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**Keeping Your Friends Close and Your Enemies Closer:
Information Networks in Legislative Politics**

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ABSTRACT

In this paper we examine information exchange networks in legislative politics and challenge the idea that legislators seek objective information prior to voting on bills. We make the intuitive claim that legislators establish contacts with each other that stand to maximize the value of the information they trade. Additionally, we make the counterintuitive claim that legislators seek information from sources that are predictably *biased* for or against their preferred outcomes. We test the propositions derived from this argument in the context of the European Parliament, using tools from social network analysis and modeling the network dependence using a multilevel approach. This research makes two primary contributions to the field of legislative politics. First, we demonstrate both theoretically and empirically how legislators use social contacts to their strategic advantage in their pursuit of legislative information. Second, our analytical approach demonstrates how to appropriately account for interdependence of observations in network data.

The process of lawmaking is an inherently social exercise and scholars have recently begun to use social network analysis to help explain some legislative behaviors (see for example, Fowler 2006). However, it is not yet clear how social networks among lawmakers contribute to legislative outcomes, policy formation, or pivotal activities such as voting. This paper seeks to begin to fill this gap by examining social networks in legislative politics as circuits of information exchange. Specifically, we are interested in examining if legislative offices establish connections amongst each other that maximize the value of the information they trade.

We maintain that in an effort to make well-informed policy choices, legislators have incentives to pursue information from sources that are *predictably biased*; the social connections they establish to collect information about the legislation they enact reflect these incentives. Information provided by sources that are predictably biased allows legislators to compare the information they expect to receive, given the known bias of the source, to the information they actually receive. This is of great value to legislators as they seek to confirm the appropriateness of the policy positions they are predisposed to take toward a given policy proposal. If the information legislators expect matches the actual information they receive, their predispositions are confirmed; in contrast, if the source provides information that deviates from their expectations it is likely to trigger a re-evaluation of their initial policy positions.

Prior authors have noted the value of “biased” information for legislators (see Kingdon 1981, 232; Calvert 1985); however, we offer that information has greater value to decision-makers if it is *predictably* biased. Such information is either in support of or in opposition to the position a legislator is predisposed to take, which means that legislators ought to seek information from both political allies and political opponents. Yet, the basic logic that underlies their choice of contacts differs for these two categories. Legislators should seek contact with political allies whose policy ideal points are particularly close to their own; that is, they rely on sources of information that are biased in support of their own preferences. In contrast, when legislators establish connections with political opponents they ought to single out those who are farthest away from their own ideal points. In other words, they seek information

that is biased away from their own preferences. These choices of social contacts reflect the desire of legislators to make the bias of the contact predictable.

If legislators had no contact with one another, we would naturally expect political allies to tend to vote together and political opponents to tend not to vote together. Our argument suggests that social connections between legislators of all types will amplify these effects. Essentially, our argument leads to two primary expectations: political allies who are socially connected will vote together to a greater extent than their voting bloc as a whole, while socially connected political adversaries will vote in opposition to one another even more frequently than typical for members of their respective voting blocs. To test these hypotheses, we develop an innovative research design that first identifies and maps the social network of legislators in the European Parliament's Committee on Environment, Public Health and Food Safety using contacts between the personal staffs of European Parliament members as a measure of social connections between legislative offices. We then employ a multi-level model to estimate the relationship between voting tendencies and social connectedness.

The contributions of this project are threefold. First, we make a general argument about information exchange in legislative politics predicated on the idea that information from predictably biased sources is of special value to legislators when engaging in legislative activity.¹ This novel argument entails clear expectations about the structure of social connections between legislators that differ in important ways for political allies or adversaries, and which are confirmed in our analyses.

Second, our empirical approach appropriately models the interdependence that inevitably arises from social network data. Standard econometrics assumes independence between observations that is both not applicable in social network analysis and not desirable. Here, we are specifically interested in how the social network between legislators helps to inform their legislative activity and we therefore use modeling techniques that allow us to capture the interdependence within the network, rather than assume it away. Our analysis not only emphasizes the importance of social networks for the flow of information in legislatures, it also suggests that the connections legislators establish with each other reflect strategic

considerations, as legislators seem to establish social contacts that maximize the utility of the information they trade.

Finally, the type of data we use for our analysis is unusual and difficult to acquire, as political actors are understandably reluctant to reveal their personal connections due to the political sensitivity of this information. We successfully conduct a survey of legislative staffers, however, that allows us to determine the connections between legislative offices. This has the advantage of being a measure of actual social connectedness, in contrast to prior studies that use proxies, such as cosponsorship. This profoundly increases the confidence we can have in our measures and results.

SOCIAL NETWORKS AND INFORMATION EXCHANGE IN LEGISLATURES

Despite recent stirrings of interest, social networks among legislators remain an understudied phenomenon. It stands to reason, however, that social connections among individuals and the networks they form have the potential to considerably impact preferences, decision-making behavior, and policy outcomes in the dense institutional environment of legislative politics. Recent research has begun to contribute to our understanding of social networks in legislatures by demonstrating, for example, that a legislator's level of social "connectedness" within a cosponsorship network significantly predicts influence, as measured by the ability to pass one's amendments, even after controlling for ideology and partisanship (Fowler 2006; see also Cho 2008; Sinclair 2008). Victor and Ringe use social network analysis to show that the legislative caucus system reinforces rather than counterbalances the formal power structure in the U.S. House of Representatives (*forthcoming*). We also know that legislators' committee assignments reveal information about their ideological preferences apart from what is indicated by partisanship or independent ideological measures (Porter et al., 2005). Social networks have therefore been shown to be indicative of preferences, but they also serve as avenues by which information flows (Carpenter, et al 2004). This is, of course, a critical function, as lawmakers require extensive information to engage in legislative activity and formulate policy (Kingdon 1981; Arnold 1990; Krehbiel 1991).

If we assume that information flows through a lawmaking body via social networks, what should we expect these networks to look like? The literature on decision-making networks in the electorate or among organized interests suggests that decision-makers tend to exchange information only with those whom they are predisposed to agree (Huckfeldt and Sprague 1987; Bauer, *et al.* 1963). Legislators, however, have incentives to seek information from sources known to have opposing interests, in addition to sources with similar interests. We argue that they cannot afford to suppress dissonance-producing information by choosing to interact only with those with whom they are predisposed to agree. In fact, having information that is “wholly and completely an extension of individually based political preferences” would put a legislator at a great disadvantage compared to her colleagues (Huckfeldt and Sprague, 1987; 1199). This is because legislators, especially those who are directly involved in the deliberation and negotiation of a particular legislative proposal, are involved in a strategic interaction with a relatively small number of players. In this context, they must maximize the information they have on the content and expected consequences of the policy proposals they seek agreement on, as well as the positions, strategies, and goals of their counterparts. If they limited their search for information to those with similar interests they would put themselves in a weak strategic position.

Hence, lawmakers require information that comes from a population of sources beyond those with whom they expect to agree *a priori*. We should therefore expect information networks among legislators to look different than those among voters, interest groups, or other sets of actors with a relatively homogenous set of discussion partners. Moreover, as strategic actors legislators should be expected to build social networks that maximize the value of the information they exchange. That is, they should not only seek information from political allies as well as adversaries, but also be strategic about their choice of contacts in light of their legislative goals. For example, Koger shows that legislators use basic legislative tools such as cosponsoring legislation to communicate strategic action to their colleagues (2003). Also, Masket provides evidence that legislators are more likely to vote the same way as colleagues seated within close proximity on the legislature floor (2008). Most information traded within the legislative network will be biased, however, rather than an objective evaluation of the content and

expected consequences of the proposed legislation. Legislators are well aware of this reality and understand that information exchange is a strategic exercise. As a result, they filter, categorize, and evaluate the information they receive based on its source and reliability (Mooney 1991; Austen-Smith 1992). What is more, individual legislators may actually *favor* biased over objective information, because decision makers who rely on biased sources of information make more accurate decisions than decision makers who use unbiased sources, as Calvert shows (1985, 542).

Information is biased if the recipient of the information knows the probability of receiving a particular message (*i.e.* “this policy is good” or “this policy is bad”) from a given messenger prior to actually receiving the information. A legislator can receive biased information from an ally or opponent, but in either case this information is of greater value to the decision-maker than information from a source who is considered to be neutral or objective, or whose biases are uncertain. The logic behind this counterintuitive idea is that a legislator with a predisposition toward one particular policy alternative is unlikely to change his or her mind in the face of unbiased information. Biased information, however, may be more successful in making the legislator re-evaluate his prior beliefs, as the following example suggests.

