieu and ideological, and partisan groups. Furthermore, as some authors have stated (Burt, 2005), tight crowd networks facilitate the appearance of structural holes, and therefore, brokers who bridge the different communities.

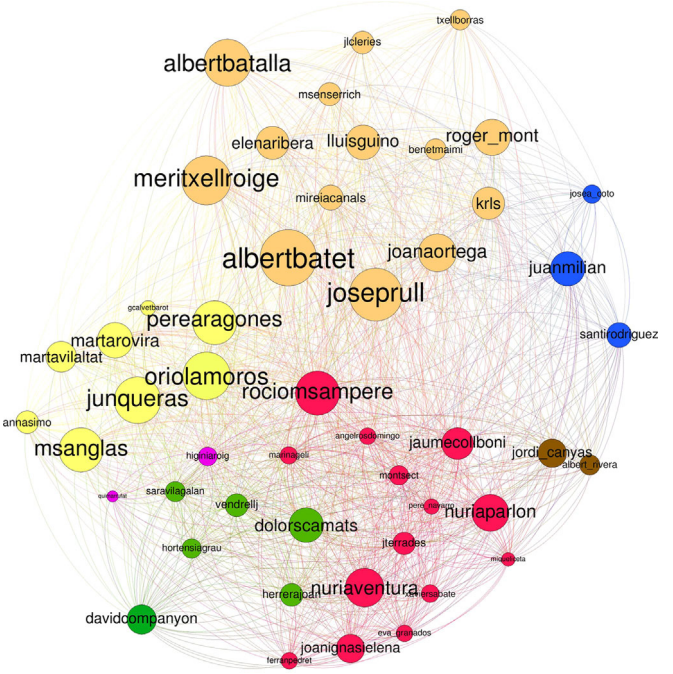

Figure 2. The Following–Follower Twitter Network of Catalan MPs (January 2014).
Notes: The nodes of the network are the 115 deputies with Twitter account. The size of the nodes is equivalent to their betweenness centrality in the network. The color of the nodes is equivalent to the political party that they pertain: orange (CIU), yellow (ERC), red (PSC), blue (PP), green (ICV), brown (C's), and violet (CUP).

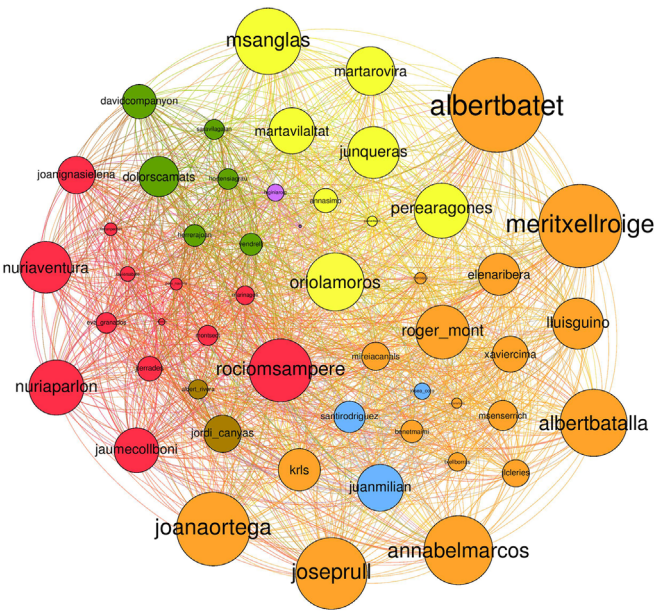

Figure 3. The Following–Follower Twitter Network of Catalan MPs (February 2014).
Notes: The nodes of the network are the 115 deputies with Twitter account. The size of the nodes is equivalent to their betweenness centrality in the network. The color of the nodes is equivalent to the political party that they pertain: orange (CIU), yellow (ERC), red (PSC), blue (PP), green (ICV), brown (C's), and violet (CUP).

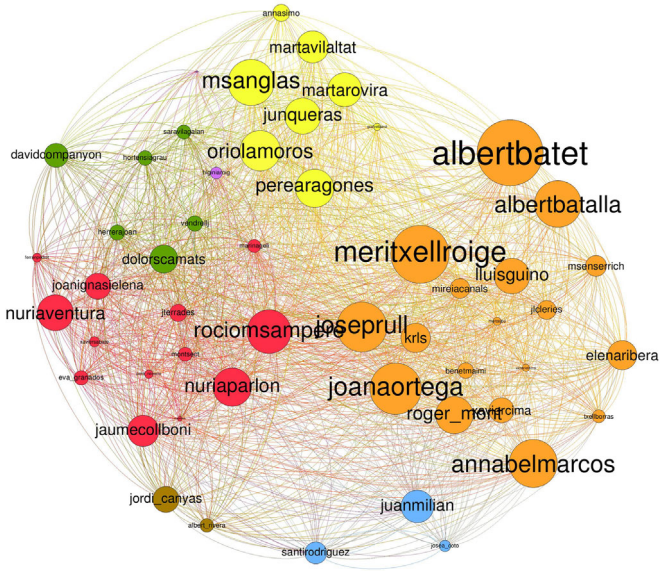

Figure 4. The Following–Follower Twitter Network of Catalan MPs (March 2014).
Notes: The nodes of the network are the 115 deputies with Twitter account. The size of the nodes is equivalent to their betweenness centrality in the network. The color of the nodes is equivalent to the political party that they pertain: orange (CIU), yellow (ERC), red (PSC), blue (PP), green (ICV), brown (C's), and violet (CUP).

