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## European Political Trends Viewed Through Patterns of Web Linking

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### Abstract

This study explored the feasibility of using Web hyperlink data to study European political Web sites. Ninety-six European Union political parties belonging to a wide range of ideological, historical and linguistic backgrounds were included in the study. Various types of data on Web links to party Websites were collected. The Web co-link data were visualized using multidimensional scaling (MDS) while the inlink data were analyzed with a two-way analysis of variance test. The results showed that Web hyperlink data did reflect some political patterns in the European Union (EU). The MDS maps showed clusters of political parties along ideological, historical, linguistic and social lines. Statistical analysis based on inlink counts further confirmed that there was a significant difference along the line of the political history of a country, such that left-wing parties in the former communist countries received considerably fewer inlinks to their Websites than left-wing parties in countries without a history of communism did. The study demonstrated the possibility of using Web hyperlink data to gain insights into political situations in the EU. This suggests the richness of Web hyperlink data and its potential in studying social-political phenomena.

**Keywords** Internet politics, Web data mining, co-link analysis, Webometrics

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## 1. Introduction

In the past ten years Internet politics have become part of the social science mainstream (Chadwick & Howard, 2009). The Web is increasingly used for political and social purposes and consequently has become an object of study in social sciences. In information science, Webometrics methods have been used to explore the social and political dimensions of the Web. For instance, Vaughan and Zhang (2007) examined the search engine coverage of Websites from different countries to explore possible biases and their implications; Gao (2009) analyzed Web server logs of China's largest online newspaper to gauge the public's political sentiment; Thelwall and Vaughan (2004) investigated the Internet archive to find out whether the Web history of different countries was fairly represented there; Bar-Ilan and Echerman (2005) examined the Web linking patterns related to the political event of anthrax scare; and Holmberg (2009) analyzed Web hyperlink patterns to study cooperation and geopolitical connections among regional governments in an area of Finland.

Building on these earlier studies, the current study examined patterns of Web linking to Europe's political parties to find out if and how information gained from Web data reflects Europe's political trends. The study included the main political parties of the European Parliament (EP). The current study differs from earlier ones in that it examines a large number of parties with diverse political orientations and social, historical backgrounds. The complexity of the political phenomena was both a challenge and an opportunity for the study. The 2009 election of the EP provided an opportunity for this kind of study, as the political parties all have a Web presence and increasingly use the Web for campaigning. Our research questions are:

Do Web link data effectively reflect the main political relationships in the European Union?

Can the relative positions of political parties visualized through Web hyperlink data be explained in terms of ideological, historical, linguistic and social variables?

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The political parties in the study represent the most important political trends in Europe, in a context in which varied social, cultural, linguistic and historical backgrounds are present. We collected both inlink and co-link data to Websites of these parties and analyzed the data using multidimensional scaling (MDS) and other methods. An inlink is a hyperlink embedded on one page that points to another page. For example, if there is a hyperlink on page Z that points to page X, then page X has an inlink. If both page X and page Y receive inlinks from page Z, then page X and page Y are co-linked. Co-link counts as a measure of relatedness between co-linked entities have been used successfully to analyze business sites (Vaughan & You, 2006, 2008), university sites (Thelwall & Wilkinson, 2004) and government sites (Holmberg, 2009).

In this study, we first looked at the general picture of the political parties belonging to distinct political groups, and then focused on the two most prominent groups representing the right and left sides of the political spectrum. The political history of a country – specifically, whether or not it was a former communist country – was a factor that was specifically analyzed and found to be an important variable in explaining the linking pattern.

## **2. Literature Review**

Although research on Internet politics has been carried out in different areas, this section focuses on some of the main issues that could be relevant to an analysis of political trends in the European Union. Burt and Taylor (2001) suggest that the ways in which technologies are exploited are influenced by social conditions, philosophies and value systems. Ward and Gibson (2009) add the framework of the political system as an additional relevant factor. March (2006) suggests that newer democracies in which political communication and political systems are less fixed and developed could allow a greater role for new

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technologies. This could be the case in Eastern European countries where democratic systems are very recent as a result of the past communist domination.

E-campaigning and e-mobilization are also important areas of research, as the Internet has been posited as a powerful tool to mobilize people. However, some studies in the United States (Gibson et al., 2003, 2005) and Europe (Norris, 2003) show that many visitors to political sites are already politically active. Web 2.0 has also arisen as a relevant subject in the development of Internet politics (Chadwick & Howard, 2009).

Some research (Kluver et al., 2007; Davis et al., 2008) has focused on political parties in the national electoral context. Regarding the analysis of European parties, it is worth mentioning that Norris (2003) analyzed 134 party Websites from 15 Member States in the EU and provided an analysis based mainly on Website contents and design. The green parties are at the top of the ranking in Norris' study followed by these other groups: far right, conservative and right-wing parties, center, social-democrats, liberal and extreme left.

This paper applies both inlink and co-link analysis to heterogeneous groups of political parties. This heterogeneity implies that there are many factors that can influence parties' positions in the European political spectrum. These factors range from the level of Internet access in a particular country or region to the various political, cultural, historical and social contexts of the different countries (van Dijk, 2009). Earlier studies also used Web link data to study political and socio-economical phenomena. The triple helix model (Etzkowitz & Leydesdorff, 1997) refers to the analysis of knowledge-based innovation systems through the interconnections between three institutional spheres: university, industry and government (Leydesdorff & Meyer, 2003, 2007). Some research (Stuart & Thelwall, 2006; García-Santiago & de Moya-Anegón, 2009) used Web link data to visualize these connections.

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### **3. An overview of the European Union political system**

A brief overview of the European Union (EU) political system is provided here to aid the understanding of the current study's context and results. The European Union is a supranational organization whose Member States are independent nations that pool their sovereignty in order to gain more influence in the international context (European Parliament, 2009; European Union, 2009). The European Parliament is the only institution in the EU whose members are democratically elected every five years by direct universal suffrage. The EP is made up of 736 Members elected in 27 Member States. The seats are, as a general rule, allocated to Member States in proportion to population. The Members of the European Parliament are grouped by political affiliation rather than nationality. There are currently seven political groups in the European Parliament. Members may not belong to more than one political group. Some Members do not belong to any political group and are known as non-attached Members. Twenty-five Members are needed to form a political group, and at least one-quarter of the Member States (currently seven countries) must be represented within a group.

The political groups in the EP play a significant role in the functioning of the institution. Outside the EP, political parties also exist at the European level. These political parties and political groups are composed of national parties and individuals as members. In practice, the political groups within the EP are supported by the political parties at the European level. The former carry out political initiatives within the European Parliament, while the latter coordinate political will at the European level. This study focused on political parties as the units of analysis; therefore, we took into account the political parties at the European level rather than considering the political groups in the EP. However, both types of entities are strongly connected and often have the same name. In order to select the parties within the study, we focused on the seats obtained by each national party in their own country. These parties and their members in the EP belong simultaneously to a political group and to the corresponding political party at the European level.

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It is worth noting that the largest groups in the EP, both currently and historically, are the Group of the European People's Party (the related party is the European People's Party, EPP) and the Group of the Progressive Alliance of Socialists and Democrats in the European Parliament, S&D (the related party is the Party of European Socialists, PES; this group was previously named "Group of the Party of European Socialists" and also "Socialist Group in the European Parliament"). For the sake of clarity, S&D will be referred to as PES.