Let us assume that Legislator A seeks to establish her position regarding policy alternatives *X* and *Y*. She is predisposed to favor alternative *X*, but some uncertainty remains about this policy choice. To minimize the uncertainty associated with her tentative policy position, she may seek information from several sources. First, she may look to Legislator B, with whom she agrees most of the time. Because agreement with Legislator B is the norm, it is her expectation that Legislator B will confirm that alternative *X* is the correct policy choice. If Legislator B meets this expectation and favors alternative *X*, Legislator A has greater confidence in her choice of Alternative *X*. If, however, Legislator B unexpectedly supports alternative *Y*, it provides a strong incentive for Legislator A to re-evaluate her prior beliefs about alternatives *X* and *Y*.

Second, Legislator A may seek information from Legislator C, with whom she tends to disagree. Since she is predisposed toward alternative *X* and expects Legislator C to oppose her position, she

anticipates that Legislator C will favor alternative *Y*. If this is indeed the case, Legislator A's inclination to choose alternative *X* will be confirmed. However, if Legislator C unexpectedly indicates his support for alternative *X*, it would provide reason for Legislator A to reconsider her tentative policy position.

In both examples, the information received through the interaction is of particular value because Legislator A has an exogenous expectation of what this information ought to be, which allows her to compare the information she receives to her preconception of what her counterparts' positions should be, given their expected biases. If her expectation is met, the appropriateness of her tentative policy position is confirmed. If her colleague provides information that contradicts her expectations, however, it increases the likelihood of a re-evaluation of her tentative policy position. To further illustrate this argument, let us consider an alternative scenario where Legislator A seeks information from somebody who is either objectively unbiased or whose predispositions are uncertain. While these two possibilities seem quite distinct at first glance, they are observationally equivalent in the sense that in either case, Legislator A has no firm expectation of what her source's policy position ought to be and how it relates to the position she is predisposed to take. Therefore, she has no basis for comparing the information she receives to the information she expects to receive. It is thus less likely that the information would either confirm Legislator A's tentative policy position or trigger a re-evaluation. For this reason, the value of the information received from an unbiased source, or from a source whose bias is unknown, is of less value to Legislator A than the information she receives from the two sources that are biased in an expected direction. The implication of this is not only that biased information is more valuable to legislators than unbiased information, but also that legislators desire their sources of information to be either particularly strongly biased in favor of their predisposition or particularly strongly biased against them, because this is what makes the bias predictable.

It is worth emphasizing, however, that a source that is truly unbiased should be a rare occurrence in the context of our discussion, if it exists at all. This is because our main focus is on contacts between *legislators*. We do not conceive of legislators as political actors who can be truly unbiased, because they have distinct political objectives that they seek to achieve and because they have a stake in the public

policy they make. Moreover, even if a source were objectively unbiased, the recipient of the information cannot be certain that she is, in fact, provided with unprejudiced information. As a result, the major categories that are meaningful in our theoretical context are legislators that are either predictably biased—for or against a certain policy proposal—and those whose bias is uncertain.

Our propositions are based on the assumption that the information legislators receive from their social contacts is sincere, rather than deliberate efforts to misrepresent actual positions for strategic reasons. For legislators who are political opponents this risk seems particularly pronounced because adversaries have a greater incentive to dupe their counterparts. We nevertheless assume that the information exchanged between legislators A and C from above is sincere, for two related reasons: because the exchange of information is mutual, and because the process is iterative. First, the interaction of A and C is not a one-way street. While A was presented as the recipient of information provided by C in our example, in reality we are looking at a mutual exchange of information. As a result, C has an interest in an honest interaction with A, because he values the information he receives from A and would risk losing a precious contact if caught cheating. This is only because of the second reason why we assume sincerity, however: because the interaction between legislators who are highly connected is an iterative process. If we were looking at a single interaction, political adversaries would have strong incentives to misrepresent their true positions; in an iterative context, however, cheating is no longer costless.

In sum, it is worthwhile for legislators to maintain avenues of communication with colleagues with whom they are likely to agree, as well as with those with whom they expect to disagree. Specifically, among colleagues a legislator tends to agree with, she should seek out those whose ideal points are closest to her own. These will be colleagues with whom the legislator perceives to share a common set of preferences over political outcomes, but who may have more information about the given bill. In contrast, she should seek out those that are farthest from her ideal points among colleagues with whom she tends to disagree. We thus hypothesize that:

H1: Political allies who are highly socially connected to one another are *more* likely to vote alike than predicted by the strength of their ideological alliance alone.

H2: Political adversaries who are highly socially connected are *less* likely to vote the same way than predicted by their ideological opposition alone.

RESEARCH DESIGN

To test the expectations laid out above we require information about the level of social connectedness between legislators. We do so by collecting data on the social relationships of legislative staff in the European Parliament's (EP) Committee on Environment, Public Health and Food Safety (hereafter Environment Committee). Research on the European Parliament has shown that politics in this first-ever international, genuine law-making body is not structured along national lines, but is primarily party-based. In fact, the party system in the EP has become more consolidated and more competitive as the powers of the EP have increased over time (Hix et al., 2007; Hix et al., 2003). Comprehensive roll-call vote analyses show an increase in ideology-based party competition in the EP on the basis of the traditional Left-Right ideological divide. They demonstrate that members of the EP (MEPs) vote primarily in accordance with their party affiliations, rather than their national affiliations; that the distance between parties on the Left-Right dimension is the strongest predictor of voting patterns; and that EP party groups are remarkably cohesive (Hix et al., 2007; Hix et al., 2005; Thomassen et al., 2004). The power of transnational parties in the EP has thus risen "via increased internal party cohesion and inter-party competition" (Hix et al., 2005).

In this sense, parties are at the heart of politics in the EP. Nonetheless, the EP differs in important ways from a conventional parliamentary regime, most significantly in that there is no government-opposition dynamic, where the executive is tied to a majority coalition in the EU's legislative chamber. Hence, the institutional framework of the EU exhibits features of a separation of power system (Shackleton, 2005), in which political actors in the EP are less constrained than in traditional parliamentary systems because they are not simply expected to rubber-stamp decisions made at the

executive level. The EP is capable of actually *creating* legislation, ‘a classical parliamentary function almost forgotten by some national parliaments’ (Corbett *et al.* 2007, 9).

In this system, individual legislators play a more important role than in a parliamentary system where party positions are enforced by strong party organizations and backbenchers are coerced into voting the party line. Policy positions in the EP are actually endogenous to the political decision-making process, and individual legislators take the lead in creating these positions. In fact, party positions in the EP come out of its specialized committees, where small groups of policy experts take the lead in creating their parties’ policy positions (Ringe, *forthcoming*). It is thus not surprising that most of the detailed parliamentary work is conducted in and by committees and that the majority of substantive changes and compromises are constructed inside the committee (Kreppel, 2005).

The existing literature on EP politics has largely focused on the aggregate level and neglected to examine the individual dimension of EP politics. Yet, recent research emphasizes the central role of individuals and the significance of their interaction in EP decision-making (Ringe, *forthcoming*), which is enhanced by the importance of informal channels in the political process (Corbett *et al.*, 2007). If it is the case that individuals shape policy positions, it is critical to examine who talks to whom, which actors interact on a regular basis, and how information flows through these networks of individual legislative actors.

Legislative Staff

Legislative staffs, or Parliamentary Assistants in this case, can be viewed as extensions of the legislators themselves, as they are key actors in the legislative offices of MEPs. We view the social network of staffers as a proxy for the corresponding social network of legislative offices. This conceptualization is supported in existing research on legislative staff, which is focused primarily on the U.S. Congress. DeGregorio, for example, argues that staffers are not entrepreneurial individualists, but “influence extenders” of their bosses (DeGregorio, 1988: 474), and that staff are largely constrained from pursuing individual ambitions (DeGregorio, 1995). Other scholars have found that elected officials tend

to hire staff who share their ideological and policy views (Hall, 1987; Salisbury and Shepsle, 1981; and DeGregorio, 1988). Existing evidence also suggests that one should expect to find a significant relationship between the networks of legislative staffers and the behavior of legislators. Whiteman (1995) describes how “congressional enterprises,” or offices made up of legislators and staffers, exchange highly diverse and specialized information with one another. In addition, Romzek and Utter emphasize that networking is one of the primary norms that legislative staffers follow. They argue that staffers use networks to gather information, develop coalitions, and affect legislation (1997: 1269).

The 785 members of the European Parliament employ 1,416 full-time assistants in their offices in Brussels and Strasbourg (EP website). On average, each Member of the European Parliament (MEP) is assisted by two staffers, which bolsters our case that staff contacts are a suitable proxy for the social network of MEPs, because legislative assistants in the EP necessarily work very closely with their members. These staffers’ tasks and responsibilities range from secretary to gate keeper to political advisor. For this reason, a recent feature article on the EP’s website described MEP assistants as “a sort of secretary-advisor-press-officer-tour guide” (EP website). Their realm of responsibility is usually confined to one of the committees of which their MEP is a member. Assistants prepare position briefs or even draft amendments for their MEPs, while having to balance this legislative part of their work with other organizational and PR-related functions.