Third, with regard to the left–right and nationalist cleavage from Figures 2–4, the existence of these two dimensions can be clearly observed. In the nationalist cleavage, we observe the parties that consider themselves Catalan nationalist parties (CiU, ERC, and CUP) and those that are not Catalan nationalist (PSC, PP, ICV, and C's). Regarding the left–right cleavage, we also observe the dimension that brings together left-wing parties (PSC, ERC, ICV, and CUP) and right-wing parties (CiU, PP, and C's).

Fourth, the reciprocated vertex pair ratio of the nodes shows an average of 0.5 (January), 0.51 (February), and 0.51 (March), which means that the following demands were reciprocated in 50 percent of the cases (on average). These figures can be aligned with those found by Yoon and Park (2014), thereby corroborating that politicians' following relations may be far more influenced by internal social pressure than the other type of politicians' networks (retweets and mentions). In other words, an MP could be under pressure to follow his or her official party leader or to follow other members of the party that are already following him or her.

Last but not least, regarding the modularity[21] of the networks, the existence of four clusters can be observed (Figure 5). Cluster 1 (CiU) and Cluster 2 (C's and PP) present a high cohesiveness and longitudinal stability in comparison with Clusters 3 and 4 (which are a combination of ERC, PSC, ICV, and CUP). More precisely, the highest variability between clusters comes with the isolation of PSC members, triggered by the modification of the stance of the ICV and CUP parliamentarians toward the PSC members and vice versa. In that regard, it should be noted that, during our analysis, the Catalan Parliament adopted

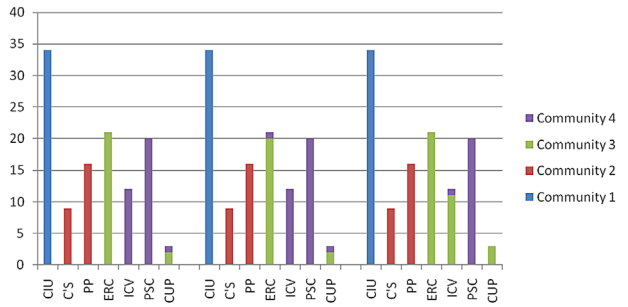

Figure 5. Clusters of the Following–Follower Networks of Catalan MPs (January/February/March).

different resolutions regarding Catalonia's pledge to hold a referendum about independence from Spain (such as Resolution 479/X, mentioned above) over which the position of the majority of the PSC members has been different from that adopted by those belonging to ICV and CUP.

In summary, the Catalan parliamentarians' following–follower Twitter network could be defined as a tight crowd network due to its high reciprocity and clustering structure, which results in the appearance of brokers that bridge parties and party clusters.

Results of the ERG Models

Tables 1–3 summarize the results of the ERG models. The selection criterion was driven by significance levels and the Akaike information criterion and the Bayesian information criterion.

The first column of the three tables reports the estimates of the baseline model (Model 1) containing the arc and the full specification of endogenous network effects: popularity, reciprocity, and brokerage. The edge parameter is negative, a common characteristic of sparse networks (see Mai et al., 2015). The estimates suggest that popularity and reciprocity remain positive and significant ($p < 1e\text{-}04$) across model specifications, whereas brokerage remains significant ($p < 1e\text{-}04$) but negative. This means that, as expected, popularity and reciprocity increase the MPs' likelihood of establishing communication ties, but contrary to our expectations, brokerage decreases parliamentarians' likelihood of forming communication ties.

Model 2 adds the MPs' political position to the endogenous network effects. The estimates of this node attribute are positive and significant ($p < 1e\text{-}04$) for the three time periods. In line with these estimates, which can be interpreted as conditional log-odds ratios, political position positively affects the MPs' likelihood of establishing communication ties. For instance, in the month of January (Model 2), holding a political position increased the MPs' odds of being followed by 10 percent.