#### **4. Methodology**

##### **4.1 Selection of political parties to study**

All national political parties represented in the June 2009 elections of the European Parliament (EP) were candidates in the study. Due to the high number of parties and groups in the EP, this study focused on the two largest groups: EPP and PES (S&D) (see Table 1). To analyze the overall situation, we also considered other major national parties and the European level parties (ALDE, GREENS and ECR). These five groups represent 87.2% of EP members. Due to the small size of the GUE/NGL group, only the European level party was included in order to situate the group within the context of the other European parties. The EFD Website was under construction at the time of data collection so it was not included in the study.

Table 1. Composition of the EU Parliament as a result of the 2009 European Elections

Political group (*)	Number of seats	Percentage of seats
EPP (A)	265	36
PES (B)	184	25
ALDE (C)	84	11.4
GREENS/EFA (D)	55	7.5
ECR (E)	54	7.3

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GUE/NGL (F)	35	4.8
EFD	32	4.3
NA	27	3.7
Total	736	100

EPP: Group of the European People's Party (e.g. Christian Democrats).

PES: Since the elections of June 2009, the PES group in the EP is called "Group of the Progressive Alliance of Socialists and Democrats in the European Parliament".

ALDE: Group of the Alliance of Liberals and Democrats for Europe.

GREENS/ EFA: Group of the Greens/European Free Alliance.

ECR: European Conservatives and Reformists Group.

GUE/NGL: Confederal Group of the European United Left - Nordic Green Left.

EFD: Europe of Freedom and Democracy Group.

NA: Non-attached.

(\*) means the label to identify the parties at European level and the national parties belonging to the corresponding family.

The composition of the parliament, as shown in Table 1, corresponds to the Incoming Parliament

(Constituent) of the seventh legislature (2009-2014). Changes are expected after the approval and

application of the Lisbon Treaty.

The complete list of the parties in the study is included in Appendices A, B and C to facilitate the understanding of the findings in Figures 1 and 2. Appendices include the following information: label in the MDS maps, name, abbreviation and URL of the political party, the number of seats in the EP, and the number of inlinks pointing to the Website. Composition of the political groups was taken at the end of July 2009 from an EP Website

([http://www.europarl.europa.eu/parliament/archive/elections2009/en/new\\_parliament\\_en.html](http://www.europarl.europa.eu/parliament/archive/elections2009/en/new_parliament_en.html)).

In order to facilitate the identification of political parties, the party labels in the MDS maps are made up of a capital letter indicating the political family followed by the country code (the top-level domain used on the Internet). The full list with labels can be found in the Appendices. If a country has more than one

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party in the EP, the label is followed by a number, with 1 being the political party that obtained the highest number of seats.

Each party's Website address was collected from the directory of each party at the European level and manually checked to ensure its correctness. The vast majority of parties in the study have only one URL for their Websites and use their own country code for the top-level domain. When a coalition of parties took part in the elections, usually there was no separate Website for the coalition; therefore, the party with the most inlinks was selected for the study. For the few that have alternative URLs in the form of an alias or redirect, we checked each URL to determine which one had more inlinks and used that one to collect inlink data. We considered including both URLs in data collection; however, Yahoo!, the search engine used for data collection, cannot handle the complex query syntax for collecting co-link data using two URLs.

#### **4.2 Collection of Web link data**

Of the three major search engines, Google, Yahoo! and MSN Bing, only Yahoo! could be used for data collection for the study. Google's inlink search only returns a sample of all inlinks that the Google database records (Google, 2009). In addition, Google cannot filter out internal inlinks (inlinks originating from within the Website itself, such as "back to home" links) as the query term "link" cannot be combined with any other query terms (Google, 2006). In other words, Google cannot report the external inlink counts required for the study. MSN Bing (formerly MSN Live Search) used to have inlink search functions but the service was turned off around March 2007 (Live Search, 2007). At the time of data collection, summer 2009, Yahoo! was the only option for collecting the inlink data required for the study.

Because search engines from different countries may have databases that favor Websites from the host country (Vaughan & Thelwall, 2004), we considered using the country-specific version of Yahoo! to retrieve inlinks to the political parties from that country. However, tests of some country-specific versions

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of the search engine, such as the Spanish, French, and UK versions of Yahoo!, returned the same inlink search results as the global version of Yahoo!. Unlike the Chinese version of Yahoo!, which has a database that is different from that of the global version of Yahoo!, these country-specific versions of Yahoo! had a different interface but the same underlying database. So the global version of Yahoo! ([www.yahoo.com](http://www.yahoo.com)) was used for all data collection through the application programming interface (API).

Yahoo! has two inlink search query terms, "link" and "linkdomain". The "link" query term finds links to a particular page (e.g., link:<http://www.abc.com> finds links to the homepage of [www.abc.com](http://www.abc.com)) while the "linkdomain" query term retrieves all links that point to all pages of a particular Website or domain, including the homepage. We used the "linkdomain" query term for data collection because all links, not just links to the homepage, are relevant to the study. The query syntax for the data collection is illustrated in Table 2 using the example URLs [www.abc.com](http://www.abc.com) and [www.xyz.com](http://www.xyz.com). We truncated the www portion of the URLs in the queries to capture links to all subdomains such as mail.abc.com. The "-site:abc.com" part of the query filters out internal links coming from within the domain of abc.com itself.

Table 2. Illustration of Yahoo! Queries for Data Collection

Types of links searched for	Query
Inlinks to <a href="http://www.abc.com">www.abc.com</a>	linkdomain:abc.com -site:abc.com
Co-links between <a href="http://www.abc.com">www.abc.com</a> and <a href="http://www.xyz.com">www.xyz.com</a>	(linkdomain:abc.com -site:abc.com) (linkdomain:xyz.com -site:xyz.com)

Since co-links involve a pair of Websites, the co-link data are collected in the form of a matrix with row x and column y of the matrix representing the number of co-links between URL x and URL y. We collected two sets of co-link data: one including all of the political families in the EP and one including only EPP and PES parties.

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#### **4.3 Methods of data analysis**

Each co-link matrix was analyzed using multidimensional scaling (MDS) to generate an MDS map. MDS uses a heuristic method to place parties with higher co-link counts closer together in the resulting MDS map. Since similar or related parties are more likely to receive co-links, the number of co-links between a pair of political parties is a measure of their relatedness. Therefore, similar or related political organizations will be placed closer together in the MDS map. The positions of the parties in the map reveal only their relative relationship to each other. We hoped to use the MDS map to see clusters of parties that would reveal their ideological positions, as well as geographical, linguistic and social features.

### **5. Results**

In this section we present an analysis of the overall positioning of the most relevant national and European parties and a comparison between the two largest groups, EPP and PES (S&D). Limitations and future research prospects are discussed in the next section. The current study analyzes heterogeneous parties in terms of their ideology and country; therefore, our first expectation is to find clusters of similar parties, that is, parties belonging to the same political family and country are expected to be grouped in the MDS maps.

#### **5.1 All political groups**

This section analyzes the plurality of ideologies in the EP. Accordingly, an MDS map showing parties belonging to the five largest groups in the study is presented (see Figure 1). Including all of the parties would result in a concentration of data points in the MDS map that would make interpretation unfeasible. Therefore, only parties belonging to the EU 12 (the first twelve Member States of the European Union) and with more than one seat in the parliament are considered. EU 12 includes some of the most important countries in terms of historical, political and economic influence. The EU 12 countries are Belgium, Denmark, Germany, Greece, Ireland, Italy, France, Luxembourg, Netherlands, Portugal, Spain, and

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United Kingdom. In addition, GUE/NGL (F in the map) as a European level party is included. These criteria reduce the number of parties in the map to 50, which includes most of the influential parties in the EU. Aie, the conservative Irish party, had no co-links with most parties so it was excluded from the analysis. The stress value of the MDS analysis of Figure 1 is 0.07, which is fairly low and suggests a good fit between the map and the data.