Network Data

Examining the relationship between legislators’ social interactions and their legislative behavior requires information on the social networks that exist between legislative offices. To collect information on such networks, we invited assistants to complete a web-based questionnaire in which they revealed the MEP offices of the assistants with whom they had contact on a regular basis.² Participants were given the option of completing the survey in English, German, or French.³ We contacted non-respondents with requests for in-person interviews to offer an alternative to the impersonal survey format. Interviews were less structured than the questionnaire but designed to obtain equivalent information.

The analysis in this paper is focused on a limited policy area, namely consumer protection and environmental policy. Hence, this analysis seeks to map the network of EP assistants who work for MEPs on the Committee on Environment, Public Health and Food Safety. One concern with this research design may relate to the small subset of legislative offices our analysis focuses on. Why should we care about empirical findings that are drawn from a small group of lawmakers in only one policy area? There are two primary reasons why. The first relates to the uniqueness of our data, because our analyses are based on *actual* connections between legislative offices, as reported by their legislative staff. As emphasized above, this means that we are measuring what we set out to measure, rather than using a relational variable as a proxy for social connectedness. We can thus have great confidence in any finding showing a significant effect of social connectedness on legislative outcomes; however, collecting this data is unusually difficult due to its sensitive nature, which is why we were only able to target a small number of respondents.

Second, the legislative reports and draft resolutions that are prepared in the responsible committees are not only submitted to the EP plenary in an almost “take-it-or-leave-it” form (Hix 2005: 93), they provide the basis for the positions taken on the EP floor. In fact, the policy positions of the members of the responsible EP committee are highly predictive of the voting patterns of their colleagues on the EP floor, as most MEPs simply adopt the positions of their committee representatives when casting their votes (Ringe, *forthcoming*). This aggregation of committee positions to the EP plenary means that our analysis of the voting patterns in the Environment Committee bears considerable significance with regard to EP policy-making more generally, since what happens in committee largely determines what happens on the EP floor.

Our network data were not collected from the entire population of MEPs, but neither were they taken from a sample in the traditional sense. All members of the Environment Committee were invited to participate in the study, so we were in effect attempting a census for the associated sub-network. Thus, limitations on any inferences we draw will be a result of nonresponse, rather than sampling design. Nonresponse poses a threat to the validity of any survey-based research; the difficulties are compounded in the case of social networks. There has been some recent progress on missing data problems in network

sampling (Frank, 2005; Gile and Handcock, 2006; Handcock and Gile, 2007), but at present there is no clear strategy available. For the time being, we must assume that nonrespondents are missing at random, that whatever mechanism is responsible for certain staff to respond and others not to do so, is uncorrelated with their social and voting habits. Fortunately, we have complete data on votes, so we can at least verify that nonrespondents are not notably different from respondents with respect to the dependent variable. Ideologically, our respondents are strikingly similar to nonrespondents, as evident in Figure 1.⁴ Notice that all spatial clusters are represented by respondents; even the four somewhat isolated pairs—three on the right and one on the left—each contain one respondent. Likewise, there is no evidence that certain geographical regions are underrepresented. As shown in Table 1, countries have been grouped roughly by region, and a chi-square test finds no statistical evidence of relationship between nonresponse and region. Similarly Table 2 indicates no indication of any self-selection bias among newer or older members of the European Union.

[Figure 1 Goes About Here]

[Table 1 Goes About Here]

[Table 2 Goes About Here]

For a conventional dataset, these patterns of nonresponse would give us great confidence in our inferences; for social network data, though, we must be cautious with anything less than a 100% response rate, given the current limitations on our knowledge of how the effects of missingness can be expected to propagate through a network. We sought to capture the entire population of people that worked on the issue area of interest by contacting EP assistants working for each member of the Environment Committee at the time the study was conducted. We structured the survey and interviews of assistants such that respondents could provide open-ended responses to questions about whom they talk to on a regular basis. Thus, we did not ask respondents to name a fixed number of social contacts, nor did we ask them to restrict their attention to other committee members; we simply asked whom they talk to and left it up to the respondents to provide a list as they saw fit. This approach is supported by social network

literature that suggests open-ended question are less likely to produce nonrandom sampling bias than methods where respondents are given a fixed list (Knoke and Yang 2008, 19).

We invited the assistants of the 65 members of the Environment Committee to complete the questionnaire.⁵ This represents assistants working for all members that sit on the Environment Committee. Of these, we received 32 responses (24 interviews and 8 completed questionnaires), for a response rate of 47 percent.⁶ The Environment Committee inter-office network in its entirety would thus include communication among all sixty-five offices, involving 4,160 dyads (or 2,080 if communication is considered symmetric). If we focus just on those dyads connecting survey respondents, we will have only 870, just about 21% of the full dyad census. However, we do in fact have information on communication between respondents and nonrespondents, since the former were given an opportunity to identify the latter. Taking this information into account yields a dyadic response rate of 46% (direct reports of 1920 of 4160 dyads). If we take respondents' reports on their contact with nonrespondents' offices as an indicator of the symmetric relationship of contact between offices, then the only dyads that are completely missing from the study are those consisting of two nonrespondents; we have no information on whether any two nonrespondents communicated with one another. From this point of view, we have a (somewhat unbalanced) dyadic response rate of 71.4%.⁷

In the questionnaire and the personal interviews, respondents indicated the frequency with which they contacted each person in their network. We converted this frequency information into a dichotomous measure, coding those contacts that occur at least once a month as one (i.e. the actors are connected) and less frequent or non-existing contacts as zero (i.e. the actors are not connected).

The relationship captured by the underlying social network we wish to observe, inter-office communication, is inherently undirected; we are not asking staffers about directed relations such as trust, advice, nor even who initiated contact with whom, but simply whether, and with what frequency, incidents of contact took place for each pair of MEP offices. Thus, we would like to treat the ties actually measured through responses to our survey as undirected, taking a tie to exist between Member A and Member B whenever a staffer from A's office names B's office as a contact or vice-versa. To do so,

however, would leave us more likely to detect contact between two offices of survey respondents than between two offices only one of which contains a respondent. One solution would be to restrict our attention exclusively to the respondents-only network, forfeiting a lot of data and drastically increasing the chance that nonresponse bias will invalidate our results. We will thus instead treat social contact as constituting a directed relation, reported contact from respondent to alter: if two offices contain respondents, both responses will constitute observations, implicitly weighting corroborated reports of contact most heavily. The dependent variable, percentage of votes in common, is of course itself an undirected relation.

It is not straightforward to report the density—percentage of all pairs exhibiting the relationship under study—for a social network such as this, where not all dyads have been observed. We are unable to consider pairs of non-respondents in our calculation, as we have had no opportunity to observe social contact, or the lack thereof, between their offices. If we focus solely on the sub-network among dyads where both the respondent and alter provided us with information, the density is 5.7% (9.7% if we treat the network as symmetric by taking a tie to be present whenever *either* member of a pair reports inter-office contact). If we instead use all information obtained and analyze the asymmetric sub-network of respondents, where at least one member of the dyad provided us with information, the density is 6.1% (118 out of 1920 possible ties).

For the purpose of measuring how close actors are to each other within the network, we start with a dichotomous measure of whether or not there is contact between two members of the network and then use this to generate a network measure called *point connectivity*. Point connectivity (“connectivity” for short) calculates the number of members that would have to be removed from the network in order for one actor to be no longer able to “reach” another one. The logic behind this measure is that if there are numerous possible pathways between two actors, they are highly connected with each other (Hanneman and Riddle, 2005). It also allows a more nuanced view of social connection, one based on the overall network structure rather than dyads in isolation. Two offices that have not reported contact with one another but have several contacts in common have a number of channels through which information can

flow. Such a measure will also be less sensitive to the effects of missing data; two offices for which direct contact exists but has gone unreported are more likely to have social partners in common than if there were truly no interaction between them, and this will be reflected in their connectivity score. The mean connectivity between two actors in our network is 2.2, with a median of 2, indicating that for a typical dyad, it would take the removal of two nodes from the network to eliminate all paths connecting the two offices. The modal dyad has connectivity of just one; 39.5% of office-pairs would be cut off from one another by removal of a single node in the network. A full 12.4% of dyads exhibit zero connectivity; no direct or indirect path connects these pairs of offices. The maximum connectivity score is 12 and applies to only one pair of MPs, a Spanish member of the European People's Party and a British Conservative. Figure 2 provides a histogram of frequencies of the point connectivity values.