Model 3 adds to the previous models the MPs' work at Parliament as a possible explanation of Catalan MPs' communication ties. Controlling for

Table 1. Factors Underlying the Formation of Communication Ties in the Catalan MPs' Twitter Network (January 2014)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	EST	SE	EST	SE	EST	SE	EST	SE	EST	SE
Structural features										
Edges	**−4.237**	0.137	**−4.241**	0.148	**−4.209**	1.468	**−4.363**	0.198	**−4.846**	0.121
Reciprocity	**2.700**	0.065	**2.685**	0.065	**2.659**	6.513	**2.676**	0.072	**2.708**	0.073
Popularity (by number of followers)	**0.308**	0.020	**0.309**	0.019	**3.220**	1.822	**0.319**	0.018	**0.330**	0.017
Brokerage	**0.005**	0.002	**−0.005**	0.002	**−7.282**	2.040	**−0.005**	0.002	**−0.007**	0.002
Parliamentarians' attributes										
Political position			**0.107**	0.030	**8.947**	3.796	**0.072**	0.038	**0.107**	0.031
Parliament activity measures										
Interventions in the commissions					**−1.708**	9.728	−0.000	0.000	**−0.000**	0.000
Interventions in the plenary					2.266	2.056	0.000	0.000	**0.000**	0.020
Internet behavior measures										
Having a blog							0.033	0.030	**0.059**	0.027
Having Facebook							−0.007	0.027	−0.002	0.023
Age									**0.006**	0.001
Gender (male)									−0.045	0.026
Akaike information criterion	14,435		14,398		14,393		14,376		14,354	
Bayesian information criterion	14,465		14,436		14,445		14,443		14,436	

Note: Coefficients in bold are significant at the 95 percent level.

endogenous network effects, the estimates suggest that parliamentarians' interventions in the commissions are significant and negative in January ($EST = -1.708$; $SE = 9.728$) and March ($EST = -2.062$; $SE = 8.733$), whereas the MPs' interventions in the plenary are not significant in any period. This means that MPs seem to shy away from peers who are highly engaged with the work being done in parliamentary commissions.

Model 4 adds to the previous models Catalan parliamentarians' Internet behavior (having a blog and a Facebook account) as a facilitator of their communication ties in the following–follower Twitter network. As for the case interventions in the plenary, neither the estimates of having a blog nor the estimates of having a Facebook account are significant (with the exception of having a blog in Model 5 of the January ERG model). This means that MPs' Internet activities do not seem to increase Catalan parliamentarians' likelihood of establishing communication ties.

Last, in Model 5 we added the MPs' age and gender to the previous ERG models. The estimates of the age attribute are positive and significant for January ($EST = 0.006$; $ES = 0.001$) and March ($EST = 0.003$; $ES = 0.001$). But the estimates for gender are only significant and positive for March ($EST = 0.042$; $ES = 0.022$). This means that older or male MPs seem to be more likely to establish communication ties than younger or female parliamentarians. However, the

Table 2. Factors Underlying the Formation of Communication Ties in the Catalan MPs' Twitter Network (February 2014)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	EST	SE	EST	SE	EST	SE	EST	SE	EST	SE
Structural features										
Edges	**−4.268**	0.118	**−4.314**	0.136	**−4.220**	0.147	**−4.332**	1.396	**−4.498**	1.786
Reciprocity	**2.670**	0.064	**2.647**	0.068	**2.680**	0.069	**2.685**	6.970	**2.696**	7.517
Popularity (by number of followers)	**0.293**	0.019	**0.307**	0.019	**0.306**	0.018	**3.119**	1.635	**3.244**	1.555
Brokerage	−0.003	0.002	**−0.004**	0.002	**−0.005**	0.002	**−5.775**	2.330	**−7.145**	2.019
Parliamentarians' attributes										
Political position			**0.075**	0.035	**0.111**	0.029	**1.173**	2.665	**9.070**	2.893
Parliament activity measures										
Interventions in the commissions					−0.000	0.000	−2.470	1.090	−4.438	1.186
Interventions in the plenary					0.000	0.000	1.995	1.717	4.690	1.622
Internet behavior measures										
Having a blog							2.028	2.456	9.832	2.237
Having Facebook							2.332	2.054	2.275	1.908
Age									1.513	1.478
Gender (Male)									3.963	2.814
Akaike information criterion	14,485		14,437		14,433		14,449		14,441	
Bayesian information criterion	14,515		14,474		14,486		14,517		14,523	

Note: Coefficients in bold are significant at the 95 percent level.

gender attribute is only significant for the March period, and we should therefore be very cautious in drawing conclusions from the effect of gender on MPs' propensity to establish communication ties.

To sum up, the first hypothesis is corroborated because MPs' popularity has a positive effect on the number of communication ties established by the parliamentarians. The second hypothesis is discarded, as MPs' brokerage position decreases the parliamentarians' likelihood of establishing communication ties. The third hypothesis is corroborated because MPs' political position increases the parliamentarians' probability of establishing communication ties.

To assess how well the model captures the structure of the data, Figure 6 shows how the observed indegree and minimum geodesic distance distributions reproduce the network statistics seen in the original data. In both plots the vertical axis is the relative frequency. The observed statistics in the actual network are indicated by the solid lines (thick black lines). The gray lines represent the range of 95 percent of the simulated statistics.