FIG. 1. MDS map for all political groups

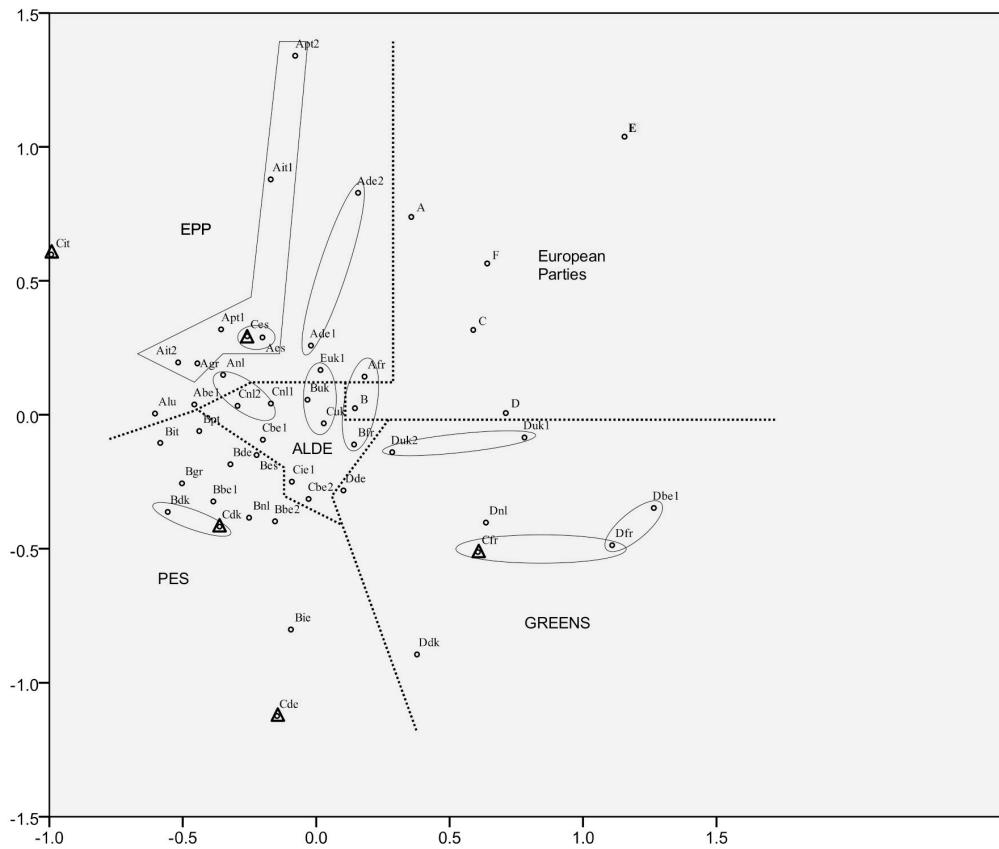


Figure 1 shows five clusters of parties. With a few exceptions, parties belonging to the same political group are located in the same cluster. To make the interpretation clearer, we will only comment on

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significant clusters in terms of geographical and linguistic similarities. The following five major party groupings are discernible based on political affiliation:

1. Political parties at the European level are shown in the upper area. This area includes the umbrella parties that integrate most of the national parties in the European Union. As coordinators of the political initiatives at the European level, they are expected to have a central position. The map shows that all of these organizations are in the same area; however, they do not form a very tight cluster. The EPP (A) and GREENS (D) parties are located relatively close to their affiliated national parties. The most noteworthy case is PES (B), which is in a central position in the map between the conservatives (EPP parties), the liberals (ALDE parties) and the greens and also close to the British and French social democrat parties (Buk and Bfr). This central position could be the result of the party's intensive work on Internet politics in recent years, in particular through the launching of the Manifesto 2009 campaign. PES is the only European party that has a central position close to parties with different ideologies. Other European parties are not as central and are close only to the parties of their own family.
2. The EPP area is located in the upper left of the map. Euk1, the British Conservative party, is located within this political group, although in this legislature they no longer belong to EPP but rather to a new political group in the EP called ECR. Ideologically, however, they are conservative and the co-link analysis correctly positioned them in this group. Ces, which stands for a Spanish coalition, is represented by the label CiU in the study. This party is a nationalist conservative Catalan party that is close in political orientation to the PP (Aes), the main conservative Spanish party. Therefore, its position is meaningful in spite of being the only ALDE party located within the EPP area of the map. This similarity explains why the two parties are positioned very close to each other. Other national clusters, such as the Italian and German

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parties, are also highlighted in the map, and parties from Mediterranean countries likewise occupy the same area (Bes, Bgr, Bit, Bpt).

3. The PES area is in the lower left section of the map. The social democrat parties are grouped together in a tighter cluster than the conservative parties. This tight cluster is evidence of the higher degree of integration of the social democrat parties, which could be explained by the fact that their ideological position is based on internationalism, in contrast to the more nationalist ideologies of the conservative parties. This explanation applies to Figure 2, which will be introduced later. The British Labour Party (Buk) and the French Socialist Party (Bfr) occupy a central position outside the PES area. This positioning could be explained not only by their influence on European politics, but also by their significant Internet presence. In addition, the linguistic factor also comes into play as English and French are probably the two most important languages in the EU.
4. Parties belonging to ALDE are located at the center of the map. This reflects the party's ideological diversity, which ranges from progressive positions to conservative ones. This is also the political group with more parties scattered outside of its area (shown by triangles in Figure 1). Apart from the previously mentioned case of Ces, the Danish party, Venstre (Cdk), is located within the PES group and very close to the Danish socialist party (Bdk) and other socialist parties from neighboring countries (Bbe1 and Bbe2 of Belgium and Bn1 of Netherlands).
5. The GREENS area is located in the lower right of the map. These parties are scattered but consistently in the same area. Parties with the same language are close to each other (English speaking Duk1 and Duk2 and French-speaking Dfr and Dbe1).

The positions of two particular clusters are worth noting. These are the British and French parties in the center of the map. Their linkages are so strong that they break the ideological pattern. The British cluster

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comprises the Labour Party (Buk), the Conservative Party (Euk1) and the Liberal Democrats (Cuk). This central position could be explained by Britain's linguistic advantage, which results from the fact that English Webpages are accessible by a majority of users in an international context. Despite Britain's reluctance to get involved in European affairs, British politics is very relevant internationally. Moreover, the British Labour party (Buk) holds positions that are more liberal than those held by other European parties in the same group. The French cluster is made of *Union pour un Mouvement populaire*, UMP (Afr), and the Socialist Party (Bfr). The language and the political influence of France could explain why these parties occupy a central position together with British parties.