[Figure 2 Goes About Here]

As one might expect, the majority of reported contact takes place between members of the same party. This is evident in Figure 3, where node shape indicates party and edges (line segments) connect nodes representing those offices between which social contact has been reported.⁸ The network graph of contact between Members of the Environment Committee shows that most contact occurs between members of the same political party. Furthermore, a number of the remaining reported social ties connect members from the same EU member state.⁹

[Figure 3 Goes About Here]

In order to test our hypotheses about levels of social contact among political allies versus opponents, we will need to operationalize these notions in the context of Environment Committee members and bills studied. A conventional approach would be simply to use shared party affiliation as an indicator of alliance or else use ideological proximity with respect to a continuous measure, such as NOMINATE score. The former may be too restrictive, as multiple parties are involved and may be expected to cluster somewhat on votes. The latter, however, would be too general, as it reflects the full spectrum of issues rather than the particular business of the Environment Committee. Thus, we will use

both party identification and policy coalition membership, where the policy coalitions are inferred from the voting record.

Specifically, on the basis of our data, the Group of the United European Left/Nordic Green Left (GUE/NGL) and the Greens/European Free Alliance (Greens/EFA) vote together on committee bills and are thus considered a coalition. Ideologically, they are the furthest to the left according to their NOMINATE 1st dim scores (-0.52 and -0.37, respectively).¹⁰ The center-left and center-right parties—the Party of the European Socialists (PES), the Alliance of Liberals and Democrats for Europe (ALDE), the Union for Europe of the Nations (UEN), and the European People’s Party (EPP-ED) (-0.11, 0.03, 0.16, and 0.20 NOM 1st dim, respectively) hang together on roll calls associated with Environment Committee bills and in opposition to the other two most left-leaning parties. There are four members who do not vote reliably with either coalition and so are not considered members of either.¹¹ In Figure 4, as in Figure 3, node shape represents EP party affiliation. Edges indicate a high level of agreement on votes (Environment Committee co-voting rate of 90% or higher).¹² The placement of nodes in Figure 4 emphasizes the tendency of actors to vote alike, where longer edges represent dyads that vote together less often and shorter edges represent dyads that vote together more often. Thus, the fact that all nodes for the two left-most parties cluster tightly together, as do the four center-left and center-right parties, lends visual support for treating these as voting blocs, or effective coalitions.

[Figure 4 Goes About Here]

Statistical Analysis

The network analysis in the previous section provides intriguing insights into the structure of personal contacts that exist between MEP offices. But to what degree does social connectivity relate to important legislative behaviors, such as voting? While our simple descriptive analysis above does not allow us to draw any conclusion on the relationship between social connections and parliamentary decision-making, we can use the social network described above to look for a possible link between point connectivity and voting behavior.

We collected information on all bills that received a final plenary vote in the EP that fell under the jurisdiction of the Environment Committee during the current parliamentary term (2004 – July 2008), as well as all votes on amendments to these bills. This provides for a total of forty votes included in this analysis.

The dependent variable here will be rate of co-voting, the proportion of votes each pair casts in agreement (either both “Yea” or both “Nay”). An alternative approach would be to treat each roll call vote as a dichotomous variable, predicting agreement on each given bill. To do this convincingly would require using information about each bill, as well as addressing the non-independence of the bills. If we were interested in estimating the particular locations of bills with respect to MEPs’ ideal points, we would have no other choice. Our intention here, however, is instead to gauge the degree to which a pair’s overall propensity to cast votes in common depends upon social connectedness between the MEPs’ offices, controlling for party and national affiliations. Notice that only one predictor variable, point connectivity, is explicitly social network based. The response variable is, however, also relational (dyadic) and subject to many of the same estimation challenges found in social networks, although it does not, strictly speaking, represent social interaction. Figure 5 shows the frequency of co-voting between all pairs. Note that about 1/3 of all pairs vote together 100 percent of the time.

[Figure 5 Goes About Here]

In attempting to choose and fit a model here, we encounter two principal challenges. One is what we will refer to as the fundamental problem of social network autocorrelation. Well known to those who work with social network data, this problem in fact arises whenever dyads (pairs of individuals) are the units of observation, regardless of whether or not they are drawn from a social network per se. Typical regression-style inference assumes independent observations, but of course, observations on pairs of actors within a single network are highly dependent. At a bare minimum, observations on any two dyads containing an actor in common cannot be considered unrelated. Incorrectly assuming that an observation on dyad (i,j) is independent of an observation on dyad (i,k) leads to biased, inconsistent estimators and underestimation of standard errors.

The second challenge involves a feature of the particular data. Of the 1920 observations, 594 of are on dyads voting together 100% of the time (on the forty Environment Committee bills). Of these, a full 97% (574) are identified as pairs belonging to a common coalition. There are in fact two distinct patterns to the voting. One third of the observations exhibit virtually no variation beyond that predicted by coalition membership. The remaining observations exhibit a great degree of variation with the potential to be explained by something other than coalition membership.

Before introducing the model, let us briefly explain our approach to addressing these two challenges. The fundamental problem of social network autocorrelation is the more serious of the two. A number of strategies have been suggested and improved upon in recent years, but even the most sophisticated of current inference methods do not fully address the problem. Nonetheless, the available methods represent a great improvement over the alternative of ignoring the issue altogether. The crux of the problem is that the autocorrelation structure of relational data may be quite complicated, making it difficult to correctly specify a model, express the likelihood, and estimate the corresponding parameters of interest. The greatest progress has been made on the special case of dichotomous variables, in which the relationship of interest is either present (1) or absent (0) (Holland and Leinhardt, 1981; Wasserman and Pattison, 1996). The best existing approaches for continuous or effectively continuous dyadic variables fall into the category of multilevel (sometimes called mixed-effects) models. The basic idea is to employ random effects to capture much of the network-type clustering of the observed data, thus greatly reducing the degree to which estimators will be biased and standard errors underestimated. The most obvious type of interdependence is also the source of the most egregious mistakes in estimation; observations on pairs consisting of at least one individual in common cannot conceivably be expected to exhibit independence. This is obvious when the response variable is truly social in nature; if, for instance, y_{ij} measures i 's expressed trust for individual j , this is bound to depend in part on the former's general tendency to trust and on the latter's trustworthiness. Although our actual response variable, the co-voting ratio, is symmetric and not truly a social measure, the same potential for autocorrelated errors is

nonetheless present, meaning the usual methods of inference will not be applicable. We thus condition on the particular individuals who make up the dyad and do so by including what are known as crossed effects in the multilevel modeling literature (Gelman and Hill, 2007). Rather than assuming these idiosyncratic individual contributions to be fixed parameters (estimated with dummy variables), it is convenient to instead assume these to be drawn from a distribution (typically bivariate normal). It may be helpful to think of this as partitioning the usual error into components associated with each individual actor, leaving any remaining error to be free of autocorrelation.

The second challenge becomes apparent if we attempt to fit the OLS version of the linear model (equation 1 below). The misspecification is apparent when we analyze the residuals, which exhibit a distinct pattern and are not normally distributed. Part of the problem is that we are dealing with a limited dependent variable, constrained to lie between 0 and 1. The standard linear regression approach may be applied in the case of a proportional response, but works best when the observed responses lie far from either endpoint. We will transform the dependent variable by taking the log-odds ratio. This means discarding all the observations of 100% vote agreement and 0% agreement (only five of the latter). Normally, this might be troubling, but we argue that there is virtually no information contained in the discarded data. As mentioned earlier, those who vote together on all forty roll calls are members of the same voting. We might surmise that these individuals' votes on Environment Committee bills are the result of either conscious intra-coalition discipline; in any case, we can do no better in predicting their decisions than by using their membership in the two coalitions. We include results for the (misspecified) linear version, which makes use of all the data as well as the log-odds-transformation fit to the subset of data.