The models perform relatively well for the indegree distribution and the geodesic distribution. The observed distributions fall with the quantile curves for most of the range. The model overestimates the average indegree distribution and geodesic distance, but overall it correctly captures the shape of the distribution of

Table 3. Factors Underlying the Formation of Communication Ties in the Catalan MPs' Twitter Network (March 2014)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	EST	SE	EST	SE	EST	SE	EST	SE	EST	SE
Structural features										
Edges	**−4.247**	0.140	**−4.277**	0.149	**−4.277**	1.638	**−4.337**	0.145	**−4.548**	0.182
Reciprocity	**2.662**	0.060	**2.683**	0.067	**2.646**	7.035	**2.678**	0.072	**2.670**	0.076
Popularity (by number of followers)	**0.301**	0.021	**0.308**	0.0186	**3.111**	1.923	**0.312**	0.017	**0.309**	0.019
Brokerage	**−0.004**	0.002	**−0.005**	0.002	**−5.050**	2.307	**-0.005**	0.002	**−0.006**	0.002
Parliamentarians' attributes										
Political position			**0.111**	0.026	**1.149**	2.329	**0.109**	0.027	**0.078**	0.035
Parliament activity measures										
Interventions in the commissions					**−2.062**	8.733	-0.000	0.000	**−0.000**	0.000
Interventions in the plenary					1.868	1.877	0.000	0.000	0.000	0.000
Internet behavior measures										
Having a blog							0.020	0.016	0.014	0.023
Having Facebook							0.010	0.019	0.017	0.020
Demographic measures										
Age									**0.003**	0.001
Gender (Male)									**0.042**	0.022
Akaike information criterion	14,525		14,507		14,493		14,491		14,506	
Bayesian information criterion	14,555		14,545		14,545		14,558		14,588	

Note: Coefficients in bold are significant at the 95 percent level.

the original network. We present plots for the January period, because the results for the other periods (February and March) follow similar patterns.

ERG models show that brokerage decreases Catalan MPs' likelihood of establishing communication ties. However, since brokerage positions in the Catalan parliamentary Twitter network act as a bridge among party clusters and parliamentarians, we wanted to know the characteristics of the brokers of the

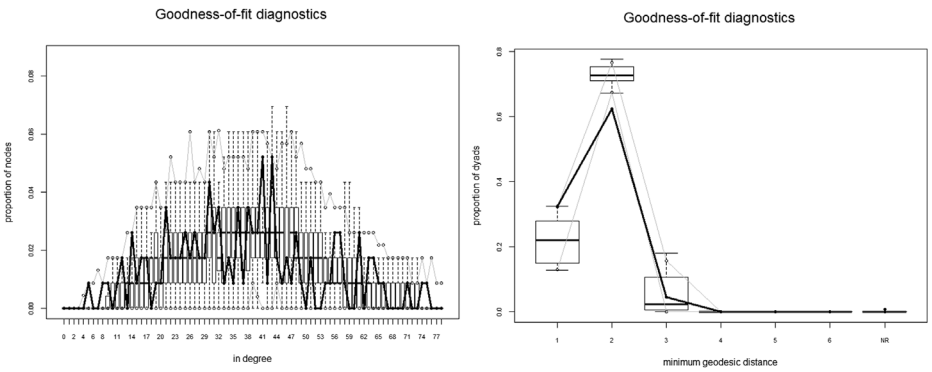

Figure 6. Goodness-of-Fit Diagnostics (Model 5—January period).

Catalan parliamentary Twitter network. In order to test this, we checked who the brokers were (parliamentarians with a betweenness centrality of over 100) and who among them held important official positions in Parliament or in the party. We compared this with the parliamentarians with a high number of followers or a high indegree because, as we have found previously, these centrality positions are differently related to the official roles played in Parliament. Table 4 shows the 26 or 27 parliamentarians with higher indegree and betweenness centrality in the Twitter network for January, February, and March. The Twitter accounts are sorted in descending order based on the indegree and the betweenness centrality of the parliamentarians. The most notable aspect of the data is that, while in the case of the indegree centrality we observe that half of the parliamentarians hold a parliamentarian or a political position (13 parliamentarians in January and February, and 11 parliamentarians in March), in the case of the betweenness centrality, the majority of the parliamentarians do not have either of these two characteristics (only six parliamentarians in January and seven parliamentarians in February and March hold a political or a parliamentarian position). Another relevant aspect highlighted in Table 4 is the relevance of party leaders (@junqueras—ERC, @dolorscamats—ICV, @Herrerajoan—ICV, @perenavarro—PSC, @Albert_Rivera—C's, @HiginiaRoig—CUP) in the indegree centrality and their virtual absence (with the exception of @junqueras and @dolorscamats) in the betweenness centrality dimension. Specifically, six out of seven Catalan party leaders with Twitter accounts (@Aliciacamacho does not appear in either of these two centrality dimensions) reach a high indegree centrality in January and February, and five out of seven in March. However, it is also important to pinpoint the role played by @junqueras (Oriol Junqueras, President of ERC and head of the opposition in the Parliament of Catalonia), for, as shown in Table 4, he is the only party leader reaching a high betweenness centrality and indegree figures in the three analysis periods. In that regard, some possible explanations for Oriol Junqueras' centrality position in the network (both in terms of followers and brokerage position) could come from his high level of activity on Twitter, his role as the head of the opposition and the entente between the party that he presides over (ERC) and the party in government (CiU) regarding the desire for Catalonia to become an independent state.

