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Political Polarisation and Network Leaderships in the Catalan Parliamentarians' Twitter Network[*]

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Abstract

This article seeks to test if Twitter is opening communication flows between parties and paving the way for the appearance of network leaderships or if it is reducing them to representatives of the same party or ideology and empowering party leaders. The study is based on a dataset spanning from 1 January 2013 to 31 March 2014 which covers all *relationships* (4,516), *retweets* (6,045) and *mentions* (19,507) of Catalan parliamentarians. The data sustain that the political polarisation of Catalan parliamentarians' Twitter flows is deeper in the relationship and retweet networks than it is in the mention and that even if party leaders are still at the centre of communication flows, other parliamentarians are taking the floor and becoming network leaders.

Keywords

parliamentarians, Twitter, polarisation, network leaderships, Catalonia

Topic

political science, communication, network analysis

Polarización política y liderazgos de red en la red Twitter de los parlamentarios catalanes

Resumen

Este artículo trata de probar si Twitter abre flujos de comunicación entre partidos distintos y allana el camino para la aparición de liderazgos en la red o si los reduce a representantes del mismo partido o ideología y empodera a los líderes del partido. El estudio se basa en un conjunto de datos que abarca desde 1 de enero de 2013 al 31 de marzo de 2014 e incluye todas las relaciones (4516), retweets (6045) y menciones (19.507) de los parlamentarios catalanes. Los datos sostienen que la polarización política de los parlamentarios catalanes en los intercambios de Twitter es más profunda en las redes de relaciones y las redes de retweets que en las redes de menciones y que, aunque los líderes del partido se encuentran todavía en el centro de los flujos de comunicación, otros parlamentarios están tomando la palabra y se están convirtiendo en líderes en la red.

Palabras clave

parlamentarios, Twitter, polarización, liderazgos de red, Cataluña

Tema

ciencias políticas, comunicación, análisis de redes

Introduction

MPs' use of social media is opening a new online political arena that has its own particularities and logics of power distribution. In Catalonia, where 85 % of parliamentarians have a Twitter[1] account, this new Internet-mediated political realm is already a reality.

The MPs' behaviour on Twitter has been studied from multiple angles which go from the reasons behind the parliamentarians' adoption of Twitter (Lassen and Brown, 2010; Chi and Yang, 2010; Williams and Gulati, 2010) to their use of this social networking site to communicate with the electorate (Small, 2010; Margaretten and Gaber, 2014). More recently, some authors have studied the phenomena of political polarisation (Gruzd, 2012) and network leaderships (Gonzalez-Bailon and Wang, 2014)

in Twitter networks. However, as far as we know, no study has examined political polarisation and leadership issues on Twitter parliamentarian networks.

Therefore, this research attempts to analyse some of the effects of Twitter on the directions (Bimber, 2014) of parliamentarians' online communication flows[2]. Specifically, this article applies statistical analysis and social network methods together in order to offer plausible and refutable answers to the following questions: Is Twitter facilitating Catalonian parliamentarians' exposure to cross-ideological opinions or is it confining them to like-minded clusters? Is Twitter empowering official party leaders or paving the way for the appearance of new network leaderships?

To do this, we have created a specific research engine to gather all the Catalan parliamentarians' relations -following/ follower- (4,516), retweets (6,045) and mentions (19,507)

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1. An online social networking website and microblogging service that allows users to post and read text-based messages of up to 140 characters, known as tweets. It gives its users the opportunity to share short messages (tweets), respond to tweets (reply), mention other users' account (mention) or simply forward a tweet (retweet).
2. Manuel Castells defines these flows as "streams of information between nodes circulating through the channels of connection between nodes" (Castells, 2009, p. 20).

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from the 1st January 2013 – 31 March 2014 period. That data covers an extraordinary and conflictive time in Catalonia in which demands for independence and a referendum as well as protests against austerity measures were widespread. We have chosen the Catalan Parliament because the Catalan party system is fragmented and ideologically polarised so it provides a perfect context for examining cross-ideological and inter-partisan interactions.

The paper is organised as follows: First, we will analyse related work on political polarisation on Twitter and political leaderships on Twitter networks. Continuing with details of the design of the research, construction of variables and stating the research hypotheses to be tested. Then we will introduce the Catalan case. We will finally present the findings of the article and discuss their implications.

2. Theoretical background

A growing body of research has begun to examine the influence of social networking sites on political communication from multiple angles, yet there is still a long way to go in studying Internet-mediated social networks of members of Parliament and the implications of these new forms of communication between parliamentarians on party leadership and relationships between parties. We will review literature dealing with two aspects: a) Political polarisation on Twitter; b) Twitter networks and political leaderships.

Political polarisation on Twitter

The phenomena of online political polarisation on Twitter has been recently analysed in some papers amongst which Yardi and Boyd's (2010) study of peoples' tweets on the shooting of George Tiller revealed that "people are more likely to reply to people who share the same view" (Yardi and Boyd, 2010, p.13). In this same light, Conover *et al*'s. (2011) study of more than 250,000 tweets from the six weeks leading to the 2010 U.S. congressional midterm elections proved that while "retweet networks exhibited a highly modular structure segregating users into two homogenous communities corresponding to the political left and right, the mention network did not show this kind of political segregation, resulting in users being exposed to individuals and information they would not have been likely to choose in advance" (Conover *et al.*, 2011, p. 89). Gruzd (2012) added a Canadian perspective to this field of research and his network analysis of 5,918 tweets on

the 2011 Canadian Federal election concluded that "on the one hand, there was a clustering effect around shared political views among supporters of the same party in the communication network of Twitter. On the other hand, there was also evidence of cross-ideological connections" (Gruzd, 2012, p. 8). In this same line of research, Hsu and Park's (2012) study of the communication relationships between members of the Korean National Assembly pointed to the fact that intraparty connections were stronger than inter-party connections on Twitter (Hsu and Park, 2012, p.5) and Himelboim *et al.*'s social network and content analysis of 10 controversial U.S. political topics on Twitter showed that "political content was overall confined to like-minded clusters of users" (Himelboim *et al.*, 2013, p. 18). Also, Conover at al., (2011) and Yoon and Park (2014) noticed that while retweet and following networks reproduced the known partisan split in the online world, the mention network showed that ideologically opposed individuals interacted with each other.

It seems therefore that political polarisation on social media could be explained by the well-known sociological phenomenon called *homophily* (McPherson *et al.*, 2001), by which interactions among similar people occur more often than among dissimilar people, or, as Himelboim *et al.* (2013) said, birds of a feather tweet together. However, findings in the literature show that even if Twitter political communications are reproducing the *homophily* concept (Yardi and Bold, 2010; Conover *et al.*, 2011; Himelboim *et al.*, 2012; Hsu and Park, 2012, Esteve and Borge, 2014), they are also facilitating cross-party and cross-ideological discourse (Conover *et al.*, 2011; Gruzd, 2012).