To further our analysis, we examined inlink counts. It is worth noting that parties in the center of the map have more inlinks, which reinforces their significance within the group. Table 3 shows the top 10 parties in terms of inlink counts. According to this impact measure, German, British, French and Spanish parties are the most relevant. The size of the country and the predominance of the English and French languages in Europe are also factors that help explain these counts. It is remarkable that only the French and British parties in the top ten list occupy a central position on the map while the Spanish and German parties do not. Again, language is a plausible explanation, as English and French are commonly used as working languages in Europe. Only one European-level party, the PES, is included in the top ten list, which means that PES attracted more inlinks than any other European-level party. In the next section, we will make a specific comparison between PES and its opponent, EPP.

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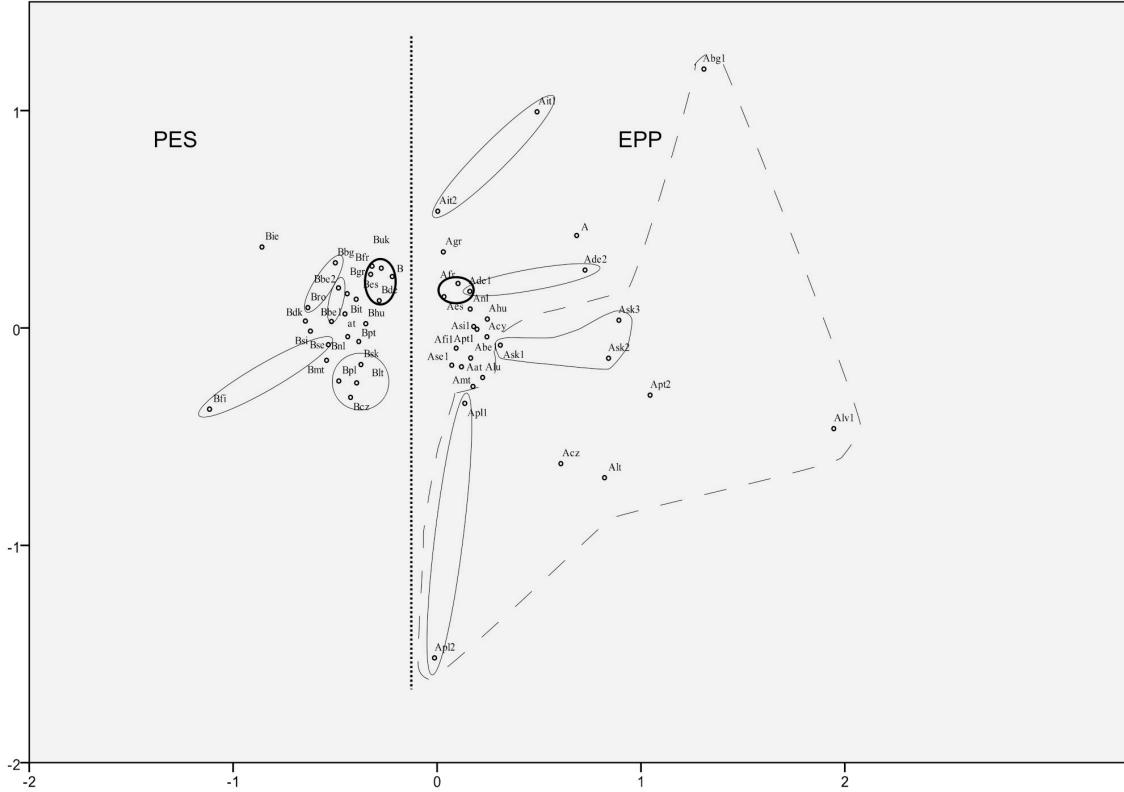
Table 3. Ranking of political parties with more inlinks

Ranking	Label	Abbreviation	Name	Country	Seats	Linkdomain
1	Bde	SPD	Social Democratic Party of Germany	Germany	23	735 000
2	Cuk	LD	Liberal Democrats	UK	11	269 000
3	Bfr	PS-f	Socialist Party (France)	France	14	232 000
4	Ade1	CDU	Christlich Demokratische Union Deutschlands	Germany	34	221 000
5	Euk1	Cons	Conservative Party	UK	24	186 000
6	Bes	PSOE	Spanish Socialist Workers' Party	Spain	21	177 000
7	Buk	Lab (UK)	The Labour Party (UK)	UK	13	170 000
8	B	PES	Party of European Socialists	Europe	184	160 000
9	Dde	GRÜNE	Bündnis 90/Die Grünen	Germany	14	144 000
10	Aes	PP	Partido Popular	Spain	23	127 000

## 5.2 The right wing EPP vs. the left wing PES

EPP and PES parties took 449 out of 736 (61%) seats in the EP. They represent the two opposite ends of a political spectrum, with EPP being the right wing and PES the left wing. They are the two most prominent parties at a European level and in most of the Member states. Historically, only these two groups have won European elections. We are thus justified in taking a closer look at these two political families by carrying out an MDS analysis just for these two groups. A total of 73 parties belong to these two groups. The MDS map would be too crowded if we included all these parties; consequently, we decided to omit fringe parties and included in our analysis only parties that have more than one seat. In addition, Aie, Aro1 and Aro2 had few co-links with other parties so they were also excluded from the analysis. Ultimately, 54 parties are included in the MDS analysis. The stress value of this MDS analysis is 0.03, which is very low and suggests a very good fit between the map and the data. Figure 2 shows the MDS map.

FIG. 2. MDS map for EPP and PES political parties



The MDS map shows, without any exception, a clear division between conservative and progressive parties. They form two distinctive clusters, although parties within each cluster are grouped differently. The cluster of left-wing parties is much tighter than that of right-wing parties. This suggests a stronger integration and homogeneity among the left. In addition, there are some other relevant clusters in the map. These are marked by bold lines and show the political core of the EU. On the left side, the British (Buk), French (Bfr), German (Bde), and Spanish (Bes) parties are in the same cluster as the PES (B). On the right side, the corresponding conservative parties (Afr, Ade1, Aes) are placed almost in a mirror position. The British Conservative party is not included in the map because it is not currently part of the EPP. The other clusters in the map show parties from the same country and region (right-wing parties: Germany,

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Italy, Poland, Slovakia) or from neighboring countries (left-wing parties: Baltic and Eastern, Mediterranean, and Scandinavian countries).

The division between the left-wing and right-wing parties could be explained by several factors.

First, left-wing parties are likely to establish more connections with civil right movements, grassroots organizations and NGOs. These organizations tend to have a strong presence on the Web and are likely to create co-links to left-wing parties. In addition, left-wing parties have traditionally supported and promoted internationalism, which translates into the creation of links with other national parties belonging to the same political family. In contrast, right-wing parties tend to be more nationalist. These two factors may explain why the degree of cohesion is lower for right-wing parties as seen in Figure 2.

However, this general explanation needs to be read in light of the countries' different historical and political histories. Probably the most prominent factor that determines departures from this general trend is the distinction between formerly communist countries and countries without a communist heritage. In former communist countries, the reaction against left-wing ideas and the communist heritage of many new social democrat parties make right-wing parties more attractive. In an attempt to compensate for this weakness, left-wing parties may tend to claim their European roots by approaching the political core of the EU in order to gain legitimacy. In contrast, right-wing parties do not need to build these European linkages with other conservative national parties; therefore the nationalist component is more significant. For example, Poland and the Czech Republic, both former communist countries with conservative leaders, demonstrated a reluctance to sign the Lisbon Treaty.