Empirical Model

We start with the OLS version of our model, both for simplicity and in order to take note of how estimates may be affected as we address the misspecification.

$$\begin{aligned}
E(\text{co-voting rate}_{ij} | \mathbf{x}_{ij}) = & \beta_0 + \beta_1 \text{same party}_{ij} + \beta_2 \text{same coalition}_{ij} + \beta_3 \text{same nationality}_{ij} \\
& + \beta_4 \text{absolute difference in seniority}_{ij} + \beta_5 \text{point connectivity}_{ij} \\
& + \beta_6 (\text{point connectivity}_{ij} \times \text{same coalition}_{ij})
\end{aligned} \tag{1}$$

Here, the dependent variable is the co-voting rate between two legislators, that is, the fraction of roll calls on which two MEPs vote in agreement, given that both members of the dyad cast a vote on any given roll call. The variables for joint party membership (*Same Party*), common membership in a voting coalition (*Same Coalition*), and joint nationality (*Same Nationality*) are set to 1 if the pair belongs to the same party, coalition, or nation respectively. We also include the *Absolute Difference in Seniority* of any two MEPs as an independent variable.¹³ Finally, we include the *Point Connectivity* of the given pair, as well as the *interaction* between point connectivity and membership in the same voting coalition, to test the hypothesis that social proximity will predict a lower rate of co-voting among political foes but not among members of the same coalition. Adding this interaction term will provide a key insight that allows us to test our primary questions of interest.

$$\begin{aligned}
E(\text{co-voting rate}_{ij} | \mathbf{x}_{ij}, a_i, b_j) = & \beta_0 + \beta_1 \text{same party}_{ij} + \beta_2 \text{same coalition}_{ij} + \beta_3 \text{same nationality}_{ij} \\
& + \beta_4 \text{absolute difference in seniority}_{ij} + \beta_5 \text{point connectivity}_{ij} \\
& + \beta_6 (\text{point connectivity}_{ij} \times \text{same coalition}_{ij}) + a_i + b_j \\
(a_i, b_i) \sim & MVN(0, \Sigma), \Sigma = \begin{bmatrix} \sigma_a^2 & \rho \sigma_a \sigma_b \\ \rho \sigma_a \sigma_b & \sigma_b^2 \end{bmatrix}
\end{aligned} \tag{2}$$

, where x_{ij} represents covariates (x) between legislator i and legislator j , and a_i and b_i represent random effects associated with respondent and the alter, respectively.

This linear mixed-effects (multilevel) model (2) was fit using all the observations, but the assumption of linearity in the expected co-voting rate is incorrect, as apparent from the residual analysis on the OLS model (1). The misspecification that results in non-normal residuals for OLS also translates into non-normal random effects in this first attempt at a multilevel model. The random effects, (a_i, b_j) correspond, respectively, to idiosyncratic error associated with the survey respondent and the member office with which she is reporting possible contact. In this way, we take into account the tendency for

observations on dyads with an individual in common to be correlated. For instance, those tending to vote with the winning coalition will in general have high co-voting rates with more colleagues than those tending to vote on the losing side. This variability can now be associated with the individual rather than with the dyads to which she belongs. Note that we are not interested in the estimated parameters for the normal distribution presumed to generate these random effects; this is purely a device by which to induce network-type dependence in order to allow the remaining errors to be more nearly conditionally independent.

Finally, we transform the dependent variable, taking the expected log-odds of co-voting to be a linear function of dyadic covariates, and dropping dyads with 0% or 100% vote agreement.

$$\begin{aligned}
 E \left[\log \left(\frac{CVRATE_{ij}}{1 - CVRATE_{ij}} \middle| \mathbf{x}_{ij}, a_i, b_j \right) \right] &= \beta_0 + \beta_1 \text{same party}_{ij} + \beta_2 \text{same coalition}_{ij} \\
 &+ \beta_3 \text{same nationality}_{ij} + \beta_4 \text{absolute difference in seniority}_{ij} + \beta_5 \text{point connectivity}_{ij} \\
 &+ \beta_6 (\text{point connectivity}_{ij} \times \text{same coalition}_{ij}) + a_i + b_j
 \end{aligned} \tag{3}$$

RESULTS

Our main finding is that the more closely connected a non-coalition pair is, the less often they vote together, for the coefficient on point connectivity is negative and significant in all three model specifications. On the other hand, point connectivity is not a significant predictor of co-voting rate for those within the same coalition, as $\hat{\beta}_5 + \hat{\beta}_6$ is not distinguishable from zero at any conceivable significance level. Notice that membership in the same party is not significant when controlling for membership in the same voting coalition; being in the same party does not predict any additional propensity to cast identical votes beyond what is predicted by virtue of being in the same cluster of parties taken to be a coalition. On the forty Environment Committee bills analyzed here, parties display no additional cohesion beyond that displayed by the coalitions as a whole. The complete results of our estimations are shown in Table 3.

[Table 3 Goes About Here]

Intuitively, the coefficients in the final model (3) can be thought of as expected percentage change in odds of voting together corresponding to a unit change in the predictor, controlling for the covariates. Thus, a coefficient of around 3 on membership in the same voting coalition means that the odds of voting together will be expected to increase by 300% if a pair shares a coalition; if the other covariate values yield a prediction of even odds (1:1 or probability of 0.5) of voting together when legislators are from opposite voting coalition, the odds would jump to 4:1 (or probability of 0.8) if they are in the same voting coalition.

Regarding our primary variables of interest, a unit increase in point connectivity leads to an expected drop of 10% in odds, or (7% - 13%) with 95% confidence for non-coalition pairs. On the probability scale, should the expected rate of co-voting be 50% (as is the case for when for two MEPs not sharing a coalition), then if point connectivity increases by one unit about its median, from 1.5 to 2.5, this corresponds to a drop of 3% (50% down to 47%) in expected co-voting. Increasing from a standard deviation below the mean point connectivity to a standard deviation above, from 0.6 to 3.8, results in a decrease in expected co-voting rate from 52% to 44%. Figure 6 depicts a graphical representation of this effect. The solid line shows that as dyads from opposite ideological coalitions increase their social connectivity, their predicted rate of co-voting declines. Without information about social connectivity, we would expect opposing coalition members to vote together about 50% of the time, the empirical mean among such dyads.

[Figure 6 goes about here]

Of the two hypotheses posed, we find evidence in favor of Hypothesis 2, the initially counterintuitive claim that socially connected MPs from opposing coalitions will vote together less often than expected. We do not find any evidence to support Hypothesis 1, however, which suggested that socially connected MPs from the *same* coalition will vote together any more or less than would be expected by their party affiliations. Why might this be? The answer is rather straightforward. As

mentioned earlier, there is virtually no variability in voting patterns among same-coalition members that cannot be explained by coalition membership alone. Of 594 same-coalition dyads, a full 574 voted together on one hundred percent of the Environment Committee bills. This means that our findings concerning this proposition are inconclusive: there is not enough variance in this particular data to allow us to either confirm or dismiss Hypothesis 1.¹⁴

CONCLUSION

In this paper, we have used social network analysis to demonstrate that legislators appear to establish social contacts with colleagues that stand to maximize the utility of the information they exchange. We also illustrated why social network analysis deserves a more prominent place in the toolkit of political scientists than has been the case to date. Our measure of social connectedness, taking staff-reported interactions as an indicator of inter-office social proximity, helps explain relationships beyond that which can be explained by party labels or voting coalitions alone. Indeed it is only through a social network approach that we can convincingly operationalize our theoretical propositions about the exchange of predictably biased information in legislative politics, and only by modeling network interactions in a principled manner, as by the inclusion of appropriate mixed effects, that we can examine the empirical evidence for such a theory.

This paper makes both theoretical and methodological contributions to the literature on legislative politics, specifically, and applications of social network analysis, more broadly. Our argument about information exchange and social ties in legislative politics suggests that legislators seek information from sources that are *predictably biased* either for or against their own preference ideal points. This information is of special value to legislators, as it allows them to compare the information they expect to receive, given the known bias of the source, to the information they receive in actuality. Following this logic, we expected legislators to establish social ties to both political allies and adversaries. We also expected these ties to be positively associated with co-voting for ideologically similar legislators, a

proposition that the nature of our particular data set prevents us from evaluating, and negatively associated with co-voting for those who are ideologically opposed, which our data confirms.

Methodologically, this paper makes an important contribution by demonstrating how to appropriately incorporate social network measures into traditional statistical models used to test inferences that are of interest to political scientists. We have demonstrated that regression models that include social network measures must be treated with care because of interdependence between observations. In our investigation we successfully employed a mixed model approach that includes random effects for each member of each dyad that corrects for the dependence between observations.

Our data on social relationships between political actors is unique because it is considered highly sensitive information. We were able to collect this data for contacts between parliamentary assistants in the European Parliament, however. This allowed us to test our theoretical propositions using a measure of *actual* social connectedness, in contrast to prior studies that use proxies for social relationships. We therefore have greater confidence in our finding of social connectedness between political opponents: legislators are more closely connected to political adversaries with whom they vote together less often. This supports our propositions about the value and exchange of predictably biased information in legislative politics.

