# Explaining the Diffusion of Web-Based Communication Technology among Congressional Offices*

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**Abstract**

Legislative websites are increasingly important in the practice of representation. Do legislative offices learn website design practices from each other? Using data from the 2006 and 2007 official homepages of members of the U.S. House of Representatives, we test whether web design features diffuse among offices through congressional state delegations. Using nonlinear conditional autoregressive models and a new method for identifying causal spatial network diffusion, we find that web design practices are driven in part by communication within state delegations. Website features do not appear to diffuse through institutional channels such as cosponsorship networks or networks defined by ideological proximity. The results suggest that congressional offices are purposeful in designing the content of legislative websites, but not in the underlying technology, and that this facet of institutional design appears to be driven by the electoral connection rather than substantive policy motivations.

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# 1 Introduction

The practice of representation is central to any legislator's responsibilities, both normatively (Pitkin, 1967) and empirically (Fenno, 1978). The relatively recent development of Internet-based communication technologies has the potential to transform the way legislators engage in the practice of representation (Druckman, Hennessy, Kifer, and Parkin, 2009; Druckman, Kifer, and Parkin, 2007). As with technological innovation in any occupational field, legislators must learn how to adopt and implement these new communication technologies. In this paper, we examine whether this learning occurs among members of the U.S. House of Representatives, focusing on the extent of diffusion of website design features among representatives' official homepages.

A vast array of studies in other organizational settings highlights the critical role that informal networks play in the adoption of innovations (Rogers, 1976). Further, there is a substantial literature on the important role networks play within the Washington system (Carpenter, Esterling, and Lazer, 1998, 2003, 2004; Heinz, Laumann, Nelson, and Salisbury, 1993; Laumann and Knoke, 1984) as well as some research on interconnections among state legislators (Arnold, Dean, and Al, 2000; Caldeira and Patterson, 1987). There has been little research on the informal mechanisms of the diffusion of technical innovations in the congressional system, however – a system that includes not just 440 members and delegates in the House of Representatives and 100 Senators, but many thousands of staff members as well. More generally, there is very little research on the informal networks among members of the congressional system and the impact of those networks on the decisions of Congressional offices (for exceptions, see Baughman, 2006; Fowler, 2006).

It is well known within the literature on Congress that members often discuss legislative issues and procedures with other members from their state delegation (e.g., Padgett, 1990; Truman, 1956). We therefore expect that a member will be more (less) likely to adopt new website design features if other members of her state delegation have (have not) adopted the practices. We investiage whether technology diffusion occurs through informal communication networks defined by membership in state delegations.

A major inferential issue in testing the effects of spatial diffusion, or diffusion among physically proximate units, is to distinguish a causal diffusion process from a process driven simply by unmeasured confounding variables that are spatially correlated with the communication network (see Lazer, 2001). As we describe below, we are able to identify the causal effect of state delegation networks on technology diffusion by exploiting the ignorable[1] state boundaries that define the state delegation communication network. Using data on the website designs of neighboring congressional districts, some of which are across state lines, we are able to control for unobserved confounding variables, and so we can identify the causal effect of membership in a state delegation on website design.

Our results suggest that the state delegation informal networks play a perceptible role in the diffusion of website design among congressional offices. The dependence we observe, however, involves content rather than the underlying technology of the websites. Website design features do not appear to diffuse through institutional channels such as cosponsorship networks or networks defined by ideological proximity. To the extent it exists, then, the diffusion of legislative website design appears to be driven by electoral connections to geographic constituencies, rather than by substantive policy motivations.

## 2 State Delegations and the Diffusion of Website Communication Technology

The role of social networks is probably the single most studied driver of the diffusion of innovations (Coleman, Katz, and et al, 1957; Hagerstrand, 1967; Ryan and Gross, 1943). Learning through observing others' experiences lowers the ambiguity and perceived risk associated with an innovation (Galaskiewicz and Burt, 1991; Haunschild and Milner, 1997; Valente, 1995). Further, the behaviors of others creates a normative environment. A behavior is legitimate because others who are similarly situated are doing it, inducing mimetic

[1] Ignorability in this context requires that the conditional distributions of unobserved variables are not affected by where the state boundary line is drawn. We test for this ignorability below.

isomorphism (DiMaggio and Powell, 1983).