The difference between the former communist countries and other countries is also revealed in Figure 2. As shown by the area with dashed line, some right-wing parties in former communist countries are located in a fringe position, far from the center of the map. This cluster has only a few exceptions: a Portuguese party is included in this area (Apt2) while the Hungarian (Ahu) and Slovenian (Asi) parties are not. This pattern of seeing parties from former communist countries located on the fringes of the map

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is also visible on the left side of the map, although the effect is less pronounced. Parties from the Czech Republic, Lithuania, Poland and Slovakia form a cluster in the lower part of the map while parties from Bulgaria, Hungary and Romania are located in the upper part of the map. Both clusters are tighter than the cluster on the right.

Finally, the roles of the political parties at the European level are also different, as is reflected in their positions in the map. PES (B) is in a more central position than EPP (A), which may be a result of PES's intense and proactive work in recent years organizing gatherings not only among party members but also with European activists. For example, PES organized an active online campaign to prepare for the June 2009 European elections. This campaign, known as "Manifesto 2009," began in October 2007 with the aim of engaging activists from all over Europe to provide ideas for the manifesto in the elections. The campaign was based on a Web platform hosted on the pes.org domain and combined a complete set of Web 2.0 tools (e.g., YouTube, Vimeo, Facebook, Twitter, Flickr, and MySpace, among others) to coordinate actions and promote debates.. Four languages, English, French, German and Spanish, were used in the campaign, especially the first two. This dynamic e-campaign could explain why, in Figure 2, the PES group forms a tighter cluster than the EPP group and also why the position of the social democrat European party is more central than that of the conservative party.

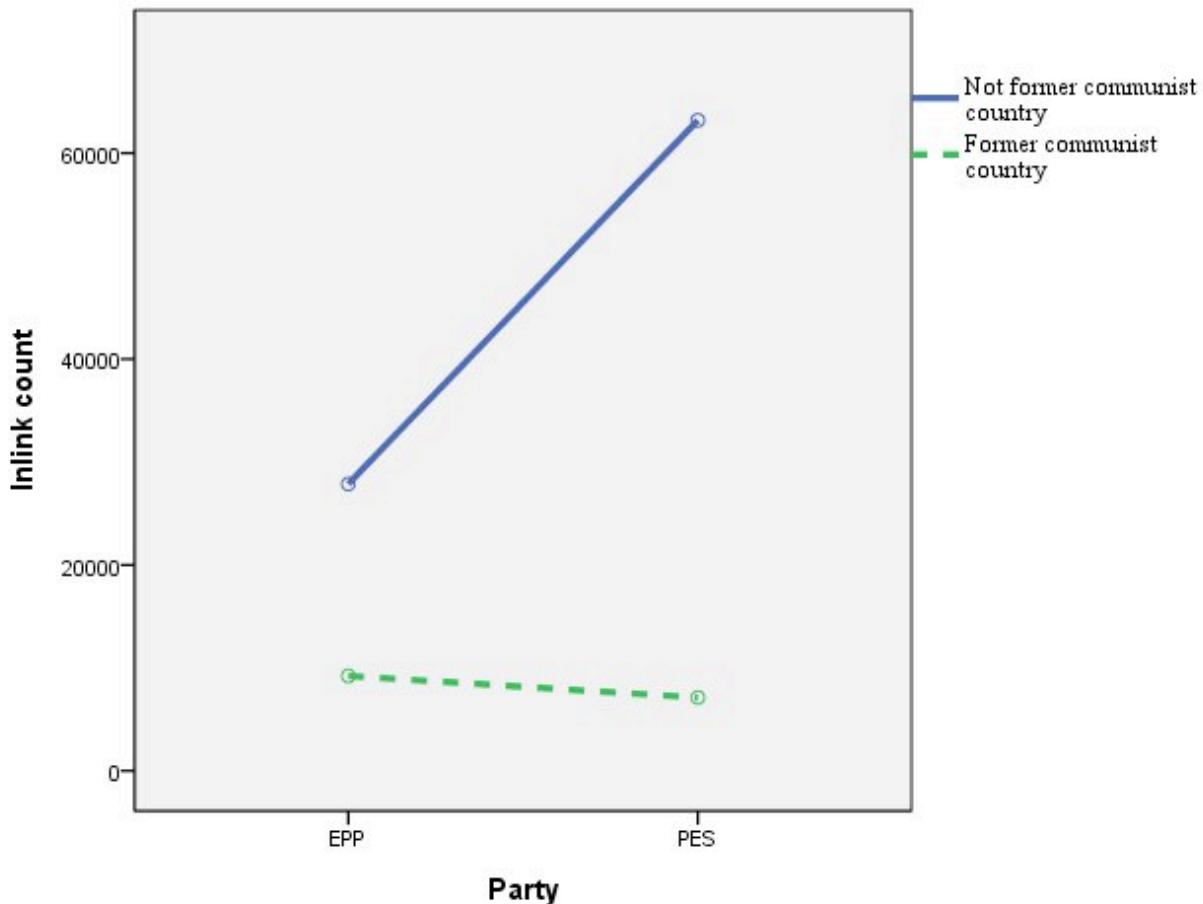
### **5.3 Comparison of inlink counts**

Results from Figures 1 and 2 showed that the two factors affecting Web co-link patterns are: political orientation (left vs. right) and political history (whether or not a the country is a former communist country). We further analyzed inlink counts by a two-way analysis of variance test to determine if these two factors are significant. The original data are presented in Table 4. Germany is excluded from this analysis as only part of the country can be considered to be formerly communist. The dependent variable of the test is the number of inlinks and the two independent variables are type of party (EPP vs. PES) and the country's political history (formerly communist or not). The test showed that the country's political

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history is indeed a significant factor ( $p=0.01$ ). As shown in Figure 3, right-wing parties are more popular in the former communist countries while left-wing parties are more popular in countries without a history of communism. The difference between EPP and PES is not statistically significant ( $p=0.26$ ), nor is the interaction between political history and political orientation ( $p=0.20$ ). This conclusion makes sense given that the EPP and PES have the opposite online popularity in the two types of countries. Their popularity, as measured by the inlink count, is not significantly different when the two types of country (formerly communist or not) are combined in the analysis.

FIG. 3. Inlink count comparison by party and country



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Table 4. Comparison of inlink counts based on former vs non former communist countries

Political party	Country	Inlink count	Party affiliation	Former communism
Socialist Party	France	285 000	PES	no
The Labour Party	UK	180 000	PES	no
Spanish Socialist Workers' Party	Spain	177 000	PES	no
Partido Popular	Spain	127 000	EPP	no
Union pour un Mouvement populaire	France	120 000	EPP	no
Dutch Labour Party	Netherlands	81 400	PES	no
The Swedish Social Democratic Party	Sweden	41 600	PES	no
Social Democratic Party of Austria	Austria	39 400	PES	no
Moderata Samlingspartiet	Sweden	38 300	EPP	no
Fidesz - Magyar Polgári Szövetség, Keresztyéndemokrata Néppárt	Hungary	37 400	EPP	yes
Panhellenic Socialist Movement	Greece	31 100	PES	no
Democratic Left	Italy	30 700	PES	no
Il Popolo della Libertà	Italy	30 500	EPP	no
Christen Democratisch Appel	Netherlands	29 900	EPP	no
Platforma Obywatelska RP	Poland	27 500	EPP	yes
Österreichische Volkspartei	Austria	22 700	EPP	no
Social Progressive Alternative	Belgium	21 800	PES	no
Danish Social Democratic Party	Denmark	18 200	PES	no
Christen-Democratisch & Vlaams	Belgium	17 200	EPP	no
Socialist Party	Belgium	16 400	PES	no
Czech Social Democratic	Czech Republic	13 900	PES	yes
New Democracy	Greece	12 200	EPP	no
Labour Party	Ireland	11 500	PES	no
Socialist Party	Portugal	11 500	PES	no
Partit Nazzjonalista	Malta	11 200	EPP	no
Hungarian Socialist Party	Hungary	11 200	PES	yes
Kansallinen Kokoomus r.p. / Samlingspartiet r.p.	Finland	10 900	EPP	no
Strana maďarskej koalície - Magyar Koalíció Pártja	Slovakia	10 500	EPP	yes
Unione dei Democratici Cristiani e Democratici di Centro	Italy	10 400	EPP	no
Uniunea Democrată Maghiară din România	Romania	10 400	EPP	yes
Křesťanská a demokratická unie – Československá strana lidová	Czech Republic	9 380	EPP	yes
Sojusz Lewicy Demokratycznej - Unia Pracy	Poland	8 050	PES	yes
Socialdemocracy	Slovakia	7 700	PES	yes
Partido Social Democrata PPD/PSD	Portugal	7 480	EPP	no
Citizens for European Development of Bulgaria	Bulgaria	5 870	EPP	yes
Social Democratic Party	Romania	5 870	PES	yes
Slovenska Demokratska Stranka	Slovenia	4 690	EPP	yes