To sum up, given the relation between the different types of networks and the diverse political polarisation degree reached by the parliamentarians in each one of these Twitter layers, the following hypothesis is proposed:

H1: Communication flows of Catalan parliamentarians' following-follower and retweet Twitter networks are polarised by party affiliation and ideology while those of the mention network reveal some cross-ideological and cross-party connections.

Twitter networks and political leaderships

Recently, some authors have started to collaterally point out the attributes of Twitter leaderships. Yoon and Park's (2011) study of Korean politicians on Twitter showed that while

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the following-follower network was a social ritual network (therefore with high reciprocated vertex pair ratio figures)[3], the mention network was a network of political support characterised by the fact that some politicians received the majority of mentions. Research carried by Hsu and Park on communication relationships among members of the Korean National Assembly also revealed that their following-follower network followed a preferential power law which is the same as saying that "several politicians in the network where far more popular than the others" (Hsu and Park, 2012). Lastly, González-Bailon and Wang (2013) have studied the effects of brokers in bridging or bonding (Putnam, 2000) social network clusters.

In sum, given the previous studies on the field which point that Twitter networks follow a preferential attachment power law skewed toward the relevant politicians or the party leaders (Yoon and Park, 2011; Hsu and Park, 2012) but that the relational power derived from the nature of Twitter networks is paving the way for the appearance of new sorts of network leaderships, not equivalent to official party leaderships (González-Bailon and Wang 2013), the following hypothesis is proposed:

H2: Communication flows in Catalan parliamentarians' Twitter network are empowering party leaders but also paving the way for the appearance of network leaderships.

3. Data and methods

Our intention in this research is to test if communication flows in the Twitter network of Catalan parliamentarians are politically polarised or if, on the contrary, they facilitate communication between parliamentarians of different parties. We also wish to ascertain if communication flows of Catalan parliamentarians' Twitter networks are empowering party leaders or paving the way for the appearance of network leaderships.

In order to test our hypotheses empirically, first we manually compiled a list containing usernames of members of the

Catalan Parliament on Twitter. There are 116 Catalan Parliamentarians with Twitter accounts (85 % of the total number). Then we created a research engine to gather all the relations, retweets and mentions of the Catalan parliamentarians from 1 January 2013 to 31 March 2014, which permitted us to quantitatively determine the direction of Twitter communication flows among Catalan representatives.

Once the directions of the communication flows were known, we determined which parliamentarians were occupying a centrality position in the three types of Twitter networks. The centrality position was measured by collecting the total number of parliamentarians following another parliamentarian and the total number of retweets and mentions a parliamentarian received. Then, regression analyses were carried out (based on our own database) to ascertain the individual attributes of the Catalan parliamentarians triggering a centrality position in the following-follower, retweet and mention Twitter networks. The regressions were run on the 116 Catalan Parliament members with Twitter accounts. Our independent variables in the model include 7 dimensions[4] and are drawn from the literature shown in previous sections:

1. Socio-demographic characteristics (age, gender, education);

2. Internet behaviour (having a blog or Facebook account) and Twitter activity (total number of tweets; total number of retweets sent; total number of retweets received; total number of mentions sent; total number of mentions received). We also introduced an estimation of the favourites of the Catalan representatives based on their favourites per day average from 1 January to 31 March 2014;

3. Electoral characteristics such as the party they belong to and the number of legislatures they have attended Parliament (up to three: 2006, 2010, 2012);

4. Parliamentary activity (number of legislative commissions in which they participate and number of interventions in these commissions and in the plenary sessions);

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3. In a directed graph, the *reciprocated vertex pair ratio* is the number of adjacent vertices that are connected to the vertex with edges in both directions divided by the number of adjacent vertices. For instance, in a parliamentarian Twitter network the vertices are the parliamentarians holding a Twitter account.

4. See appendix for codification and description of the variables. The data was retrieved on January 2014. Most of the values of the parliamentarians' individual characteristics did not vary along the year.

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5. Political position in the Parliament (role in the parliamentarian group and Parliament and role in Parliament commissions), at the party (party president) or as mayors when that is the case;

6. Relational variables: In-Degree (Number of parliamentarian followees a parliamentarian Twitter holds), Out-Degree (Number of parliamentarians each parliamentarian is following on Twitter);

7. Cleavages: Left (ERC, PSC, ICV-EUiA and CUP)- Right (CiU, PP and C's) and Catalan nationalists (CiU, ERC, ICV-EUiA and CUP) and Non-Catalan nationalists (PSC, PP and C's).

Lastly, we carried out a network analysis in order to find the centrality position of Catalan parliamentarians' in the following-follower, retweet and mention networks but in a different way that we previously did. This time, we measured the centrality position of the Catalan parliamentarians by using the total number of parliamentarians that were following, retweeting or mentioning a particular parliamentarian. By doing so, what we wanted to find was not the centrality position of the Catalan parliamentarians based on the quantity of retweets and mentions that they received[5] (which has been previously done) but to ascertain the distribution of the mentions and retweets that a particular parliamentarian received. More precisely, this network twist gives more weight to the distribution of the mentions and retweets than to the quantity of retweets and mentions that a parliamentarian received. Consequently, the Catalan parliamentarians with a higher centrality position will be those who receive more mentions and retweets from the total number of deputies (and vice versa).

4. The Catalan Parliament and Twitter

The Catalan parliament is a good case study for several reasons: First, the early adoption of networking sites by the Catalan Parliament and its members. On 17 March 2009, the Catalan Parliament initiated the Parliament 2.0 project which consisted in 'adapting the Parliament to the new active role of users with social media' (Benach, 2010). As a result, the Parliament launched a YouTube channel and a Facebook and Twitter profile. Furthermore, in October 2013, the Catalan Parliament initiated the project *Escó 136,*[6] consisting in a web page on which Catalan citizenry could leave comments and suggestions to projects and laws proposed by the Catalan Parliament[7]. Second, the ratio of Catalan parliamentarians with Twitter profiles in 2014 (85 %), was greater than the number of parliamentarians with Twitter profiles in the Spanish central parliament (52.6 %)[8], in the Spanish senate (33.06 %)[9], in the German Bundestag (31.61 %) (Thamm and Bleier, 2013), in the UK House of Commons (72.3 %)[10], but somewhat behind the number of politicians with Twitter profiles in the US senate (100 %) and in the House of Representatives (90 %)[11].