Social network research has found that strong or "high bandwidth" relationships – those based on personal familiarity, trust, and high frequency – are especially important for the exchange of complex, tacit, or confidential knowledge (Hansen, 1999). A number of studies in the social networks literature show, for example, that physical co-location increases job related communication in work groups, because proximity tends to drive and facilitate regularized communication (den Bulte and Moenaert, 1998). Co-location or spatial proximity itself will not lead to an increased communication; they are just prerequisites for higher exposure, more frequent informal occasions where people meet in the hallways or other social areas within office buildings. These meetings in turn increase the probability of informal communication regarding successful technology practices (Allen, 1978; Festinger, 1950; Kraut, Egido, and et al, 1990; Monge, Rothman, and et al, 1985; Rice and Aydin, 1991; Zahn, 1991). Walker's (1969) classic study of the diffusion of innovations among the American states shows that diffusion tends to occur more regularly among adjacent states, which he took to proxy for more regular communication among state-level policy activists (see also Mintrom, 1997).

In the present case, the adoption of website design is largely public; all Member web sites are public. The logic and experience underlying particular decisions is private, however, and this private information is unevenly distributed. The role of informal advice networks (who asks whom for advice regarding their web sites) and attention networks (who pays attention to whom) are likely fairly powerful with respect to Members of Congress. Thus, for example, it might require repeated interactions and high levels of familiarity between two chiefs of staff from Members' offices to effectively transfer the knowledge about implementation challenges with respect to particular web-based practices.

In this paper, we test whether diffusion of website design occurs through state delegations. Scholars have long recognized (Deckard, 1972; Kessel, 1964; Padgett, 1990; Truman, 1956) the tendency of members from the same state to meet and discuss policy and process legislative issues. At the state level, Caldeira and Patterson (1987) find similar patterns of friendship among Iowa state legislators with districts closer together. Arnold et al. (2000) purport[2] to demonstrate that friendship ties among Ohio state legislators causes members to more often vote on the same side of issues, holding other causes of members' vote similarity constant.

As we mention above, there has been very little research on the potential influence of social networks within the US Congress.[3] To motivate our causal analysis, and to justify our focus on state delegation networks, we make use of a small survey we conducted in winter, 2007, of the Congressional staff in charge of the members' official websites. Out of 440 offices surveyed, we received 100 responses (23 percent).[4]

In the survey, we asked respondents, "Among other Members of Congress' websites, are there ones that stand out to you as especially good? If yes, which do you think are particularly good?" Fifty two websites were named, some multiple times. Of those 52, 86 percent were within the same party, and (when combined with 11 responses indicating the state delegation), 60 percent were within the same state delegation.[5]

We used these data and random effect logit regression to estimate the change in the probability that one members' staff would mention another member's website. For covariates, we use *Same party* indicating both the "mentioner" and "mentionee" are in the same party; *Same state* indicating both are in the same state delegation; the difference in first dimension `DW-Nominate` scores (`http:\www.voteview.com`); and the number of cosponsorships common between both members. We grouped the random effect on the mentionee to control for any additional unobserved (confounding) variables that tend to increase the

[2]Unfortunately their results are questionable because their OLS analysis is vulnerable to the criticisms of spuriousness that we describe below. In short, the non-random assignment of nodes to network locations raises inferential problems that are very common in studies of social network analysis.

[3]Notable exceptions include Baughman (2006), who shows how informal staff communication among members who have overlapping committee assignments reduces the transaction costs for writing and negotiating legislation, and Fowler and Cho (2010), who examine the effects of co-sponsorship networks on legislative productivity; see also Fowler (2006).

[4]We use these analyses, not as inferential findings, but instead as a summary of but what a large number of staff reported to us regarding their own interpersonal attention networks. We offer a formal inferential test in the next section.

[5]We also asked about who the Member was friends with, with similar results: of 90 "friends" named, 87 percent were same party, and 44 percent were same state.

overall probability a mentionee website is mentioned.

The logistic regression confirms that state delegation was a powerful predictor that one office would name another ($p = 0.045$). The difference in `DW-Nominate` scores, capturing ideological distance, has a negative point estimate as one would expect, but the estimate is not significant ($p = 0.711$). The effect of sharing cosponsorships, which may indicate an institutional collegiality between two offices, also has no discernable effect ($p = 0.830$). Taken together, these findings indicate that staffers themselves, at least in the aggregate, believe they learn from the practices of others in their own state delegation, but perhaps not through other institutional channels such as cosponsor networks or networks defined by ideological proximity. We next describe a formal test for identifying a causal effect of state delegation social networks on technology diffusion.

Also important were whether both offices were from the same party ($p = 0.030$). However, in the network analysis that we present below we cannot distinguish party as a social network from party as an institution, since parties are both formal and informal organizations.[6] To capture any change in probability of website design practices due to the legislative parties, we simply include a dummy party variable in the statistical model. Including this dummy variable is equivalent (in the limit as sample size within both parties increase) to modeling the social network dependence within parties.Note that the presence or absence of a party effect does not imply the presence or absence of party effects of within-party diffusion. For example, if some website feature diffuses within both parties equally, the effect of party would appear to be zero.