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Polskie Stronnictwo Ludowe	Poland	4 530	EPP	yes
Lithuanian Social Democratic Workers' Party	Lithuania	4 280	PES	yes
Partido Popular CDS/PP	Portugal	4 230	EPP	no
Tėvynės sajunga - Lietuvos krikščionys demokratai	Lithuania	3 840	EPP	yes
Social Democrats	Slovenia	3 040	PES	yes
Coalition for Bulgaria	Bulgaria	2 940	PES	yes
Slovenská demokratická a kresťanská únia - Demokratická strana	Slovakia	2 040	EPP	yes
Kresťanskodemokratické hnutie	Slovakia	1 990	EPP	yes
Labour Party	Malta	1 600	PES	no
Chrëschtlech Sozial Vollekspartei	Luxemburg	1 580	EPP	no
Democratic Rally of Cyprus	Cyprus	1 430	EPP	no
Partidul Democrat Liberal	Romania	1 320	EPP	yes
Fine Gael	Ireland	833	EPP	no
Social Democratic Party of Finland	Finland	668	PES	no
Pilsoniska Savieniba	Latvia	402	EPP	yes

## 6. Discussion and Conclusions

The study has shown a clear difference between left-wing and right-wing parties in Web presence. The MDS maps generated from Web co-link data reflect Europe's political trends. Ideology seems to be the main factor in the clustering of political parties, followed by country or regional affiliation. This clustering pattern based on ideology could be explained a result of replication of Web production practices on a global scale (Foot et al., 2009). Also, visitors to political sites are typically already politically active (Gibson et al., 2003, 2005; Norris, 2003). Consequently, political Websites may be of limited use in reaching the majority of voters, which could explain why the greater Web presence of the left-wing parties in the EP did not translate into a higher number of seats in the 2009 election.

The results show a distinct Web linking pattern based on the political history of the country (whether it is a former communist country). This Web linking pattern reflects political trends in countries in which conservative governments are in power and right-wing ideology is currently more attractive. These trends could be considered a reaction against communist political heritage. By contrast, in countries without a

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communist heritage, Websites of social democrat parties are more inlinked than Websites of conservative parties, irrespective of which party is in power.

The influence of Web 2.0 on Internet politics (Chadwick & Howard, 2009) needs to be taken into account because of its potential impact on linking patterns. Ward and Gibson (2009) point out that one positive effect of online channels is the creation of stronger links between an organization and its supporters and between organizational supporters. Ward and Gibson are referring to offline ties but we believe that online links are also created. This effect is especially significant in the context of our study as the creation of political content on the Web is often accompanied by the creation of links, which increases the likelihood that Web data will more accurately reflect offline political patterns. This in return makes link analysis increasingly useful in analyzing political trends.

In order to understand the findings of our study properly, the limitations of the study must be acknowledged. As noted in section 4.2, we were able to use only one search engine for data collection because of the state of major search engines at the time of the study. Different search engines provide different Web coverage (Vaughan & Zhang, 2007), so the result from a single search engine may not be as reliable as a result from multiple search engines. Future studies should consider using multiple search engines for data collection if possible. An additional problem is the potential for measurement errors in commercial search engines, as earlier studies have pointed out (e.g. Bar-Ilan, 2004, 2005). These errors make studies based on quantitative data from search engines vulnerable. Qualitative studies could help to determine the nature of the limitations of the current study as well as provide insight into the motivations behind Web links. This kind of qualitative studies have been carried out for other types of Websites, including academic (Thelwall, 2003) and business Websites (Vaughan, Kipp & Gao, 2007), but not the Websites of political parties. Further research is needed in this area.

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A methodological issue of data analysis needs to be discussed. The study used MDS for data analysis but MDS is not the only statistical method that can be used to generate clusters. Cluster analysis is an alternative method. To compare the two methods, we ran cluster analysis on the two data sets used to generate Figures 1 and 2. The clusters generated from the cluster analysis did not match very well the clusters in the MDS maps. The advantage of cluster analysis is that it requires less human judgment than MDS. However, this could also be a disadvantage because the method is more data-driven than theory-driven. When theoretically meaningful clusters are not clearly delineated (i.e., when neighboring clusters are not far apart, as is the case in this study), cluster analysis results in clusters that fit the data but are not theoretically meaningful. There are many interrelated factors affecting the positions of political parties and we believe this to be the main reason that the clusters in the MDS maps (Fig. 1 and Fig. 2) are not far apart. MDS is more effective than cluster analysis in this situation because it is both data-driven (the MDS maps are generated from the data) and theory-driven (human interpretation of the maps), and provides better visualization of the data.

This study used an innovative method to investigate European politics and offered some insights into political trends by exploiting Web hyperlink data. The work focused on an overall analysis of European political parties and therefore presents many possibilities for analyzing political issues at both the European and national levels. The diverse variables that are likely to affect the parties' positions in the political spectrum are complex. Future research could examine variables not considered in this study, such as language. Some earlier studies have analyzed the linguistic variable (Thelwall, Tang & Price, 2003; Vaughan, 2006) and found it to be a significant factor. The dominance of the English language could play a role in political sites. The impact of Web 2.0 on the link structure that interconnects political parties could be studied using content analysis, particularly to test whether or not the types of Webpages that co-link or inlink parties differ based on a party's ideology. In addition, a longitudinal study could test the feasibility of using link analysis to monitor political evolution in the European Union. Finally, in-

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depth analysis could be carried out to examine unusual cases of Web presence, such as the Italian parties, which do not appear in central positions in the MDS maps generated in the current study, despite the relative importance of the country in European politics. One potential explanation for this situation is the continual change to Italian party websites as a result of political instability. For example, the Website of Ait1 (the party of the Italian prime minister) appears for the first time in the Internet Archive only in April 2008.