It is also important to note the fragmentation and ideological divisions in the Catalan party system that enables us to test hypotheses related to interaction and communication intra and between several parliamentarian groups in depth. That is, specifically to test the polarisation degree among the nodes of the network and their leadership role in terms of brokerage and in-degree positions. In that regard, after the 25 November 2012 elections, the Catalan party system is fragmented into a wide variety of fringe and medium-size parties: CiU[12] (50 seats), ERC[13] (21 seats), PSC[14] (20 seats),

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5. Evidently, in the case of the following-follower network the centrality position of the Catalan parliamentarians will be always measured by the number of parliamentarians following a precise parliamentarian.

6. Seat 136 as the Parliament seats 135 members.

7. 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

8. http://parlamento20.es/twitter-en-el-congreso-de-los-diputados

9. http://www.blogsdepolitica.com/el-senado-tambien-existe-presencia-y-actividad-en-twitter-de-los-senadores/

10. http://blogs.telegraph.co.uk/news/willheaven/100228088/how-long-before-every-single-mp-is-on-twitter

11. https://blog.twitter.com/2013/100-senators-and-57th-inauguration

12. CiU is a Catalan nationalist centre-right party.

13. ERC stands for republican left of Catalonia and it is a left wing and Catalan nationalist party.

14. PSC is the Socialist Party of Catalonia and it is federated with the Spanish Socialist Party.

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PP[15] (19 seats), C's[16] (9 seats), ICV-EUIA[17] (13 seats) and CUP[18] (3 seats). Indeed, the Catalan party system is distributed along two main ideological cleavages (see Figure 1): left/right-wing and Non Catalan nationalist/Catalan nationalist. The figure below places Catalan parties on these two axes:

Figure 1: The position of Catalan parties on the political spectrum of Catalonia according to Catalan respondents
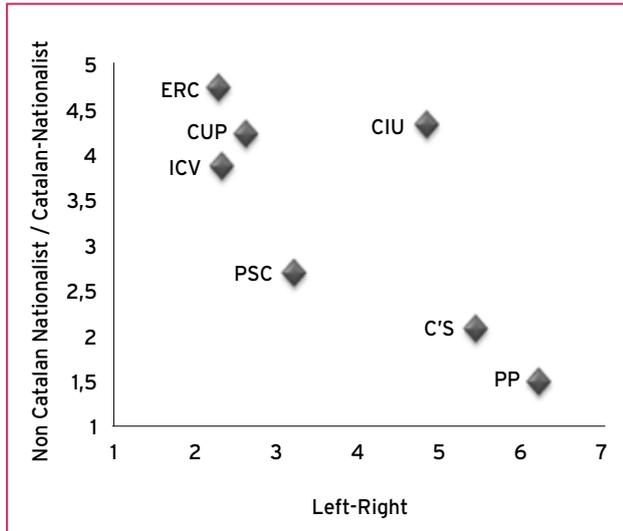
Source: Second round of CEO surveys (20 June 2013); N=2000.

Several studies have already shown that social media are contributing to equalise opportunities for political communication between Catalan parties, since new, fringe and medium-size parties as well as parties from varied different political positions achieve greater online interaction and participation than larger and more institutionalised parties (Balcells and Cardenal, 2013; Esteve and Borge, 2013). We expect therefore that, in the particular political context of the Catalan parliament, some of the network leaderships that could arise from the Twitter interaction between the parliamentarians will be members of the new and medium-size parties.

5. - Findings

Political polarisation

Communication flows in Catalan parliamentarians' Twitter networks show both party and ideological polarisation. However, the intensity of this political polarisation is deeper in the following-follower and retweet networks than in the mention network. More precisely, as can be seen in Table 1 and Figure 2, members of the Catalan
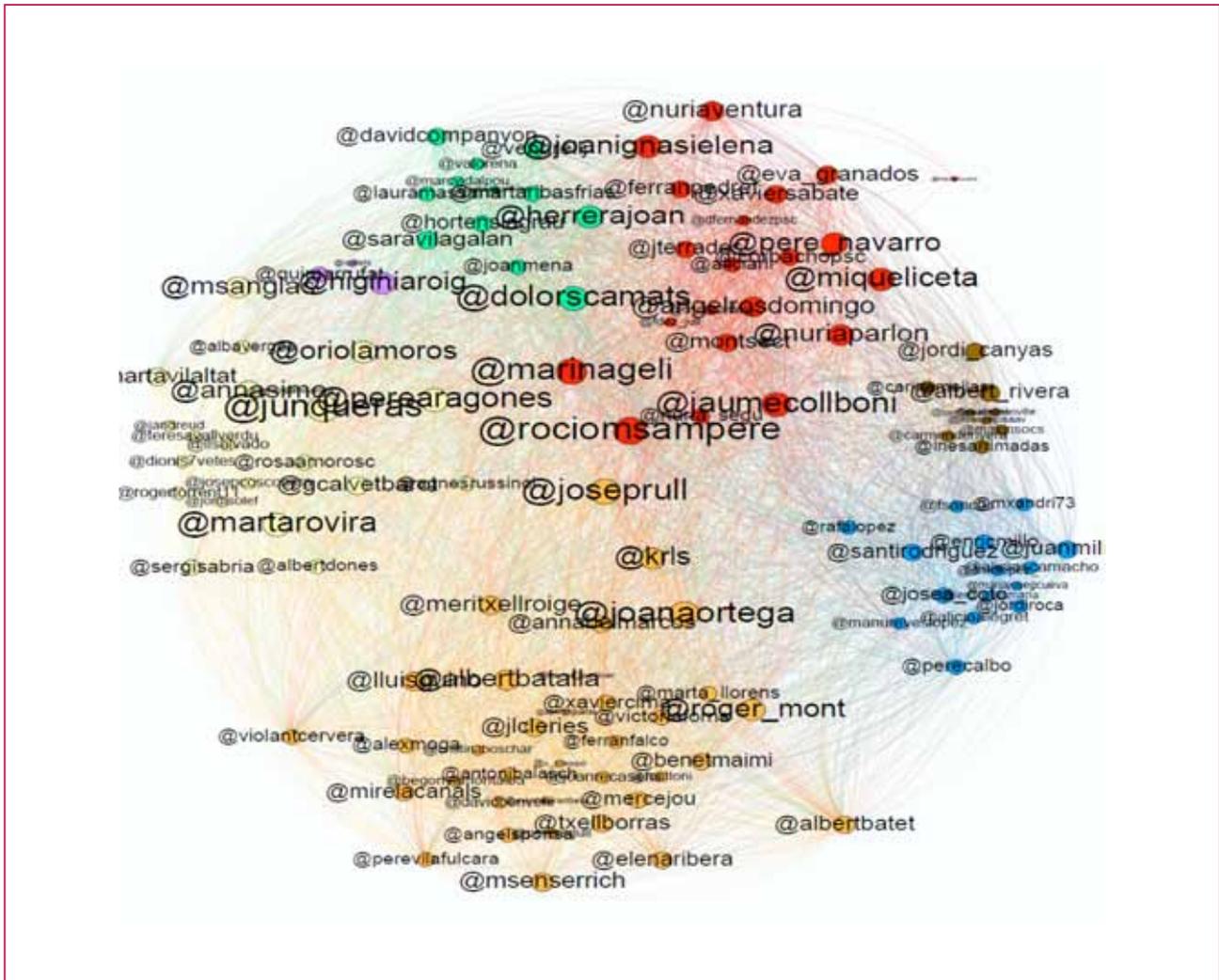
Table 1: Percentage of parliamentarians' following relations over the total possible MPs' following relations between parliamentarian groups in the Catalan parliamentarians' Twitter network (1 January 2013–31 March 2014)