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Table 1 No evidence of response bias by region

	East	North	South	West	<i>Total</i>
No Response	5 (14.29)	6 (17.14)	7 (20.00)	17 (48.57)	35 (100.00)
Respondent	4 (13.33)	5 (16.67)	9 (30.00)	12 (40.00)	30 (100.00)
<i>Total</i>	9 (13.85)	11 (16.92)	16 (24.62)	29 (44.62)	65 (100.00)

Pearson Chi-square (3) = 0.935, Pr = 0.817

Table 2 No evidence of response bias by date of joining EU

	EU member prior to 2004	Joined EU since 2004	Total
No Response	30 (85.71)	5 (14.29)	35 (100.00)
Respondent	24 (80.00)	6 (20.00)	30 (100.00)
Total	54 (83.08)	11 (16.92)	65 (100.00)

Pearson Chi-square (1) = 0.3752, Pr = 0.540

Table 3 Results for restricted sample

Variable	(1) OLS	(2) Linear Multilevel	(3) Log-odds Multilevel
Intercept	0.6111 (0.0105)	0.484 (0.0285)	0.1379 (0.1613)
<i>Joint party membership</i>	0.0164 (0.0119)	0.0063 (0.0079)	-0.0953 (0.0704)
<i>Joint membership in a voting coalition</i>	0.3552 (0.0147)	0.5590 (0.0135)	2.9103 (0.0985)
<i>Joint nationality</i>	0.0141 (0.0186)	0.0028 (0.0120)	0.0356 (0.0885)
<i>Difference in seniority</i>	0.0023 (0.0045)	0.0019 (0.0036)	0.0014 (0.0251)
<i>Point connectivity</i>	-0.0716 (0.0043)	-0.0234 (0.0051)	-0.1020 (0.0307)
<i>(Point connectivity) × (Joint membership in a voting coalition)</i>	0.0711 (0.0055)	0.0110 (0.0045)	0.0801 (0.0298)
N	1912	1912	1319
R-Squared	0.668	n.a.	n.a.
Random Effects Variance	n.a.	Respondent:0.010 Alter: 0.016	Respondent:0.348 Alter:0.446
Log Likelihood	n.a.	-1344	-1405

Numbers in parentheses are standard errors.

Figure 1 No evidence of response bias by ideological position.

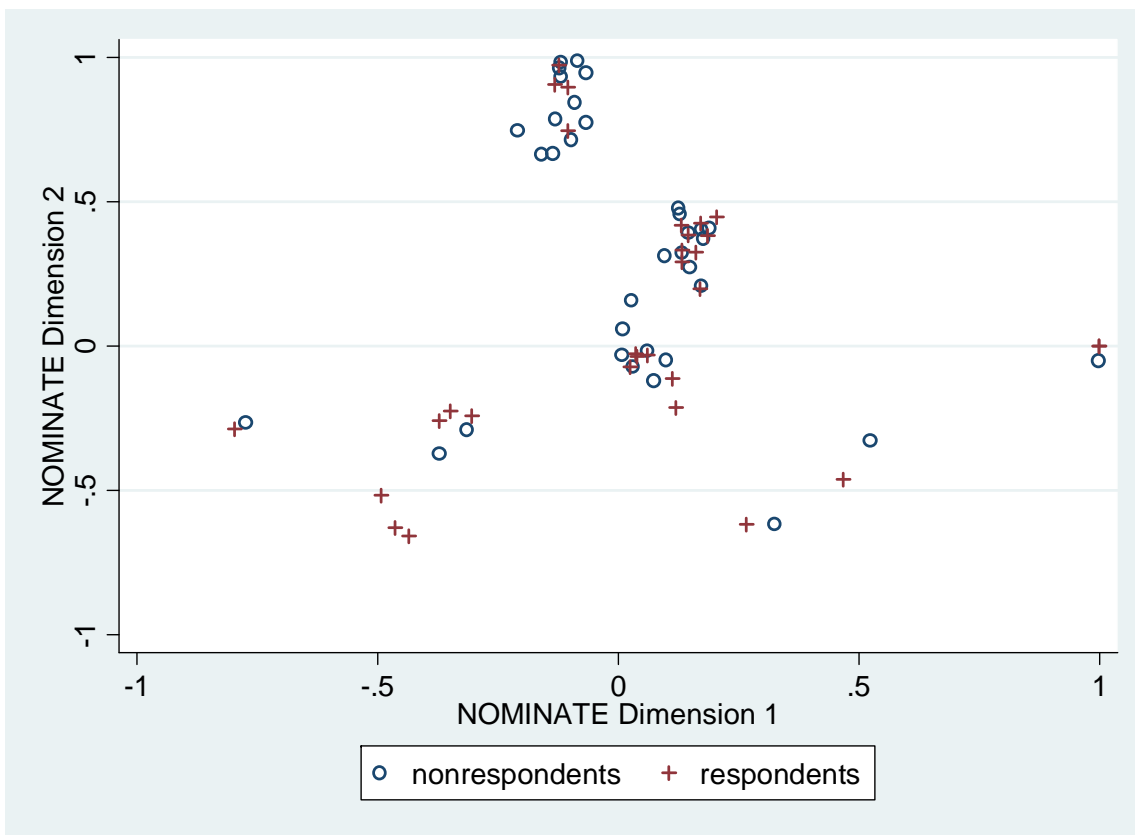


Figure 2 Relative Frequency of *Point Connectivity Scores* for All Reported Dyads.

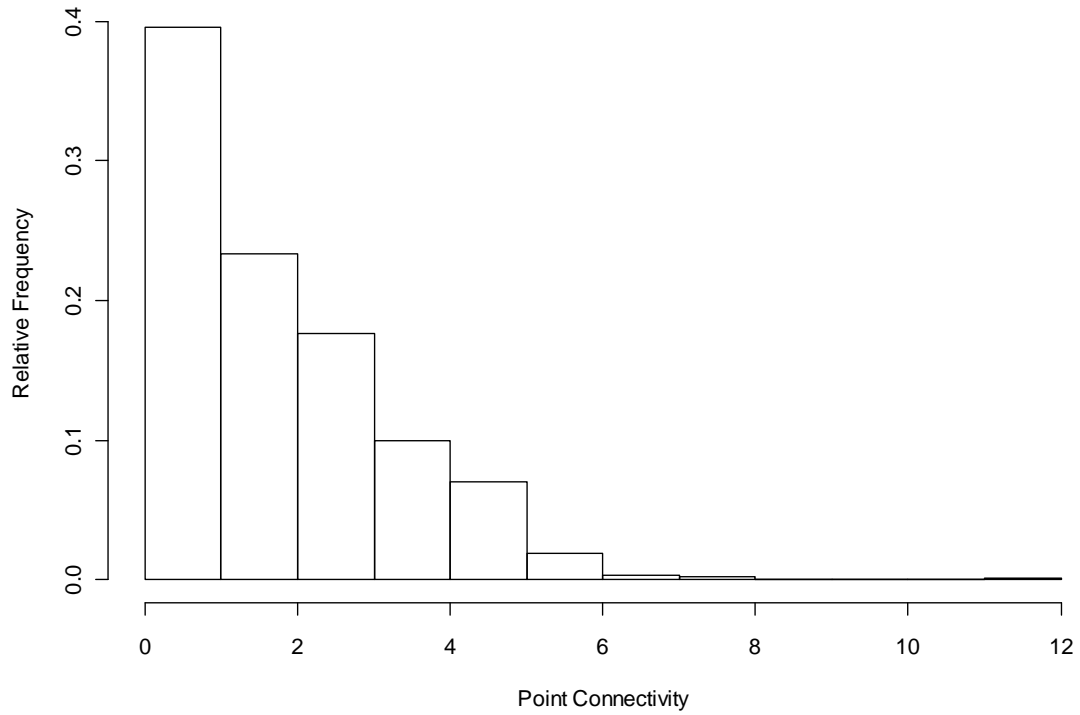


Figure 3 Reported Inter-office Social Contact Among Staff of All 65 Members of the Environment Committee.
Nodes of the same shape and color represent members belonging to the same party. Size of node differentiates respondents (large) from nonrespondents (small). The graph shows that like-party members tend to vote together.