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#### Appendix A. EPP political parties

Label	URL	Abbre-viation	Name	Country	Seats	linkdomain
A	http://www.epp.eu	EPP	European Popular Party	Europe	265	97 400
Ade1	http://www.cdu.de	CDU	Christlich Demokratische Union Deutschlands	Germany	34	221 000
Afr	http://www.u-m-p.org	UMP	Union pour un Mouvement populaire	France	29	120 000
Ait1	http://www.ilpopolodellaliberta.it	PdL	Il Popolo della Libertà	Italy	29	30 500
Ap11	http://www.platorma.org/	PO	Platforma Obywatelska RP	Poland	25	27 600
Aes	http://www.pp.es/	PP	Partido Popular	Spain	23	127 000
Ahu	http://www.fidesz.hu	FIDESZ - KDNP	Fidesz - Magyar Polgári Szövetség, Keresztyén demokrata Néppárt	Hungary	14	37 400
Aro1	http://www.pdl.org.ro	PD-L	Partidul Democrat Liberal	Romania	10	491
Agr	http://www.nd.gr	ND	New Democracy	Greece	8	12 200
Apt1	http://www.psd.pt	PPD/PSD	Partido Social Democrata PPD/PSD	Portugal	8	7 480
Ade2	http://www.csu.de	CSU	Christlich Soziale Union Deutschlands	Germany	8	27 600
Aat	http://www.oevp.at	ÖVP	Österreichische Volkspartei	Austria	6	23 000
Anl	http://www.cda.nl	CDA	Christen Democratisch Appel	Netherlands	5	29 900
Ait2	http://www.udc-italia.it	UDC	Unione dei Democratici Cristiani e Democratici di	Italy	5	10 400

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			Centro			
Abg1	<a href="http://www.gerb.bg">http://www.gerb.bg</a>	GERB	Citizens for European Development of Bulgaria	Bulgaria	5	5 900
Aie	<a href="http://www.finegael.org">http://www.finegael.org</a>	FG	Fine Gael	Ireland	4	835
Alt	<a href="http://www.tsajunga.lt">http://www.tsajunga.lt</a>	TS-LKD	Tėvynės sajunga - Lietuvos krikščionys demokratai	Lithuania	4	3 840
Ase1	<a href="http://www.moderat.se">http://www.moderat.se</a>	M	Moderata Samlingspartiet	Sweden	4	38 400
Apl2	<a href="http://www.psl.pl">http://www.psl.pl</a>	PSL	Polskie Stronnictwo Ludowe	Poland	3	4 510
Abel	<a href="http://www.cdenv.be">http://www.cdenv.be</a>	CD&V	Christen-Democratisch & Vlaams	Belgium	3	17 200
Alu	<a href="http://www.csv.lu">http://www.csv.lu</a>	CSV	Chrëschtlech Sozial Vollekspartei	Luxembourg	3	1 570
Afi1	<a href="http://www.kokoomus.fi">http://www.kokoomus.fi</a>	KOK	Kansallinen Kokoomus r.p. / Samlingspartiet r.p.	Finland	3	10 900
Aro2	<a href="http://www.udmr.ro">http://www.udmr.ro</a>	UDMR	Uniunea Democrată Maghiară din România	Romania	3	6 000
Amt	<a href="http://www.pn.org.mt">http://www.pn.org.mt</a>	PN	Partit Nazzjonalista	Malta	2	11 300
Acz	<a href="http://www.kdu.cz">http://www.kdu.cz</a>	KDU-ČSL	Křesťanská a demokratická unie – Československá strana lidová	Czech Republic	2	9 420
Apt2	<a href="http://www.cds.pt">http://www.cds.pt</a>	CDS-PP	Partido Popular CDS/PP	Portugal	2	4 230
Asi1	<a href="http://www.sds.si">http://www.sds.si</a>	SDS	Slovenska Demokratska Stranka	Slovenia	2	4 710
Ask3	<a href="http://www.kdh.sk">http://www.kdh.sk</a>	KDH	Kresťanskodemokratické hnutie	Slovakia	2	1 990
Ask1	<a href="http://www.sdkuonline.sk">http://www.sdkuonline.sk</a>	SDKÚ – DS	Slovenská demokratická a kresťanská únia - Demokratická strana	Slovakia	2	2 040
Acy	<a href="http://www.disy.org.cy">http://www.disy.org.cy</a>	DISY	Democratic Rally of Cyprus	Cyprus	2	1 430
Alv1	<a href="http://www.pilsoniska-savieniba.lv">http://www.pilsoniska-savieniba.lv</a>	PS	Pilsoniska Savieniba	Latvia	2	401
Ask2	<a href="http://www.mkp.sk">http://www.mkp.sk</a>	SMK-MPK	Strana maďarskej koalície - Magyar Koalíció Pártja	Slovakia	2	10 600

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Abg2	<a href="http://www.dsb.bg">http://www.dsb.bg</a>	SDS-DSB	Blue Coalition	Bulgaria	1	4 820
Abe2	<a href="http://www.lecdh.be">http://www.lecdh.be</a>	cdH	Centre Démocrate Humaniste	Belgium	1	8 840
Asi2	<a href="http://www.nsi.si">http://www.nsi.si</a>	N.Si	Nova Slovenija – Krščanska Ljudska Stranka	Slovenia	1	1 550
Adk	<a href="http://www.konservative.dk">http://www.konservative.dk</a>	C	Det Konservative Folkeparti	Denmark	1	10 400
Aee	<a href="http://www.irl.ee">http://www.irl.ee</a>	IRL	Isamaa ja Res Publica Liit	Estonia	1	8 980
Aro3	<a href="http://www.elenabasescu.net">http://www.elenabasescu.net</a>	Băsescu	Băsescu Elena	Romania	1	700
Ase2	<a href="http://www.kristdemokraterna.se">http://www.kristdemokraterna.se</a>	KD	Kristdemokraterna	Sweden	1	12 700
Abe3	<a href="http://www.csp-dg.be">http://www.csp-dg.be</a>	CSP	Christlich Soziale Partei	Belgium	1	870
Afi2	<a href="http://www.kristillisdemokraatit.fi">http://www.kristillisdemokraatit.fi</a>	KD-PS	Vaaliliitossa - i Valförbund	Finland	1	1 180
Alv2	<a href="http://www.jaunaislaiks.lv">http://www.jaunaislaiks.lv</a>	JL	Jaunais laiks (New Era)	Latvia	1	519
Ait3	<a href="http://www.svpartei.org">http://www.svpartei.org</a>	SVP	Südtiroler Volkspartei	Italy	1	2 110

#### Appendix B. PES political parties

Label	URL	Abbre-viation	Name	Country	Seats	link-domain
B	<a href="http://www.pes.org">http://www.pes.org</a>	PES	Party of European Socialists	Europe	184	160 000
Bde	<a href="http://www.spd.de">http://www.spd.de</a>	SPD	Social Democratic Party of Germany	Germany	23	735 000
Bes	<a href="http://www.psOE.es">http://www.psOE.es</a>	PSOE	Spanish Socialist Workers' Party	Spain	21	177 000
Bit	<a href="http://www.dsionline.it">http://www.dsionline.it</a>	PD	Democratic Left	Italy	21	30 800
Bfr	<a href="http://www.parti-socialiste.fr">http://www.parti-socialiste.fr</a>	PS-f	Socialist Party (France)	France	14	232 000
Buk	<a href="http://www.labour.org.uk">http://www.labour.org.uk</a>	Lab (UK)	The Labour Party (UK)	United Kingdom	13	170 000
Bro	<a href="http://www.psd.ro">http://www.psd.ro</a>	PSD	Social Democratic Party (Romania)	Romania	11	5 890
Bgr	<a href="http://www.pasok.gr">http://www.pasok.gr</a>	PASOK	Panhellenic Socialist Movement	Greece	8	31 100
Bcz	<a href="http://www.cssd.cz">http://www.cssd.cz</a>	CSSD	Czech Social Democratic	Czech Republic	7	13 900