Parliamentarian Groups and their cleavage positioning	Left (1)-Right (0)	Catalan-nationalist (1)/ Non Catalan nationalist (0)	CiU (35)	ERC (21)	PSC (21)	PP (15)	ICV-EUiA (11)	C'S (9)	CUP (3)
CiU	0	1	71.93 %	27.17 %	16.53 %	19.71 %	12.03 %	11.76 %	3.92 %
ERC	1	1	36.13 %	90.48 %	14.99 %	13.33 %	34.63 %	5.29 %	33.33 %
PSC	1	0	28.43 %	23.39 %	84.29 %	32.70 %	44.16 %	24.34 %	14.29 %
PP	0	0	27.84 %	12.70 %	18.41 %	95.24 %	7.88 %	17.78 %	4.44 %
ICV-EUiA	1	0	22.73 %	44.16 %	41.13 %	22.42 %	95.45 %	18.18 %	18.18 %
C'S	0	0	16.34 %	8.99 %	18.52 %	50.43 %	18.18 %	100.00 %	0.00 %
CUP	1	1	33.33 %	55.56 %	30.16 %	11.90 %	24.24 %	3.70 %	100.00 %

The MPs' total possible following relations between or in the parliamentarians groups could reach 100 % in each cell table, in the sense that any party could follow the 100 % of the parliamentarians of his/her group or of other group.

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15. PP is the Popular Party of Catalonia, which is a member of the Spanish Popular Party, a right-wing and Spanish nationalist party.
16. C's stands for 'Citizens' and it is a relatively new centrist party that is against Catalan nationalism.
17. ICV-EUIA is a left-wing party self-defined as eco-socialist and an autonomous part of the Spanish United Left (IU).
18. CUPs stands for 'Candidacies of Popular Unity' and are an extreme left and Catalan nationalist coalition.

Figure 2 The following centrality of the Catalan parliamentarians' Twitter Network (1 January 2013–31 March 2014)

*The nodes of the network are the 116 deputies with Twitter account
**The size of the nodes is equivalent to their in-degree centrality in the network
***The colour of the nodes indicates the political party they belong to: orange (CIU), yellow (ERC), red (PSC), blue (PP), green (ICV), brown (C'S) and violet (CUP)

parliament Twitter network are more likely to follow parliamentarians of their own political groups than parliamentarians of other political groups. That is, the percentage of MPs' following relations over the total possible parliamentarians' following relations between the parliamentarian groups in the Catalan parliamentarians' Twitter network show that MPs' are more likely to follow parliamentarians of their own groups than parliamentarians of other political parties. In fact, the average percentage of the total possible following relations reached by the 116 parliamentarians in 7 parliamentarian groups with respect to the representatives of their political groups is

91.05 % (average of the diagonal zone in Table 1) in the following-follower network.

Also, this same *homophily* tendency can be observed (see Table 2) in the data regarding the retweet network. More precisely, the average percentage of the total possible retweets reached by the 116 parliamentarians in 7 parliamentarian groups compared to representatives of their political groups is 88.84 % in the retweet network.

Moreover, the results in Figure 2, Table 1 and Table 2 also reveal the influence exerted by cleavages in the Catalan

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Table 2: Percentage of parliamentarians retweet relations over the total MPs' retweet relations between parliamentarian groups in the Catalan parliamentarians' Twitter network (1 January 2013–31 March 2014)

Parliamentarian Groups and their cleavage positioning	Left (1)-Right (0)	Catalan-nationalist (1)/ Non Catalan nationalist (0)	CiU (35)	ERC (21)	PSC (21)	PP (15)	ICV-EUiA (11)	CS (9)	CUP (3)	Total
CiU	0	1	93.83 %	4.15 %	0.67 %	0.56 %	0.67 %	0.11 %	0.00 %	100 %
ERC	1	1	5.00 %	90.62 %	0.52 %	0.15 %	3.56 %	0.15 %	0.00 %	100 %
PSC	1	0	2.87 %	4.37 %	84.52 %	2.12 %	5.24 %	0.50 %	0.37 %	100 %
PP	0	0	0.00 %	1.19 %	0.34 %	96.76 %	0.00 %	1.36 %	0.34 %	100 %
ICV-EUiA	1	0	0.50 %	17.37 %	3.11 %	0.10 %	78.31 %	0.30 %	0.30 %	100 %
C'S	0	0	0.29 %	0.15 %	0.00 %	0.73 %	0.15 %	98.69 %	0.00 %	100 %
CUP	1	1	1.33 %	5.33 %	3.33 %	0.00 %	13.33 %	0.00 %	76.67 %	100 %

political system (left/right wing; Catalan nationalist/Non-Catalan nationalist) on parliamentarians' communications flows. Specifically, at a party level, these results show:

1. CiU representatives follow (27.17 %) and retweet (4.15 %) more the ERC parliamentarians than the others. Perhaps, the government agreement reached between these two parties and their common leaning towards Catalan independence has some effect on the communication flows of CiU parliamentarians. In any case, CiU is the party which follow less its own representatives (71.93 %).

2. The nationalist cleavage seems to be guiding the communication flows of the ERC's representatives for they follow (CiU -36.13 %- and CUP -33.33 %-) and retweet (CiU -5.0%-) Catalan nationalist parliamentarians more than the others.

3. MP's belonging to the PSC follow in a considerable proportion the rest of the parties (more than 20%) and show a left wing leaning orientation (ERC -4.37 %- and ICV-EUiA - 6 %-) on the retweet network.

4. Parliamentarians belonging to the PP party follow right wing (CiU -27.84%- and C's -17.78%-) and Non-Catalan nationalist (PSC -18.41%- and C's) parliamentarians more than others, but they retweet left wing Catalan nationalist parties (ERC -1.19%- and CUP -0.34%-) almost on a par with non-Catalan nationalist parties (PSC -0.34%- and C's -1.36%-).