[6]One could imagine creating an adjacency matrix where the off diagonal cells equal one if the row and column member are in the same party, and a zero if not, and substituting this matrix for, say, the state adjacency matrix. Since networks partition the chamber into two distinct sets of members, the random effect variable $s_i$ at the limit (as the number of members increases in size) will only take on two values, equal to the propensity of all party members to have the item or feature. This random effect then is perfectly collinear with the party variable. Modeling the party using an indicator variable, as we do, or as a social network yield identical results (although on a different scale).

# 3 Identifying the Causal Effect of Spatially-Defined Networks

The major inferential issue in testing hypotheses about diffusion among geographically-proximate units involves distinguishing a diffusion process from mere spatial heterogeneity, where omitted confounding variables exist that are correlated with spatial network patterns (Congdon 2003, 274; Lazer 2001). If the websites of the members of a state delegation are all likely to have a given characteristic, and websites in another state are unlikely to, we wish to be able to test whether this correlation is due to a causal diffusion process, or due to a spurious dependence where many members of a state delegation may happen to share an unobserved causal variable.

Using conditional autoregressive (CAR) models (Congdon, 2003, 278-282), we are able to control for spatial heterogeneity by exploiting data from several members whose congressional districts are adjacent to each other. If spatially confounding variables exist, they would most likely be evident in these localized networks, since adjacent congressional districts share more similarities than districts in opposite ends of a state. For example, the California $45^{th}$ district (including the desert cities of Palm Springs and Indio) shares more similarities with the Arizona $7^{th}$ district (parts of Yuma, Maricopa and Pima desert counties) than with the California $6^{th}$ district (wine country, Marin and Sonoma counties). Evidence is lent in support of the causal effect of state delegation networks on diffusion if members' web design practices are observed to be dependent within networks defined by state delegation after having controlled for district-level spatial heterogeneity.

One can see the logic of this approach to controlling for unobserved local level confounding variables in figure 1. This figure takes congressional district $D = \{6\}$ as the "subject" district (the estimator of course repeats the analysis for all 438 districts in the dataset). $D$ is in state X, and is directly adjacent to seven other districts: $O = \{3, 4, 5, 7\}$ also in state X, and $C = \{11, 13, 14\}$ that are in states Y and Z; $A = \{O \cup C\}$ is the full set of adjacent districts. The state delegation for state X is composed of districts $S = \{1, 2, \ldots, 9\}$, and

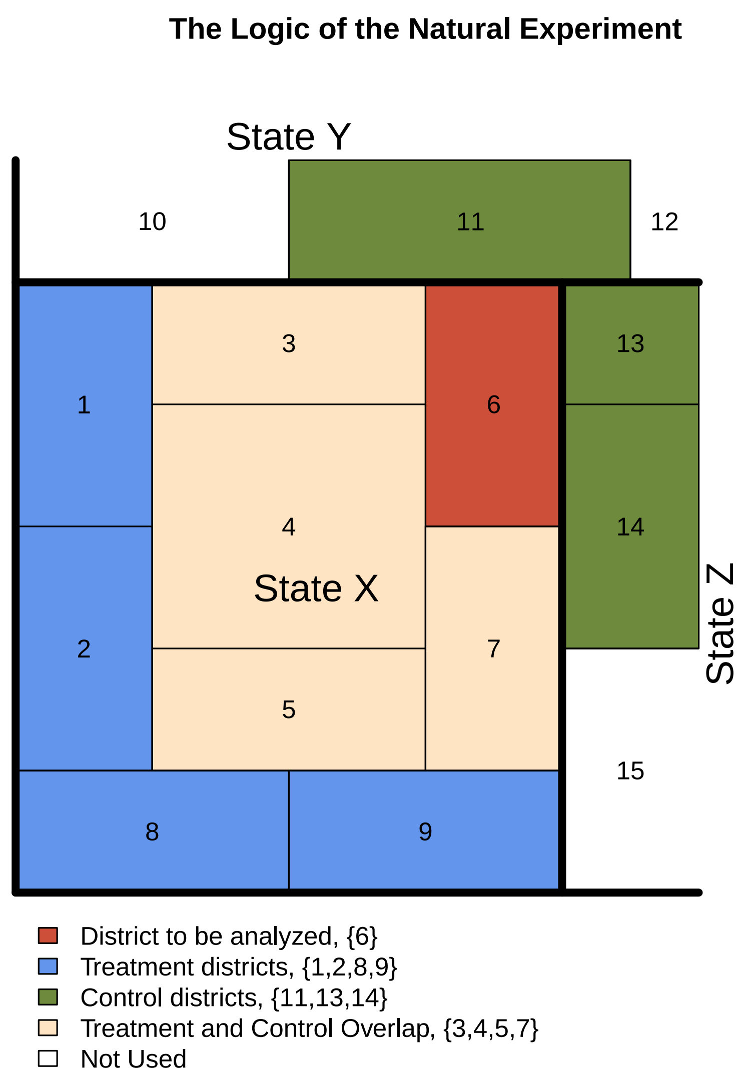


Figure 1: How the Model Conditions on District-Level Confounding Variables

in this delegation, only $T = \{1, 2, 8, 9\}$ are not adjacent to $D$. Assume that the adjacent districts $A$ have the most similar values on unobserved variables to $D$.[7]