Following up on the reasons behind the centrality position of Catalan MPs in the following–follower Twitter network, it is important to note the fact that, while the parliamentarians' centrality position in terms of followers could be rooted in the party discipline that imposes reciprocity and following of the leaders, the ties with the parliamentarians of the other political parties are at the base of the bridging role of those parliamentarians with high betweenness centrality.

Going a step further in comprehending the differences between the brokers and the rest of the parliamentarians, we studied the attributes of the MPs with the highest betweenness centrality. Brokers are slightly younger (average age of 43 years compared to an average age of 45 for the rest) and there is a greater presence of women than men (42.3 percent for women vs. 40.9 percent for men), but these differences are not statistically significant. They have more Facebook

Table 4. The 26 or 27 Parliamentarians With Higher Indegree and Betweenness Centrality

January 2014		February 2014		March 2014	
ID	BC	ID	BC	ID	BC
Rocio Martinez (PSC)	Albert Batet (CiU)	Rocio Martínez (PSC)	Albert Batet (CiU)	Rocio Martinez (PSC)	Albert Batet (CiU)
Oriol Junqueras**△ (ERC)	Violant Cervera (CiU)	Oriol	Violant Cervera (CiU)	Oriol Junqueras**△ (ERC)	Violant Cervera (CiU)
Joana Ortega** (CiU)	Agnès Russinyol (ERC)	Junqueras**△ (ERC)	Agnès Russinyol (ERC)	Joana Ortega** (CiU)	Agnes Russinyol (ERC)
Josep Rull* (CiU)	Meritxell Roige (CiU)	Joana Ortega** (CiU)	Meritxell Roige (CiU)	Marina Geli (PSC)	Meritxell Roige (CiU)
Jaume Collboni (PSC)	Josep Rull* (CiU)	Marina Geli (PSC)	Annabel Marcos (CiU)	Josep Rull* (CiU)	Annabel Marcos (CiU)
Dolors Camats**△ (ICV)	Annabel Marcos (CiU)	Josep Rull*(CiU)	Josep Rull*(CiU)	Pere Aragones (ERC)	Josep Rull* (CiU)
Marina Geli (PSC)	Oriol Amorós (ERC)	Pere Aragonès (ERC)	Marc Sanglas (ERC)	Jaume Collboni (PSC)	Marc Sanglas (ERC)
Oriol Amorós (ERC)	Pere Calbo (PP)	Jaume Collboni (PSC)	Pere Calbo (PP)	Dolors Camats**△ (ICV)	Pere Vilafulcara (CiU)
Perear Aragonès (ERC)	Pere Vilafulcara (CiU)	Dolors Camats**△(ICV)	Rocio Martínez (PSC)	Joan Herrera**△(ICV)	Pere Calbo (PP)
Marta Rovira* (ERC)	Oriol	Marta Rovira*(ERC)	Oriol Amorós (ERC)	Marta Rovira* (ERC)	Rocio Martinez (PSC)
Joan Herrera** △ (ICV)	Junqueras**△ (ERC)	Miquel Iceta*(PSC)	Pere Vilafulcara (CiU)	Miquel Iceta* (PSC)	Oriol Amoros (ERC)
Miquel Iceta* (PSC)	Rocio Martínez (PSC)	Oriol Amorós (ERC)	Pere Aragonès (ERC)	Oriol Amoros (ERC)	Perear Aragones (ERC)
Joan Ignasi Elena (PSC)	Marc Sanglas (ERC)	Joan Ignasi Elena (PSC)	Oriol	Joan Ignasi Elena (PSC)	Oriol
Roger Montanyola (CiU)	Roger Montanyola (CiU)	Joan Herrera**△(ICV)	Junqueras**△ (ERC)	Roger Montanyola (CiU)	Junqueras**△ (ERC)
Albert Batalla (CiU)	Joana Ortega** (CiU)	Roger Montanyola (CiU)	Marisa Xandri (PP)	David	Marisa Xandri (PP)
David Fernàndez	Marta Rovira* (ERC)	Albert Batalla (CiU)	NúriaVentura (PSC)	Fernàndez**△ (CUP)	Nuria Ventura (PSC)
**△ (CUP)	Núria Ventura (PSC)	David Fernàndez (CUP)	Roger Montanyola (CiU)	Marc Sanglas (ERC)	Roger Montanyola (CiU)
Marc Sanglàs (ERC)	Xavier Cima (CiU)	Marc Sanglas (ERC)	Rafa López (PP)	Carles Puigdemont (CiU)	Rafa Lopez (PP)
Carles Puigdemont (CiU)	Pere Aragonès (ERC)	Anna Simó* (ERC)	Joan Ignasi Elena (PSC)	Albert Batalla (CiU)	Joan Ignasi Elena (PSC)
Anna Simó* (ERC)	Joan Ignasi Elena (PSC)	Pere Navarro**△ (PSC)	Xavier Cima (CiU)	Anna Simo[a] (ERC)	Xavier Cima (CIU)
Pere Navarro**△ (PSC)	Rafa López (PP)	Núria Parlon** (PSC)	Joana Ortega** (CiU)	Pere Navarro**△ (PSC)	Joana Ortega** (CiU)
Àngel Ros** (PSC)	Dolors Camats**△ (ICV)	Meritxell Roige (CiU)	Marta Rovira** (ERC)	Nuria Parlon** (PSC)	Marta Rovira* (ERC)
Meritxell Roige (CiU)	Rosa Amorós (ERC)	Núria Ventura (PSC)	Rosa Amorós (ERC)	Meritxell Roige (CiU)	Lluis Guino (CiU)
Núria Parlon** (PSC)	Lluis Guino(CiU)	Josep Lluis Cleries (CiU)	Lluis Guino (CiU)	Nuria Ventura (PSC)	Rosa Amoros (ERC)
Núria Ventura (PSC)	Elena Ribera (CiU)	Lluis Guino (CiU)	Manuel Reyes** (PP)	Merce Senserrich (CiU)	Manu Reyes* (PP)
Lluis Guino (CiU)	Juan Milian (PP)	Albert Rivera**△ (C's)	Juan Milian (PP)	Lluis Guino (CiU)	Juan Milian (PP)
Albert Rivera**△ (C's)	Manuel Reyes[b] (PP)		Elena Ribera (CiU)	Josep Lluis Cleries (CiU)	Elena Ribera (CiU)
			Dolors Camats**△(ICV)		