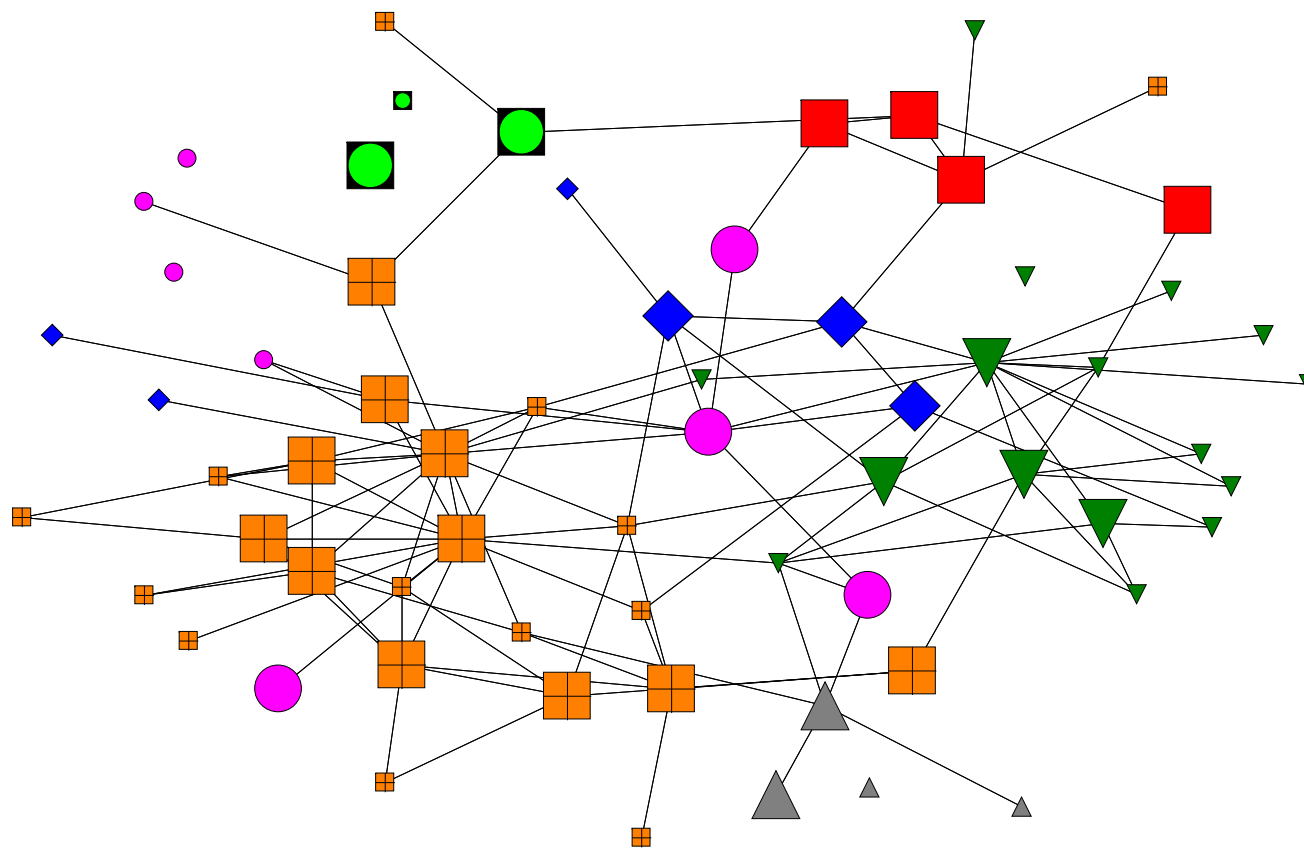


Figure 4 Voting Blocs Among All 65 Members of the Environment Committee on Environment Committee Bills.

Edges are visible for pairs voting together more than 90% of the time. As in the previous figure, nodes of the same shape and color belong to the same party and large nodes represent survey respondents. The graph shows two voting blocs and cohesion among like-party members.

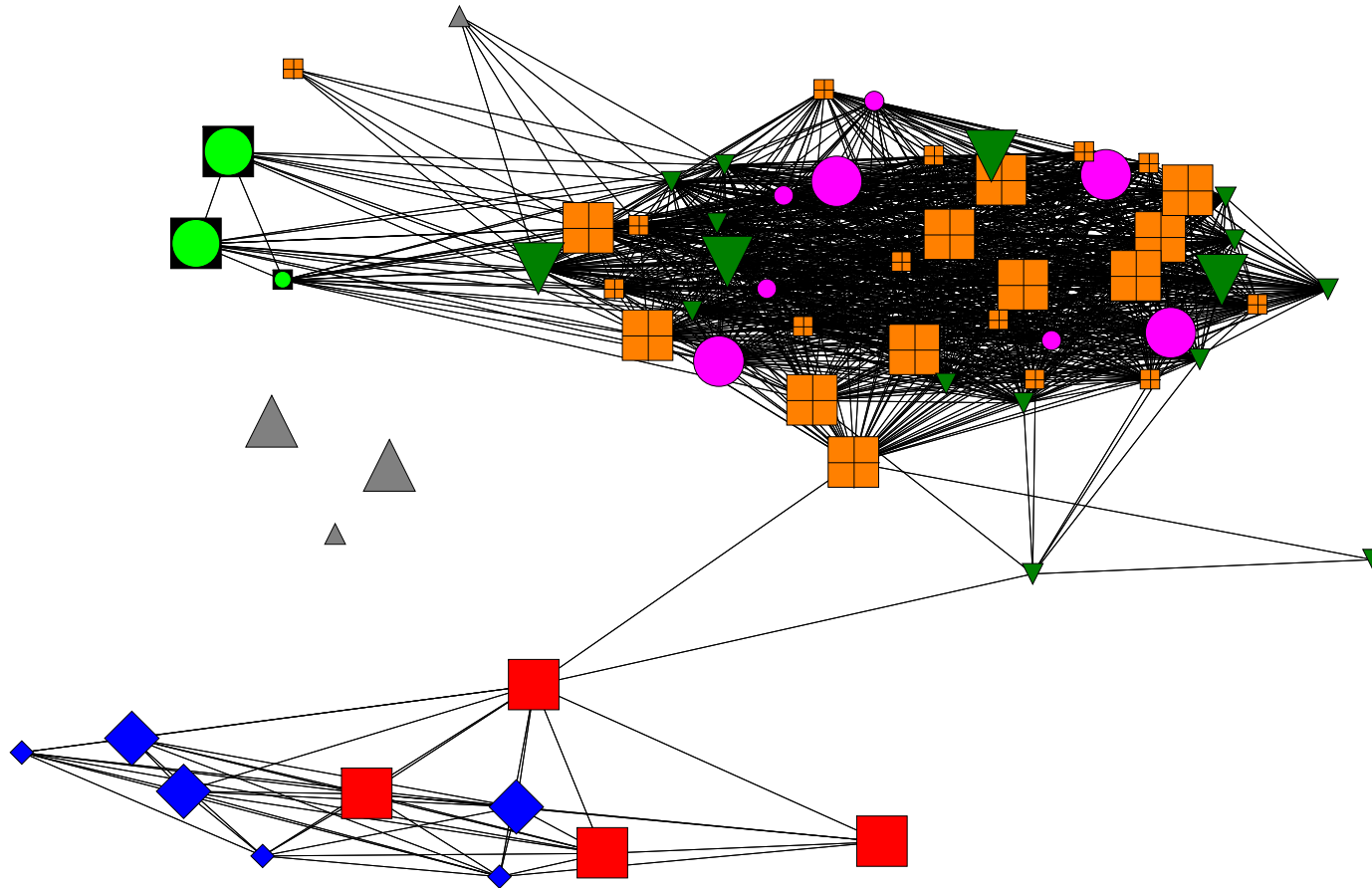


Figure 5 Co-voting Rates for Each Reported Committee Member Pair

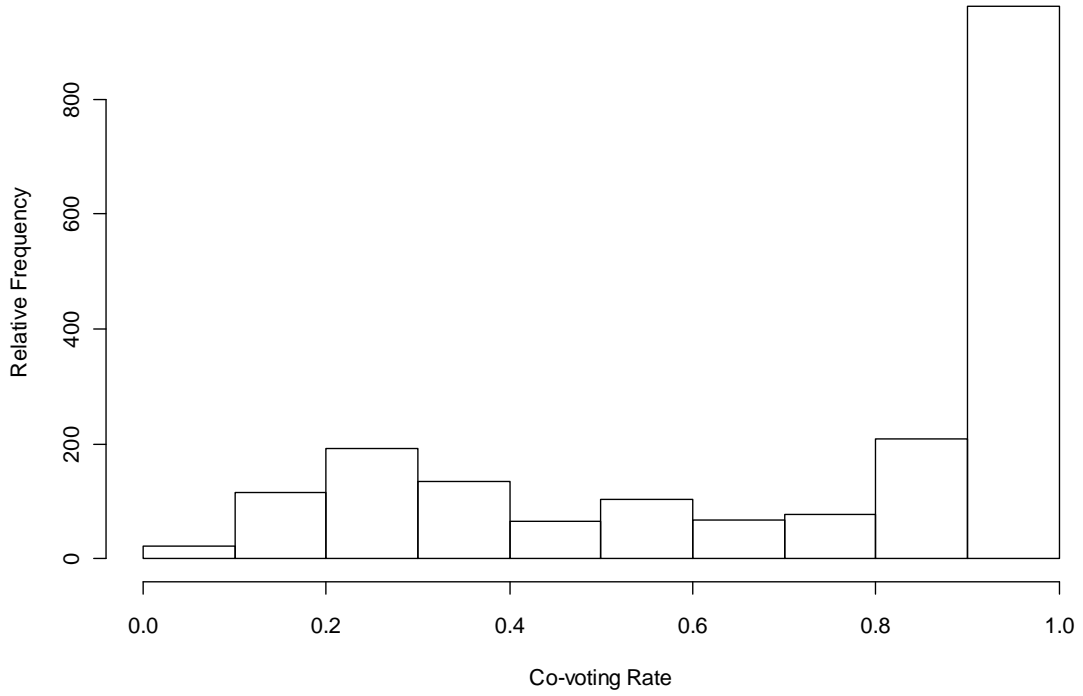
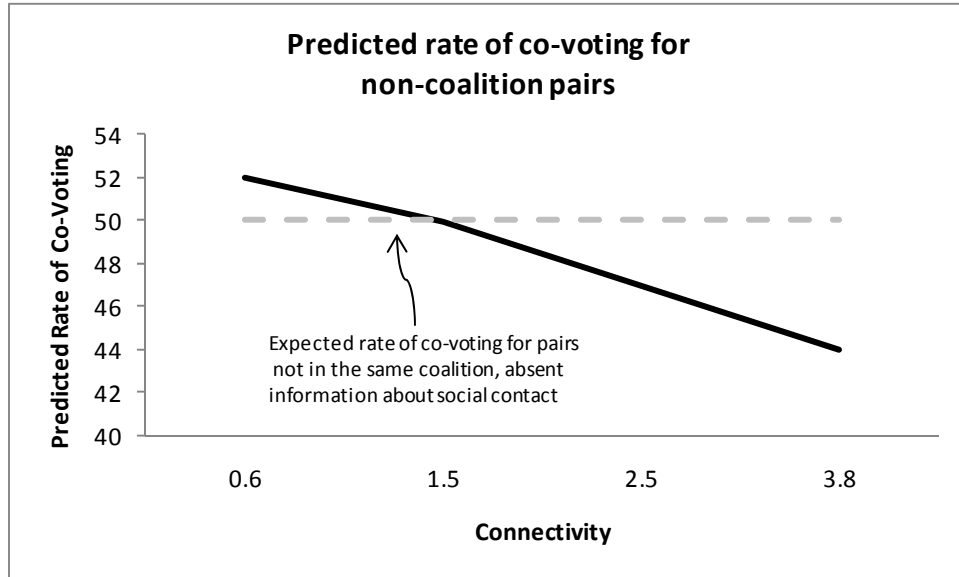