5. ICV-EUiA's parliamentarians follow and retweet left wing parties (ERC, PSC and CUP) more than the others.

6. Representatives in C's follow Non-Catalan-nationalist parties (PSC -18.52 %- and PP -50.43 %-) and retweet right wing parties more (CiU -0.23 %- and PP -0.79 %-).

7. CUP MPs follow in higher proportion, first, Catalan nationalist parties (CiU -33.33 %- and ERC-55.56 %-) and, second, left wing parties (PSC -30.16 %- and ICV-EUiA -24.24 %-), yet they retweet left wing parties more (ERC -5.33 %-, PSC -3.33 %- and ICV-EUiA -13.33 %-) than others.

Lastly, regarding the mention network of Catalan parliamentarians on Twitter, Table 3 shows that political polarisation is less deep in this network than in the following-follower and retweet networks. In fact, the average percentage of total mentions reached by the 116 parliamentarians of the 7 parliamentarian groups with respect to the representatives of their political groups is 66.12 % (far lower than 91.05 % and 88.48 % in the following-follower and retweet networks). However, the results in Table 3 also point out the influence exerted by cleavages in the Catalan party system on mentions between the Catalan representatives:

1. The two parties more frequently mentioned by CiU parliamentarians are those of a Catalan nationalist party −ERC (10.72 %)− and a Non-Catalan nationalist right wing party −PP (8.91 %)-.

2. ERC representatives mention more frequently left wing parties, specifically the PSC (3.54 %) and ICV (8.46 %).

3. PSC parliamentarians focus their mentions on members of a Catalan nationalist party –ERC (14.53 %)– and a left party wing –ICV (10.01 %).

4. MPs in the PP concentrate their mentions on one Catalan-nationalist and left wing party –ERC (12.19 %)– and another Catalan-nationalist but right wing party –CiU (6.65 %).

5. Members of ICV-EUiA clearly focus their mention activity on ERC (20.98%) and, in lower proportion, the PSC (4.92%) MPs.

6. The most frequently mentioned group by parliamentarians in C's is by large the Catalan-nationalist and left wing party ERC (10.77 %).

7. CUP members focus their mention activity on left wing parliamentarians in ICV (32.21) and ERC (14.32 %).

In short, the results in Figure 2, Table 1, Table 2 and Table 3 show that communication flows between Catalan parliamentarians' Twitter network are polarised by party and ideology. However, the degree of that political polarisation is higher, first, in the following-follower and, second, in the retweet network than it is in the mention network, similar to what other studies (Connover *et al*., 2011; Yoon and Park, 2012) found. More precisely, Yoon and Park (2012) found that following other politicians is a social ritual based on dyadic reciprocity but the strategy of mentioning other politicians is based on achieving more popularity, regardless of the

ideology of the mentioned politician. In fact, it is in the mention network where we observe, in higher proportion, that Catalan members of parliament not only mention parliamentarians with their same ideological (left/right wing or Catalan nationalist/Non-Catalan nationalist) stances but also MPs holding politically opposite points of view. Therefore we can accept our H1.

Network leaderships

As mentioned in previous sections of this article, the network leaderships of the Catalan parliamentarians following-follower, retweet and mention Twitter networks will be analysed from a double perspective: On the one hand, we will ascertain the individual characteristics of the most followed, retweeted and mentioned Catalan parliamentarians by carrying out regression analysis. On the other, we will unfold the appearance of new network leaderships by using network-analysis methods.

In order to understand the individual characteristics of the most followed, retweeted and mentioned Catalan parliamentarians, we carried out multiple regression analyses. While the distribution of the in-degree variable was normal, the distribution of the other two dependent variables, mentions received and retweets received were skewed towards the lowest limit, as it is usual among Internet users (Hogan, 2008). That is, few parliamentarians (as shown in Table 4) have a high centrality in these two networks. Therefore, we transformed these two dependent variables into two normal distributions (Mentions_LN10

Table 3: Percentage of the total possible MP's mentions between the parliamentarians' groups in the Catalan parliamentarians' Twitter network (1 January 2013–31 March 2014)

Parliamentarian Groups and their cleavage positioning	Left (1)-Right (0)	Catalan-Nationalist (1)/ Non Catalan Nationalist (0)	CiU (35)	ERC (21)	PSC (21)	PP (15)	ICV-EUiA (11)	CS (9)	CUP (3)	Total
CiU	0	1	65.99 %	10.72 %	5.25 %	8.91 %	6.12 %	2.57 %	0.44 %	100 %
ERC	1	1	2.81 %	76.21 %	3.53 %	4.44 %	8.46 %	3.70 %	0.84 %	100 %
PSC	1	0	6.28 %	14.53 %	62.94 %	2.66 %	10.01 %	3.00 %	0.59 %	100 %
PP	0	0	6.65 %	12.19 %	1.85 %	72.02 %	3.74 %	3.05 %	0.51 %	100 %
ICV-EUiA	1	0	1.89 %	20.98 %	4.92 %	3.52 %	65.51 %	1.89 %	1.28 %	100 %
C'S	0	0	2.49 %	10.77 %	1.86 %	2.56 %	2.03 %	80.18 %	0.11 %	100 %
CUP	1	1	1.68 %	14.32 %	6.95 %	3.89 %	32.21 %	0.95 %	40.00 %	100 %

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and Retweet_Rec_SQRT) by performing square root and logarithmic transformations. Then we carried out three multiple regression analyses to find the parliamentarian's characteristics triggering a centrality position in the in-degree, retweet and mention networks[19].

The results of the three regression analyses are statistically significant with an adjusted R-square of 0.494 in the case of the following network, 0.560 in the retweet network and 0.488 in the mention network. Specifically, the results shown in Table 4 point to factors explaining the centrality of the

Table 4: Multiple Regressions on the centrality variables (In-degree; Retweets_recieved_SQRT and Mention_received_LN10) in the Catalan parliamentarians' Twitter network

Explanatory variables	DV= In-Degree	DV= Retweets_Received_SQRT	DV= Mentions_Received_LN10
Gender	3.256	-1.102**	0.49
Age	.275**	-.009	-.011**
Education level	-1.284	-.113	-.039
Blog	3.732	-.216	-.055
Facebook	-.484	-.292	.054
Total tweets	.004***	.000	-2.435E-005
Total mentions sent	-0.10	.010***	.000
Total mentions received	.000	.007***	
Total retweets sent	-0.22	-.002	.001
Total retweets received	.017		.004***
Favourites per day	.471	-.022	-.017
Incumbency	2.172	.361	-.105
Participation in commissions	-.523	.027	.008
Intervention in commissions	-.017	-.001	.001
Intervention in the plenary	.039	-.006	.000
Parliamentarian position (0-1)	9.142**	-.462	.214
Position at the legislative commissions (0-1)	.405	-.620	-.104
Political position (0-1)	-.325	-.889	.199*
In-degree		.043*	.009**
Out-degree	.353***	.008	-.002
Right-left_0_1	-4.035	.499	-.095
Catalan nationalist/Non-Catalan nationalist (0-1)	.553	.384	-.001
Constant	6.003	3.352	1.891
Adjusted R²	0.494	0.560	0.488
N	115	115	115

*p<0.10; **p<0.05; ***p<0.001

19. In our models the multicollinearity tests do not show the existence of any collinearity between the independent variables.