Notes: ID, indegree; BC, betweenness centrality; *Parliament position; **political position; Δ, party leader. The MPs' parliamentarian groups are in parentheses.

accounts than the other parliamentarians (85 percent vs. 71 percent), and they follow many more parliamentarians ($\mu = 64$) than the rest of the parliamentarians with Twitter accounts ($\mu = 29$). On the contrary, they intervene much less in parliamentary commissions ($\mu = 73$ times vs. $\mu = 112$ times) and plenary sessions ($\mu = 42$ times vs. $\mu = 49$ times).

In summary, we have discovered that new potential influencers, who are not official party leaders and who do not play important roles in the Parliament, are rising up within the Catalan Parliament Twitter network. Although this Twitter network still maintains the leadership and influence of official party leaders by means of its following structure, other parliamentarians are deploying the function of bridging between different parties and parliamentarians. And this brokerage role is not related to individual or political characteristics but rather to networking variables (following other MPs) and Internet behavior (having a Facebook account). These results are in line with the findings of authors such as Diani (2003), Dubois and Gaffney (2014), or Young and Park (2014), which showed that the number of followers on Twitter is related to traditional political or social leadership, while brokerage is performed by new actors skilled in networking activities.

Discussion

In this study, we have found evidence that, in the Catalan parliamentarians' following–follower Twitter network, opinion leadership is exerted by traditional political leaders and also by new potential influencers whose influence is not rooted in their political visibility but instead in their brokerage position.

Theoretically, this research addresses the two-step flow of communication studies and it provides some evidence of its validity in the Internet-mediated era. More specifically, our study shows that, in line with the results found by Dubois and Gaffney (2014) and Choi (2015), in Twitter networks, the flows of information are concentrated around a limited number of the nodes that play opinion leader roles.

With regard to methodology, in this research we adopted a multilevel approach (Choi, 2015) by studying the flow of information in the whole following–follower network (macro level), by analyzing the relationships between the nodes of the network (meso level), and investigating the characteristics of the potential influencers (micro level).

At a network level, the structure of the Catalan parliamentarian following–follower Twitter network corresponding to January, February, and March 2014 allows us to determine that Twitter relations among Catalan parliamentarians correspond to a typical affiliation network, due to the partisan structure and working milieu of the Parliament. The network analysis reveals high reciprocity between parliamentarians (Yoon & Park, 2014), short distances between them and a clustering structure of four communities, which brings about the appearance of brokers (Burt, 2005) who bridge the different political clusters. Furthermore, in addition to the studies that have analyzed the structure of online political networks on Twitter and pointed out the influence of the party

cleavages in structuring relations among the nodes of the network (Conover et al., 2011), our analysis shows that Catalan MPs' Twitter relations are distributed along the two main cleavages of the Catalan party system (left–right and Catalan–Spanish nationalist). Along these lines, our research contributes to the previous congressional network studies, which have mainly focused on the United States two-party system, adding a new case study characterized by a multiparty system that could have paved the way for the appearance of brokers. The analysis of a highly fragmented (six parties) and ideologically divided (two cleavages) party system like Catalonia's shows that the probability of the appearance of parliamentarian brokerage positions that connect structural holes is very high. In addition, it sheds some light on the relevant role an electoral system plays in triggering the appearance of parliamentarian structural holes. That is, the Catalan case shows that an electoral system based on proportional representation has more political parties appearing in Parliament (and therefore more structural holes) than in majoritarian electoral systems (as in the case of the United States).