Figure 6 Predicted rates of co-voting under the log-odds multi-level model for pairs NOT in the same coalition and varying rates of connectedness. (The predicted change appears nearly linear on the probability scale in the neighborhood of 50% co-voting, but this is not the case for less typical values.)



Appendix

Thank you for agreeing to participate in this short survey. This questionnaire will take about 15 minutes to complete.

Purpose: The purpose of the study is to investigate the communication networks of parliamentary assistants. We are interested in learning how you communicate and interact with other parliamentary assistants.

Your personal information: In the survey that follows we ask you to reveal what you may feel is personal information and we understand if you feel some hesitation to do so. To help ease your hesitation it is important that you know the following:

- Any information you provide us will remain strictly confidential. We will not share your data or information with anyone.
- Results of this study are to be used strictly for academic research. Any publications resulting from this project will only describe general trends. Nobody will be identified by name, and it will be impossible to attribute any quotations or findings to you. If you have any questions or concerns, please feel free to contact me using the information below.

Right to Withdraw: You understand that you can withdraw from this research study at any time. You can ask to be removed from this study if you feel the confidentiality of the information you provide is not sufficiently guaranteed.

INSTRUCTIONS AND DEFINITIONS

Below, we ask you to name the parliamentary assistants with whom you have had recent contact. By parliamentary assistants we mean assistants employed in the offices of Members of the European Parliament (MEPs) who help MEPs with their parliamentary work.

*It is okay to repeat names in the questions.

1a. Who are the parliamentary assistants with whom you had LUNCH in the past two weeks?

1b. For which MEP does each of the assistants you named to the left work?

1c. How often would you say you have contact with each of the assistants you named to the left? (daily, 2-3 times a week, once a week, 2-3 times a month, once a month or less)

2a. Who are the parliamentary assistants with whom you have spoken on the PHONE in the past two weeks?

2b. For which MEP does each of the assistants you named to the left work?

2c. How often would you say you have contact with each of the assistants you named to the left? (daily, 2-3 times a week, once a week, 2-3 times a month, once a month or less)

3a. Who are the parliamentary assistants with whom you spoke at an event or RECEPTION after work hours in the past two weeks?

3b. For which MEP does each of the assistants you named to the left work?

3c. How often would you say you have contact with each of the assistants you named to the left? (daily, 2-3 times a week, once a week, 2-3 times a month, once a month or less)

4a. Who are the parliamentary assistants with whom you have E-MAILED in the past two weeks?

4b. For which MEP does each of the assistants you named to the left work?

4c. How often would you say you have contact with each of the assistants you named to the left? (daily, 2-3 times a week, once a week, 2-3 times a month, once a month or less)

5a. Who are the parliamentary assistants with whom you met casually for a cup of coffee or informal chat in the past two weeks?

5b. For which MEP does each of the assistants you named to the left work?

5c. How often would you say you have contact with each of the assistant you named to the left? (daily, 2-3 times a week, once a week, 2-3 times a month, once a month or less)

6a. Who are the parliamentary assistants with whom you spoke at a MEETING in the past two weeks?

6b. For which MEP does each of the assistants you named to the left work?

6c. How often would you say you have contact with each of the assistants you named to the left? (daily, 2-3 times a week, once a week, 2-3 times a month, once a month or less)

7. How long have you worked for your current boss (MEP)?

8. For which MEP do you work?

9. How long have you worked for the EP?

What is your gender?

This concludes the survey. Thank you for participating. We appreciate your valuable time. When you click 'done' below your responses will be sent to the researcher and your web browser will be directed to the EP homepage.

If you'd like to provide comments for the researcher you may do so here:

¹ While we focus on information exchange between legislative offices, there is no reason that the theory presented in this paper could not be generalized to other sources of information (e.g., media, interest groups, lobbyists, etc.)

² Survey questions can be found in the Appendix. The survey was hosted by SurveyMonkey.com.

³ English and French are the working languages of the European Union. The great majority of legislative assistants, if not all, speak at least one of these languages. We also made the questionnaire available in German because more MEPs are native German speakers than any other language.

⁴ The NOMINATE scores are based on all roll call votes from the first half of the sixth European Parliament, between July 2004 and December 2006 (Hix and Noury 2008). We are grateful to Simon Hix and Abdul Noury for making these scores available.

⁵ Three members, from Bulgaria and Romania, were excluded because they joined the EP in January 2007.

⁶ Interviews were conducted in June and July 2007.

⁷ This is “unbalanced” in the sense that we will have had two opportunities to observe contact for dyads consisting of two survey respondents, but only one chance at observing dyads with one respondent and one non-respondent. We suspect that the most careful way to handle this discrepancy would be to think of social contact as the latent variable of interest, which is then measured with error that depends on the opportunities to observe contact. We plan to explore this in a subsequent technical paper.

⁸ Figures 3 and 4 were both created using NetDraw’s spring-embedding algorithm, with some minor manual adjustments to facilitate viewing. Spring-embedding for graphical display is based on a heuristic of nodes as mutually repulsive and edges as springs acting to bring connected nodes closer together. Nodes are initially scattered randomly about the two-dimensional grid, then iteratively relocated so that pairs with short path lengths between them are located closest to one another. “Node repulsion” places limits on how close together any pair may be placed. At each iteration, the combined forces upon each node are calculated and taken into account, with the system tending toward equilibrium as the net forces

approach zero. This type of algorithm does not produce unique representations, but repeated runs tend to produce similar-looking graphs up to a rotation (Hanneman and Riddle, 2005; Borgatti, 2002).

⁹ To refrain from inadvertently disclosing the identities of individual MEPs or staffers, we do not indicate national identity in the figure.

¹⁰ We are grateful to Simon Hix for making NOMINATE data for the first half of the 6th European Parliament (2004-2009) available to us (Hix and Noury 2008).

¹¹ We are withholding further information about the party affiliation of these members because to do otherwise would allow readers to identify the MEPs and we wish to protect the anonymity of participants in our study.

¹² We calculate the agreement (or co-voting) rate as the number of roll calls for which both members voted the same way divided by the total number of roll calls for which both cast votes. For this particular pair of MEPs, votes were recorded for both members on twenty-six of the forty roll calls studied.

¹³ There is no theoretical reason to suspect that comparable levels of seniority will predict tendency to vote alike; however, since estimates of standard errors for coefficients on dyadic variables tend to suffer from attenuation bias, leading to high incidence of Type I error, it may be comforting to find no apparent significance where none is expected.

¹⁴ Analysis of a more heterogeneous set of bills including a broader set of legislators would be required to shed light on whether connectivity predicts political allies' propensity to vote together. For the European Parliament's Environment Committee social network, however, we are using the best data available.