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Catalan parliamentarians in the following network, such as their age (having more followers increases with age), out-degree (number of parliamentarians someone is following), total number of tweets and their parliamentarian position (having a parliamentarian position increases the number of followers). Moreover, as shown in Table 4, the characteristics explaining the centrality position of Catalan parliamentarians in the retweet network are: gender (being a woman diminishes the likelihood of being central), mentions sent, in-degree and the mentions received. Lastly, regarding the centrality position in the mention network, Table 4 shows that age (the number of mentions decreases with age), political position (mentions increases if a parliamentarian holds a political position), retweets received and in-degree are explanatory factors of the dependent variable. In brief, analysis of the factors explaining the parliamentarians' centrality position in the following, retweet and mention networks points to the relevance of relational variables; parliamentarians holding a centrality position in the three networks are those who are the most followed and who at the same time concentrate more retweets and mentions than others. However, holding an official responsibility in the party or in Parliament increases the number of following parliamentarians and the number of mentions received, yet it has no influence on the number of times a parliamentarian is retweeted.

The results observed in the regression analyses can also be corroborated by the results shown in Table 5. According to these results, parliamentarians holding a political position in their parties are only receiving 26.22 % of the retweets (1,585 retweets) but taking the lead in the following and mention networks. More precisely, as shown in Table 5, parliamentarians holding a political position are the most followed (average of In-degree= 41.86) and mentioned (8,309) than all the others. Furthermore, among these

parliamentarians, it is important to note the dominant position reached by the 6 party leaders in the in-degree (average of 55.14), retweet (1,107) and mention (6,333) networks.

Nevertheless, for a deeper understanding of the centrality position of the Catalan parliamentarians based not only on the quantity of followers, retweets and mentions that they have or receive but on the number of the parliamentarians following, retweeting or mentioning a particular deputy, we analysed the centrality position of the Catalan parliamentarians in the following, retweet and mention Twitter networks by using the total number of parliamentarians following, retweeting and mentioning a specific representative. In this way, we are able to better detect the parliamentarians whose popularity is spread between many parliamentarians and not only concentrated in a few parliamentarians that are very active in retweeting, mentioning and following others but only their own party peers or leaders. The results obtained by doing that network twist (shown in Table 6 and Table 7) are different compared with those observed in the regression analysis and in Table 5. More precisely, Table 6 shows that, of the 21 representatives[20] with a higher in-degree, 47.61 % hold a political position (4 are party leaders) while the other 52.39 % do not. Also, regarding the mention network (see Figure 3 and Table 6), among the 21 parliamentarians with a higher mention centrality degree, 33.33 % hold a political position (6 are party leaders) while the other 66.67 % do not. But the most surprising figure comes when analysing the retweet network (see Figure 4 and Table 6); of the 21 representatives with the highest retweet centrality degree, only one holds a political position (a party leader).

In fact, the data showed below points to the appearance of new network leaderships who do not need to hold

Table 5: In-degree (following), retweets and mentions in the parliamentarians' Twitter network

Type of network	All parliamentarians (115)	Political position* (22)	Only party leaders (6)
In-degree (following) (average)	38.93	41.86	55.14
Retweets (total)	6,045	1,585	1,107
Mentions (total)	19,507	8,309	6,333

*Political position: Parliamentarians holding a relevant political position (party leaders or mayors)

20. This number of representatives has been chosen as it approaches 20 % of the total of the nodes of the network and we believe that it helps to show the centrality position of some parliamentarians in the following, retweet and mention networks.

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Table 6: Political position characteristics of the 21 Catalan parliamentarians with highest in-degree (following), retweet and mentions network centrality in the Catalan parliamentarians' Twitter network

Type of network	Parliamentarians	Political position*	Party leaders (6)
In Degree (following) (average)	52.39	47.61	4
Retweets (%)	95.24	4.76	1
Mentions (%)	66.67	33.33	6

*Political position: the parliamentarians holding a relevant political position (party leaders or mayors)