At a meso level, the results of the ERG models (p*models) show that, while parliamentarians' popularity (indegree) and reciprocity increase the MPs' likelihood of establishing communication ties, parliamentarians' brokerage position (betweenness centrality) decreases the MPs' probability of establishing communication ties. We expected to find that these three network parameters would have a positive and significant effect on the MPs' likelihood of establishing communication ties, and therefore, the results that we found for the brokerage parameter do not corroborate our initial expectations. A possible explanation for the negative effect of MPs' brokerage position on their propensity to form communication ties comes from the partisan structure of the Catalan Parliament. That is, in a parliamentary system highly controlled by the political parties such as Catalonia's, in which for instance the legislators vote according to an official line set down by the party, the bridging role played by some MPs to link parliamentarians from different parties seems to be penalized by their peers. Moreover, the analysis of the following–follower relationships among Catalan MPs revealed that a limited number of parliamentarians play leading roles in terms of concentrating the majority of communication flows. Similar to the results found by Hsu and Park (2012) in their analysis of communication relationships among members of the Korean National Assembly, our data show that opinion leadership is concentrated in a reduced number of MPs and pinpoints the role played by an elite number of brokers in bridging the different clusters of the Catalan parliamentarian Twitter network, a factor that had previously been discovered by González-Bailón and Wang (2016).

At a micro level, we have found evidence to back the claim that the Catalan MPs' popularity (indegree) in the Catalan parliamentarians' following–follower Twitter network is mainly determined by political leadership factors. More specifically, the results of our ERG models show that Catalan parliamentarians who are official party leaders have a higher propensity for establishing communication ties than the rest of the parliamentarians. These results are in line

with those found by Caldeira and Patterson (1987) and Patterson (1952, 1972), who when dealing with the friendship networks in parliaments (which, in the case of Twitter, may be similar to the following–follower networks), pointed out that the leadership role was determined by political friendship. Indeed, similar to what was revealed by Diani (2003) and Dubois and Gaffney (2014), our data corroborate that the traditional political elite who have a clear public profile and political responsibilities are related to high indegree figures. Furthermore, our data show that neither Catalan MPs' engagement with parliamentary work nor parliamentarians' use of Facebook and blogs seems to increase their propensity to establish communication ties. In addition, older MPs seem to be more likely to establish communication ties than young parliamentarians.

Finally, regarding the analysis of the MPs with the highest indegree and betweenness centrality (26 or 27 parliamentarians), the results show that, while in the case of indegree centrality we observe that half of the parliamentarians hold a parliamentarian or political position, in the case of betweenness centrality, the great majority of parliamentarians have neither of these characteristics (only six parliamentarians in January and seven parliamentarians in February and March held a political or parliamentarian position). Moreover, our results point to the relevance of party leaders in the indegree centrality and their virtual absence (with the exception of two party leaders) in the betweenness centrality dimension. If we compare the brokers with the rest of the MPs, they take much less part in parliamentary commissions and plenary sessions, but they are much more active in Internet activities (Facebook) and follow many more parliamentarians. These results are in line with those found by Diani (2003), Dubois and Gaffney (2014), and Xu et al. (2014), which point to the very different functions being performed by nodes with popularity (indegree) and those with brokerage capacity.

In summary, we have discovered that new potential influencers, who are not official party leaders and who do not play important roles in Parliament, are emerging within the Catalan Parliament Twitter network. Although this Twitter network still maintains the leadership and influence of official party leaders by means of its following structure, other parliamentarians are deploying a bridging function between different parties and parliamentarians. These results are similar to the findings of Diani (2003), which showed that the number of followers on Twitter is related to traditional political or social leadership, while brokerage is performed by new actors, skilled in networking activities.

Would it be possible to apply our research to other cases? Although the current political climate of Catalonia is quite unique, we believe that the methods and open software used in the research could be replicated in other studies. In fact, we expect this research to inspire more analysis of parliamentarians' online networks, as there is still a long way to go in comprehending the multiple and diverse facets of this particular field of research.

