Analyzing social networks in the European Parliament, and changes in the social network over time

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***Abstract*—We did a couple things to some graphs which contained data about social networks in the European Parliament.**

***Index Terms*—Social networks, European Parliament.**

I. Introduction

The European Parliament (EP for short) is a legislative institution of the European Union, in which representatives from each of the 28 (27 after Brexit) member states vote on legistation concerning the European Union. The Parliament consists of *Members of the European Parliament* (MEPs), each of whom have a well-defined country of origin and political party. The political parties of each MEP are specific to their country of origin, but parties holding similar views organize themselves into *political groups*, which act as super-parties in the context of the European Parliament.

The major political groups in the EP are the European People's Party (EPP, centre-right), the Progressive Alliance of Socialists and Democrats (S& D, left), Renew Europe (RE, liberal), the Greens–European Free Alliance (Greens/EFA, green), European Conservatives and Reformists (ECR, right), Identity and Democracy (ID, far-right) and The Left in the European Parliament (GUE/NGL, left). Representatives who do not belong to any of these groups are usually called Non-iscrits (French for 'not registered'), often abbreviated as NI.

Our aim is to analyze the social networks of the European Parliament, and the temporal changes incited by major global events, such as the global COVID-19 pandemic, and the Russo-Ukrainian war.

Some analysis of social networks in the European Union has already been done in [1] and [2]. Work that is analogous to ours in the context of the United States Congress and Senate has also been seen before in [4], [6], [10] and [11]; while in [5], Fischer et al. conducted an analysis of such co-sponsorship networks in the Swiss parliament.

II. Our data

Our dataset was acquired directly from the European Parliament's website. It is organized as a `csv` file which contains entries for each proposed amendment to a law, with information about when the amendment was proposed, some details about the amendment, and more importantly, information about who proposed the amendment, what party they belong to, which EP group said party belongs to, and which country are they are representative of.

This data can therefore be viewed as a bipartite graph, in which one part consists of the MEPs, and the other consists of the proposed amendments. An MEP and an amendment are joined by an edge if and only if said MEP contributed to the amendment (*sponsored* the amendment). Importantly, a single amendment may have multiple contributors, which allows us to analyze the social structure of the European Parliament as a whole.

In total, our dataset contains 750,578 entries, which is the total number of edges in this bipartite graph. The dataset has data on a grand total of 754 MEPs.

To analyze the social structure, we *projected* this bipartite graph onto the set of MEPs. This procedure creates a new graph, wherein the nodes represent MEPs, and each edge connects two MEPs which have two contributions in common. (I.e. they *co-sponsored* a bill.)

III. Preliminary analysis

In this section, we talk about the conclusions we can draw from the data while analyzing it in its entirety. This phase of our analysis allowed us to get a sense of what the data looks like from a bird's eye view.

A. Analysis of activity by country

We conducted an analysis of how many amendments were produced in each country. The data we acquired can be seen in Figure 1. Besides the contributions visible in the table, our data also included 175 data points, which did not have an MEP attached. For the remainder of this analysis, we will discard these data points.

We direct the reader's attention to the fact that representatives of the United Kingdom were the least active in this period. This is unsurprising, since these representatives left the European Parliament early, in February 2020.

Of course, this data is heavily influenced by the uneven population distribution within the Union. We can see that the most populous countries are among the most active as well.

In order to account for these differences, we normalized the data for population. For population data, we used the latest population data from [3]. Or course, there is an inherent inaccuracy in this, because the population fluctuated during the time period we analyzed, but we believe that these errors are negligible.

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Country	Contributions
Germany	5539
France	4242
Spain	3853
Italy	3550
Poland	2531
Romania	2497
Netherlands	1941
Sweden	1613
Belgium	1411
Portugal	1406
Austria	1272
Bulgaria	1260
Slovakia	1201
Hungary	1135
Greece	1092
Czechia	1020
Denmark	955
Finland	859
Ireland	806
Slovenia	760
Croatia	636
Luxemburg	623
Malta	614
Lithuania	541
Cyprus	502
Latvia	426
Estonia	423
United Kingdom	268

Fig. 1. Amendments by country

Country	Contributions per million people
Malta	1181.76
Luxembourg	965.30
Cyprus	546.78
Slovenia	360.67
Estonia	317.61
Latvia	225.01
Slovakia	221.23
Bulgaria	193.26
Lithuania	192.47
Croatia	164.26
Denmark	160.97
Ireland	156.53
Finland	154.39
Sweden	153.30
Austria	139.69
Portugal	135.94
Romania	131.05
Belgium	121.81
Hungary	116.14
Netherlands	110.34
Greece	104.67
Czechia	96.92
Spain	81.29
Germany	66.54
Poland	66.54
France	65.01
Italy	60.32
United Kingdom	4.00

Fig. 2. Amendments by country normalized for population

In the normalized data, we see a near-perfect reversal of the previous chart. Having normalized for population, smaller countries seem more productive.

This is also unsurprising, however, in view of the fact that smaller countries get disproportionately more representatives per capita.

B. Analysis of activity by political group

IV. Changes to the social network over time

In this section, we talk about how we divided the data based on time.

We divided our data based on time. Our goal was to make it possible to analyze the changes in the social environment based on time. We used major events that shaped European politics as breakpoints, because we expected that the social network might change drastically as a result of these events. The most important events we considered were the United Kingdom leaving the European Union (Brexit), on February 1st, 2019, and the start of the Russian invasion of Ukraine on February 24th, 2022. These events have undoubtedly shaped public opinion, and our research is centered around finding out whether they also influenced the social structure of the European Parliament.

Our dataset contained data from July 24th, 2019 to September 5th, 2022, and we divided this time interval into 12 parts. Our goal was to divide the time interval based on important events that happened during this time, in order to facilitate the study of how these events influenced the political network. For example, a major event in this time period was Brexit, since after Brexit, delegates from the United Kingdom left the European Parliament. We therefore divided our time interval in such a way that the date of Brexit is the endpoint of one of the parts. We did a similar thing for two more events in the specified time period. An important date we considered was the controversial Hungarian right-wing party Fidesz leaving the EPP political group inside the European Parliament, as we expected that this changed the dynamics between political groups. The last major event we considered was of course the start of the Russian invasion of Ukraine. Since our data ends in September 2022, we are unfortunately not able to analyze the effects of later phases of the war, notably the 2022 Kharkiv counteroffensive. In the future, we plan to continue our research to investigate whether the change in the dynamics of the war was able to further influence political networks in the European Parliament.

V. Conclusion

In conclusion, we can say that the social networks of the European Parliament are an ever-changing structure. Some changes to it happen seemingly spontaneously, while some of

Beginning	End	Length (days)	# Data points
2019-07-24	2019-10-31	99	6291
2019-11-01	2020-01-31	91	18590
2020-02-01	2020-05-20	109	52589
2020-05-21	2020-08-31	102	71793
2020-09-01	2020-11-30	90	85737
2020-12-01	2021-03-03	92	70345
2021-03-04	2021-05-31	88	64459
2021-06-01	2021-08-31	91	75077
2021-09-01	2021-11-30	90	51429
2021-12-01	2022-02-23	84	105180
2022-02-24	2022-05-31	96	86629
2022-06-01	2022-09-05	96	62853

Fig. 3. Division of our data based on time

them happen as a result of important events. The events that can have a noticeable effect on this social structure can be internal (such as Fidesz leaving the EPP group), or external, such as COVID-19, or the Russo-Ukrainian war.

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