Figure 3 The mention centrality of the Catalan parliamentarians' Twitter network (1 January 2013–31 March 2014)
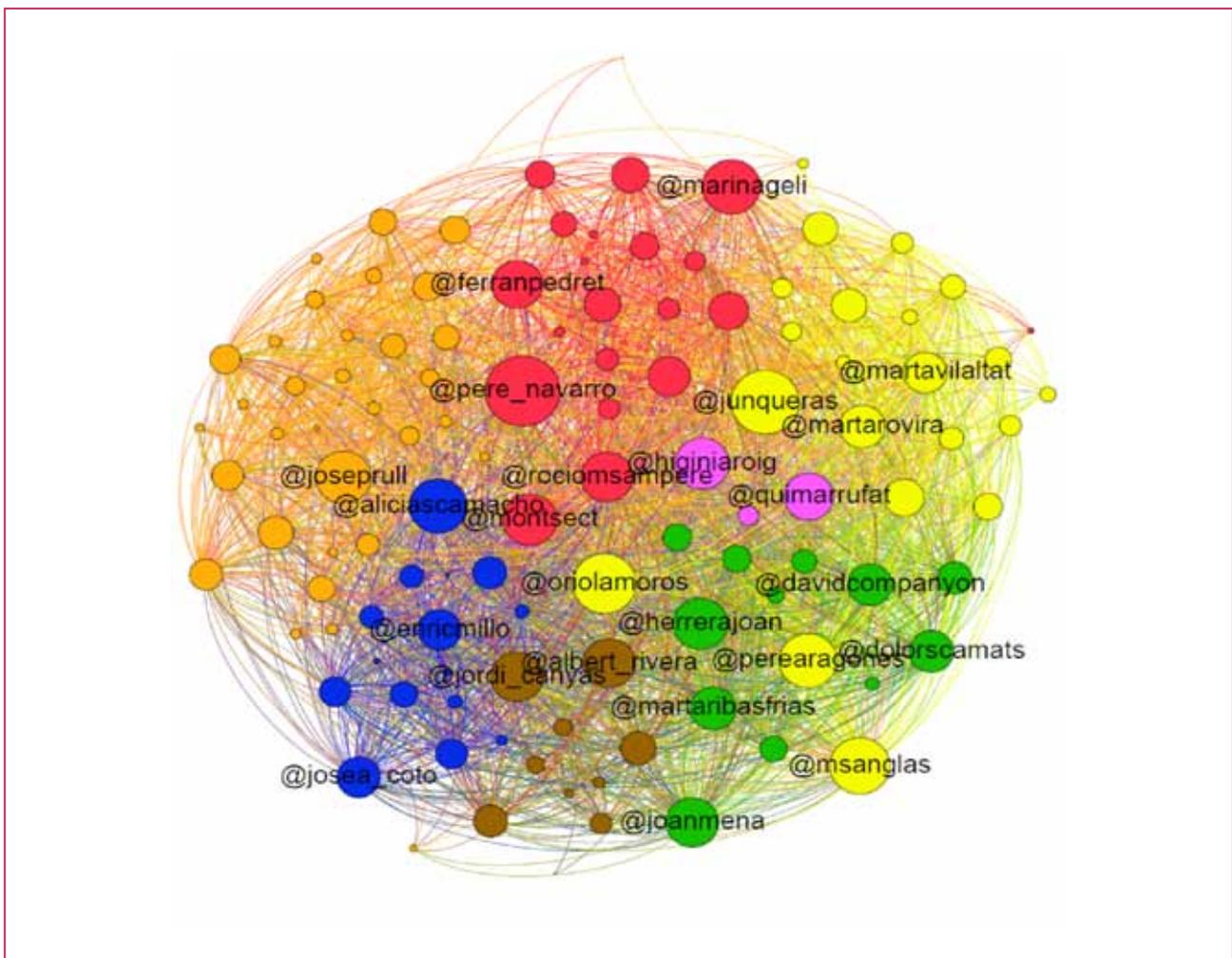
*The nodes of the network are the 116 deputies with Twitter account and those with labels are the 20% of parliamentarians with a higher mention degree of whom 8 representatives out of 24 hold a relevant political position (@alber_rivera; @dolorscamats; @herrerajoan; @pere_navarro; @higiniaroig; @aliciascamacho; @junqueras; @martarovira).
**The size of the nodes is equivalent to their mention centrality in the network
***The colour of the nodes is equivalent to the political party that they belong to: orange (CIU), yellow (ERC), red (PSC), blue (PP), green (ICV), brown (C'S) and violet (CUP)

Figure 4 The retweet centrality position of the Catalan parliamentarians' Twitter network (1 January 2013–31 March 2014)
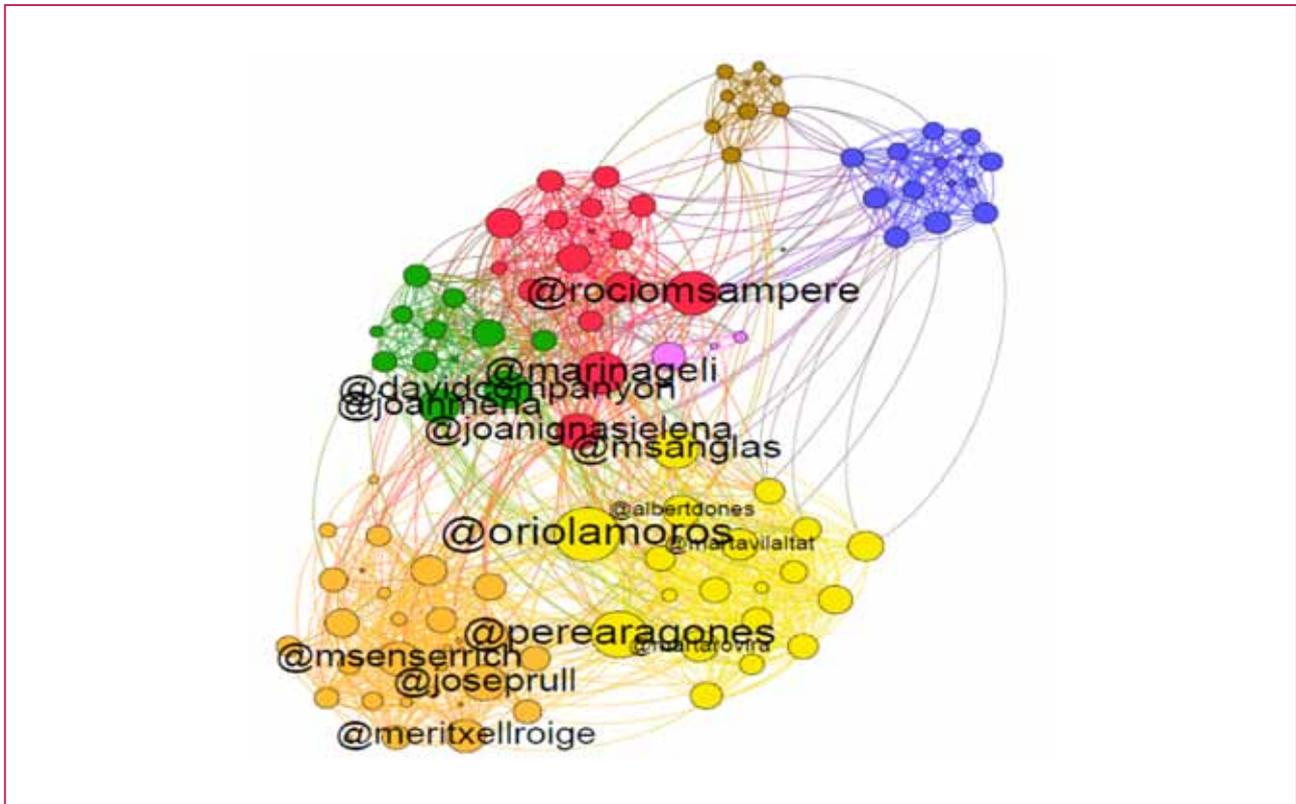
*The nodes of the network are the 116 deputies with Twitter account and those with labels the 10 % of parliamentarians with higher retweet centrality of whom there is only one with a relevant political position, @martarovira (Secretary General of ERC).
**The size of the nodes is equivalent to their retweet centrality in the network
***The colour of the nodes is equivalent to the political party they belong to: orange (CIU), yellow (ERC), red (PSC), blue (PP), green (ICV), brown (C'S) and violet (CUP)

relevant political positions or being a party leader to be central in the Twitter networks of the Catalan parliament, a fact that is also corroborated when we analyse the parliamentarian position of the Catalan representatives. In this vein, Table 7 shows that of the 21 representatives with a higher in-degree, 42.85 % hold a parliamentarian position (5 are party leaders) while the remaining 57.15 % are not. Also, with respect to the mention network, of the 21 parliamentarians with the highest mention centrality degree, 14.28 % hold a parliamentarian position (1 is a party leader) while the remaining 85.72 % do not. But again, the most surprising case is that of the retweet network, where only 1 parliamentarian holds a parliamentarian position (and he is also a party leader).