Notwithstanding, this study has several limitations and creates a number of complementary hypotheses to be tested in future research. First, it might be interesting to analyze parliamentarians' behavior on Twitter by studying and comparing not only the following–follower network but also the retweet and

mention network. Second, it is important to ascertain whether the attributes of our ERG models should be complemented with more dimensions, such as the party the parliamentarians belong to, the MPs' activity on Twitter, or the number of years the parliamentarians sat in Parliament, to give a better account of the affinities in the following–follower Twitter network of parliaments. Third, further research is necessary to better understand why and how the majority of the parliamentarians who are bridges of Twitter communication in Parliament are not official party leaders and do not hold important positions in Parliament. It may be a question of opportunity, costs, and free time. Parliamentarians who are not so overloaded with party responsibilities could devote more time to networking on Twitter. Last, more studies going beyond the limited time span of our article, carrying out comparative analysis between parliamentarians of different and similar political systems, could provide powerful insights into the way in which MPs deal with social media.

In conclusion, in view of the broader debate on cyberpolitics, this research implies that social media are opening up a new online political arena in parliaments. Twitter is opening a window through which new online potential influencers may appear on the scene. In many cases, their informative power and centrality is based on their political status (leaders), but in many others it is rooted in their network's friendship ties and their ability to connect opposing actors (brokers).

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Notes

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1. Hansen et al. (2011, p. 40) define betweenness centrality as "a measure of how often a given vertex —or node—lies on the shortest path between two other vertices." Similarly, Freeman (1978/1979, p. 221) defines betweenness centrality as "the frequency with which a point falls between pairs of other points on the shortest or geodesic paths connecting them."
2. Seat 136, as the Parliament seats 135 members.
3. The comments and suggestions of the citizenry are transferred to the authorities in charge of elaborating Catalan legislation and they will be annexed to the law initiative. See http://www.parlament.cat/web/participacio/esco-136/index.html [accessed on January 28, 2017].
4. http://www.gutierrez-rubi.es/tag/parlament-de-catalunya/ [accessed on January 28, 2017].
5. http://parlamento20.es/twitter-en-el-congreso-de-los-diputados [accessed on January 28, 2017].
6. http://www.blogsdepolitica.com/el-senado-tambien-existe-presencia-y-actividad-en-twitter-de-los-senadores/ [accessed on January 28, 2017].
7. http://blogs.telegraph.co.uk/news/willheaven/100228088/how-long-before-every-single-mp-is-on-twitter [accessed on January 28, 2017].
8. https://blog.twitter.com/2013/100-senators-and-57th-inauguration [accessed on January 28, 2017].
9. CiU is a Catalan nationalist center-right party.
10. ERC stands for "Republican Left of Catalonia" and it is a left-wing party for independence.

11. PSC is the Socialist Party of Catalonia and it is federated with the Spanish Socialist Party.
12. PP is the Popular Party of Catalonia, which is a member of the Spanish Popular Party, a right-wing and Spanish nationalist party.
13. C's stands for "Citizens" and it is a relatively new centrist party that is against Catalan nationalism.
14. ICV is a left-wing party self-defined as eco-socialist and an autonomous part of the Spanish United Left (IU).
15. CUP stands for "Candidacies of Popular Unity" and is an extreme left and pro-Catalan independence coalition.
16. CEO is a Catalan government center for public opinion studies.
17. In 2013, there were 6,000 demonstrations in Catalonia, Catalan Ministry of Home Affairs. See http://www.lavanguardia.com/encatala/20131117/54394193564/manifestacions-catalunya.html [accessed January 28, 2017].
18. According to the CEO figures (June 2014), 45.2 percent of survey respondents were in favor of Catalan Independence (N = 2,000).
19. One November 9, 2014, a nonbinding consultation for independence was held by the Catalan government with the help of thousands of volunteers but without the legal approval of the Constitutional Court and the Spanish Government.
20. An Affiliation network is a network in which actors are connected via comembership of groups of some kind" (Newman, 2010, p. 53).
21. Modularity measures how well a network decomposes into modular communities or subnetworks. The Catalan MPs' Twitter network contains four clear communities.

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Appendix

Network Parameter	Description
Popularity (Idegreepopularity)	This network parameter adds one statistic to the model equaling the sum over the actors of each actors' indegree taken to the 3/2 power (or equivalent, multiplied by its square).
Reciprocity (mutual)	This network parameter adds one statistic to the model equaling the number of adjacent actors that are connected to the actor with edges in both directions divided by the number of adjacent actors.
Brokerage (m2star)	This network parameter adds one statistic to the model equal to the number of mixed 2-stars in the network, where a mixed 2-star is a pair of distinct edges (i-j), (j-K). A mixed 2-star is sometimes called a 2-path because it is a directed path of length from i to k via j. However, in the case of a 2-path, the focus is usually on the end points i and k, whereas for a mixed 2-star the focus is usually in the midpoint j.
Node attributes	Codification
Political position (PolPos)	1−Local mayor 2−President of the party Recoded 0–1 (0 = no position; 1 = 1–2)
Interventions in the commissions (IntCom)	From 0 to 445
Interventions in the plenary (IntPlen)	From 0 to 262
Blog	1 = yes 0 = no
Facebook	1 = yes 0 = no
Age	0 = male, 1 = female
Gender	From 28 to 66 years