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Bpt	<a href="http://www.ps.pt">http://www.ps.pt</a>	PS	Socialist Party (Portugal)	Portugal	7	6 800
Bpl	<a href="http://www.sld.org.pl">http://www.sld.org.pl</a>	SLD-UP	Sojusz Lewicy Demokratycznej - Unia Pracy	Poland	7	8 090
Bsk	<a href="http://www.strana-smer.sk">http://www.strana-smer.sk</a>	SMER	Socialdemocracy	Slovakia	5	7 010
Bse	<a href="http://www.socialdemokraterna.se">http://www.socialdemokraterna.se</a>	S	The Swedish Social Democratic Party	Sweden	5	41 700
Bdk	<a href="http://www.socialdemokraterne.dk">http://www.socialdemokraterne.dk</a>	A	Danish Social Democratic Party	Denmark	4	18 200
Bat	<a href="http://www.spoe.at">http://www.spoe.at</a>	SPÖ	Social Democratic Party of Austria	Austria	4	39 500
Bbg	<a href="http://www.bsp.bg">http://www.bsp.bg</a>	BSP	Coalition for Bulgaria	Bulgaria	4	2 950
Bhu	<a href="http://www.mszp.hu">http://www.mszp.hu</a>	MSZP	Hungarian Socialist Party	Hungary	4	5 980
Bie	<a href="http://www.labour.ie">http://www.labour.ie</a>	Lab	Labour Party	Ireland	3	11 500
Bmt	<a href="http://www(mlp.org.mt">http://www(mlp.org.mt</a>	PL (MLP)	Labour Party	Malta	3	1 600
Bbe2	<a href="http://www.ps.be">http://www.ps.be</a>	PS-b	Socialist Party (Belgium)	Belgium	3	9 440
Blt	<a href="http://www.lsdpl.lt">http://www.lsdpl.lt</a>	LSDP	Lithuanian Social Democratic Workers' Party	Lithuania	3	4 290
Bnl	<a href="http://www.pvda.nl">http://www.pvda.nl</a>	PVDA	Dutch Labour Party	Netherlands	3	81 400
Bsi	<a href="http://www.socialnidemokrati.si">http://www.socialnidemokrati.si</a>	SD	Social Democrats	Slovenia	2	2 620
Bfi	<a href="http://www.sosialidemokraatit.fi">http://www.sosialidemokraatit.fi</a>	SDP	Social Democratic Party of Finland	Finland	2	669
Bbe1	<a href="http://www.s-p-a.be">http://www.s-p-a.be</a>	SP.A	Social Progressive Alternative	Belgium	2	17 400
Bcy2	<a href="http://www.diko.org.cy">http://www.diko.org.cy</a>	DIKO	Dimokratiko Komma	Cyprus	1	1 310
Blu	<a href="http://www.lsap.lu">http://www.lsap.lu</a>	LSAP	Luxembourgian Socialist Workers' Party	Luxemburg	1	1 080
Blv	<a href="http://www.saskanascentrs.lv">http://www.saskanascentrs.lv</a>	LSDSP	Saskaņas Centrs	Latvia	1	1 770
Bcy1	<a href="http://www.edek.org.cy">http://www.edek.org.cy</a>	EAEK	Movement of Socialdemocrats EDEK	Cyprus	1	2 810
Bee	<a href="http://www.sotsdem.ee">http://www.sotsdem.ee</a>	SDE	Estonian Social Democratic Party	Estonia	1	1 620

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#### Appendix C. Other political parties

Label	URL	Abbre-viation	Name	Country	Seats	link-domain
C	<a href="http://www.alde.eu">http://www.alde.eu</a>	ALDE	Alliance of Liberals and Democrats for Europe	Europe	84	39 000
Cde	<a href="http://www.liberale.de">http://www.liberale.de</a>	FDP	Freie Demokratische Partei - Die Liberalen	Germany	12	115 000
Cuk	<a href="http://www.libdems.org.uk">http://www.libdems.org.uk</a>	LD	Liberal Democrats	United Kingdom	11	269 000
Cit	<a href="http://www.italiadeivalori.it">http://www.italiadeivalori.it</a>	IdV-LdP	Italia dei Valori - Lista Di Pietro	Italy	7	19 200
Cfr	<a href="http://www.mouvementdemocrate.fr">http://www.mouvementdemocrate.fr</a>	MoDem	Mouvement Démocrate	France	6	90 200
Cbe1	<a href="http://www.vld.be">http://www.vld.be</a>	Open VLD	VLD-Open Vlaamse Liberalen en Democraten	Belgium	3	13 500
Cnl2	<a href="http://www.d66.nl">http://www.d66.nl</a>	D66	Democraten 66	Netherlands	3	40 000
Cnl1	<a href="http://www.vvd.nl">http://www.vvd.nl</a>	VVD	Volkspartij voor Vrijheid en Democratie	Netherlands	3	3 320
Cdk	<a href="http://www.venstre.dk">http://www.venstre.dk</a>	V	Venstre – Danmarks Liberale Parti	Denmark	3	5 780
Cie1	<a href="http://www.finnafail.ie">http://www.finnafail.ie</a>	FF	Fianna Fáil	Ireland	3	25 300
Cbe2	<a href="http://www.mr.be">http://www.mr.be</a>	MR	Mouvement Réformateur	Belgium	2	91 700
Ces	<a href="http://www.ciu.cat">http://www.ciu.cat</a>	CiU-CpE	Coalición por Europa	Spain	2	3 680
D	<a href="http://www.greens-efa.org">http://www.greens-efa.org</a>	GREENS / EFA	Greens/European Free Alliance	Europe	55	68 800
Dfr	<a href="http://www.europeecologie.fr">http://www.europeecologie.fr</a>	Europe écologie	Europe écologie	France	14	36 000
Dde	<a href="http://www.gruene.de">http://www.gruene.de</a>	GRÜNE	Bündnis 90/Die Grünen	Germany	14	144 000
Dnl	<a href="http://groenlinks.nl">http://groenlinks.nl</a>	GroenLinks	GroenLinks	Netherlands	3	51 800
Duk2	<a href="http://www.snp.org">http://www.snp.org</a>	SNP	Scottish National Party	UK	2	61 800
Ddk	<a href="http://www.sf.dk">http://www.sf.dk</a>	F	SF – Socialistisk Folkeparti	Denmark	2	22 900
Dbe1	<a href="http://web4.ecolo.be">http://web4.ecolo.be</a>	ECOLO	Ecologistes Confédérés pour l'Organisation de Luttes	Belgium	2	5 770

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			Originales			
Duk1	<a href="http://www.greenparty.org.uk">http://www.greenparty.org.uk</a>	Greens	The Green Party	UK	2	60 800
E	<a href="http://www.europeanreform.eu">http://www.europeanreform.eu</a>	ECR	European Conservatives and Reformists Group	Europe	54	4 840
Euk1	<a href="http://www.conservatives.com">http://www.conservatives.com</a>	Cons	Conservative Party	United Kingdom	24	186 000
F	<a href="http://www.guengl.eu">http://www.guengl.eu</a>	GUE/NGL	Confederal Group of the European United Left - Nordic Green Left.	Europe	35	18 400

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