Table 7: Parliamentarian position characteristics of the 21 Catalan parliamentarians with highest in-degree (following), retweet and mentions network centrality in the Catalan parliamentarians' Twitter network

Type of network	Parliamentarians	Parliamentarian position*	Party leaders (6)
In degree (following) (average)	57.15	42.85	5
Retweets (%)	95.24	4.76	1
Mentions (%)	85.72	14.28	1

* Parliamentarian position: the parliamentarians holding a relevant political position in the Catalan Parliament (Spokesperson or President of the parliamentarian group, Secretary, Vice-President or President of the Parliament).

The data presented above show that official party leaders with political or parliamentarian positions are dominant in the following and mention networks but not in the retweet relationships. Some authors have pointed out that the former networks are subjected to partisan pressures and attempts to reach more followers (Yoon and Park, 2012) whereas the later could be more ruled by information exchanges and personal interests. Consequently, the data and the network analysis presented below seem to clearly show that "communication flows of Catalan parliamentarians' Twitter Network are empowering party leaders but also paving the way for the appearance of Network Leaderships" (H2).

Conclusions

This article has shown that Twitter plays a double game, it enclosures communication flows among party representatives and empowers party leaders but it also facilitates dialogue between MPs from different political groups and paves the way for the appearance of network leaderships.

From a political communication perspective, in line with the results found by Yardi and Bold (2010), Conover *et al.*,(2011), Himelboim *et al.*, (2012) and Hsu and Park (2012), our research points out some evidence for the argument that communication flows among the Twitter network of Catalan parliamentarians' are polarised by party affiliation and ideology. However, as Conover *et al.*, (2011), Gruzd (2012) and Yoon and Park (2014) have already corroborated, our results also confirm that the degree of political polarisation is higher in the following-follower and the retweet networks than in the mention network. More precisely, the data sustain that, in the mention network, Catalan parliamentarians not only communicate with parliamentarians sharing their similar ideological stances (left/right wing or Catalan nationalist/Non-Catalan nationalist cleavages) but also with MPs holding politically opposite points of view.

However, regarding the analysis of network leaderships, the results related to the volume of the communication flows between the parliamentarians (number of parliamentarians following another parliamentarian, total number of retweets and total number of mentions) and those linked to the distribution of the communication flows (number of parliamentarians following another parliamentarian,

total number of retweets a parliamentarian receives from the other parliamentarians and total number of mentions a parliamentarian receives from other parliamentarians) reveal different dimensions of the Catalan parliamentarians' Twitter network leaderships. The regression analyses have pointed out that parliamentarians holding a centrality position in the three networks are those who are the most followed, hold relevant political positions and, at the same time, concentrate more parliamentarian followers, retweets and mentions than others. However, the network analysis of the centrality position of the parliamentarians based on the in-degree, mentions and retweets that they receive from other nodes (representatives) in the three networks has revealed that new network leaders (who do not hold a political or a parliamentarian position) are concentrating the majority of retweets and taking the lead in the following and mention networks. This last result is more relevant since it takes into account the number of different parliamentarians retweeting and mentioning another parliamentarian and not the gross volume of retweets and mentions that is frequently affected by few parliamentarians giving heavy support to their own peers.

Could our research be extended to other contexts? Our study object is the directions of parliamentarians' communication flows on Twitter and we conceive parliamentarians' online communications as comparable entities across countries. Consequently, our argument could then be applicable to all kinds of political contexts. Moreover, the statistical and network analyses used in the research are also prone to be replicated in other studies.

However, a number of complementary issues remain to be tested;

1. It would be necessary to explain exactly why the following, retweet and mention networks are different in terms of ideological polarisation and leadership. It seems that the parliamentarians strategically decide to behave differently in each of these layers of twitter-based communications.

2. It is reasonable to assume that other characteristics shaping the parliamentarians' communication flows play a role in explaining their directions. For instance, the electoral district of the parliamentarians, since relationships could rise up among representatives of the same constituency (Lassen and Brown, 2010), the core goals sought by parties (Römmele, 2003) or the predominant issues on the Catalan political agenda (Esteve and Borge, 2013).

3. It may be useful to identify not only the directions of the communication flows between Catalan parliamentarians, but also the content of the information transmitted through Twitter interactions (Yoon and Park, 2012).

4. Finally, more studies extending the time span of our article and carrying out comparative analysis between parliamentarians of different and similar political systems could add powerful insights to how MPs deal with social media.

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Appendix I

Description of variables and codification

Variable	Codification
Gender	0= Male 1=Female
Age	28 to 66 years old
Level of education	1= Undergraduate 2= Bachelor 3= Master's degree or PhD
Blog	1= yes 0= no
Facebook	1= yes 0= no
Total tweets	From 0 to 3244.
Total mentions sent	From 0 to 773.
Total mentions received	From 0 to 1274.
Total retweets sent	From 0 to 227.
Total retweets received	From 0 to 361.
Favourites per day	Average of the Parliamentarians' favorites per day. Ranges from 0 to 26.07.
Incumbency (2006, 2010 or 2012 Legislatures)	1= One Legislature 2= Two Legislatures 3= Three Legislatures
Number of commissions in which the parliamentarian participates	From 0 to 16 commissions
Number of interventions in commissions	From 0 to 445
Number of interventions in the Plenary	From 0 to 262
Political position in Parliament and the parliamentarian group	1 - Spokesperson of the parliamentarian group 2 - President of the parliamentarian group 3- Parliament Secretary or Vice-President of the Parliament 4 - President of the Parliament Recoded 0-1 (0= no position; 1= 1 to 4)
Political position in Parliament commissions	1 - Secretary 2 - Vice-President 3 - President Recoded 0-1 (0= no position; 1= 1 to 3)
Political position in the political party	1 - Local mayor 2 - President of the party Recoded 0-1 (0= no position; 1= 1 to 2)
In-degree	Number of followers a parliamentarian's Twitter holds. Ranges from 6 to 77.
Out-degree	Number of parliamentarian Twitter accounts each parliamentarian is following. Ranges from 0 to 115.
Right-left	1= Right 0= Left
Catalan nationalist and non-nationalist	1= Yes 0= No

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