The statistical estimator uses the outcome data from the districts in A to hold constant unobserved district-level variables, and at the same time, estimates the effect of being in set $S$. So for example, consider the effect of being in delegation $S$ on whether or not a member

[7] An analogy to an imaginary experimental design may help. The set $C \subset A$ serves as a true control group, analogous to a "pretreatment" condition, since these districts are not in $S$. The set $T = S/O$ is the exposure to the treatment, analogous to a "post treatment" condition. The set $O = \{A \cap S\}$ are only partial controls since in this region the treatment condition (being in the set $S$) and the control condition (being in set $A$) overlap.

chooses to have a blog on her official webpage. The model dynamically estimates 1) p($A$) equal to the average propensity of the districts in $A$ to have a blog on their web pages, 2) p($S$) equal to the average propensity of the districts in $S$ to have a blog on their web pages, and 3) holding p($A$) constant, the model estimates the effect of p($S$) on the propensity for $D$ to have a blog on her website.[8] One can think of this approach as similar to a random effect model, where the adjacent districts in $A$ serve as "repeated observations" for district $D$, and the districts in $S$ represent exposure to a causal variable of interest. The districts in $S$ and in $A$ necessarily have some overlap (their intersection is only null if there is only one congressional district in a state, since $T = O = \emptyset$); the greater the overlap the fewer districts in $T$, and hence the more conservative is the random effect estimate for the causal effect of interest. Thus, the model gets the most purchase from districts that lie on a state border. (294 out of 438 districts lie on a border, or about 67 percent of districts).

The persuasiveness of this quasi-experimental approach depends on the ignorability of state boundaries for unobserved spatially distributed confounding variables. Ignorability requires that the conditional distributions of any unobserved causal variables across districts that are geographically proximate, but on either side of the state line, are similar. For example, this assumption holds that residents in Calumet City, Illinois (IL-2, in southeast Chicago), are similar to those who live in nearby Gary, Indiana (IN-1), and members that serve in each each of these districts share similar qualities. One would also expect that each of these will differ demographically and politically from those in New Albany, Indiana (IN-9, near Louisville).

We can test for the ignorability of state boundaries using aggregate district level census data. If state borders are ignorable, then variables constructed from aggregate census data should be balanced between districts that are on either side of the state border, among those that are adjacent to a district that lies on a border. That is, census data should be balanced between the districts in $O$ and $C$ across all border congressional districts. At the

[8] As we describe below, p($A$) and p($S$) are the posterior distribution of these propensities, and so the model accounts for the full distributions of each, not simply their point estimates.

same time, one would not expect census data to be balanced between districts in $C$ and those in $T$. We test balance only among the 242 districts that lie adjacent to a border and that are in a state large enough to have districts that are within the state but not adjacent (55 percent of districts in the sample meet these conditions). For covariates we use current census data on district median income; the percent of the district residents that are college educated; in the service employment sector; the blue collar sector; the white collar sector; under 18; over 64; Black; and the percent voting for Kerry in the 2004 general election. In addition, the attributes of the members from these districts also should be ignorable. For the member attribute variables, we use the number of terms each has served, and the first and second dimension `DW-Nominate` score (see `www.voteview.com`). Using the omnibus balance test statistic of Hansen and Bowers 2008, we cannot reject the hypothesis of balance between $O$ and $C$ ($p = 0.307$), but we can reject the hypothesis of balance between $C$ and $T$ ($p < 0.0001$). That the districts are balanced at the local level justifies using adjacent districts as "repeated observations" in a random effect model, as a method to hold constant district-level unobservable variables, and so to identify the causal effect of the networks themselves.

# 4 Data

Within the U.S. House of Representatives, congressional offices are 440 (including nonvoting delegates) small, functionally identical, public organizations with a set of policy and procedural outputs (Hedlund, 1984; Salisbury and Shepsle, 1981). This enables a large $N$ statistical study of innovation adoption. Web technology was changing rapidly in this time period, and so we do not offer this analysis as a journalistic account of contemporary web practices. Instead, we argue that examining the dynamics of web practices is useful as a case study of how legislators adapt to technology at a time when the objective technology itself is in flux (Bimber, 2003, 8).

In this section we describe our measures of website design features, how we created the district adjacency and state delegation matrices, and control variables (Druckman et al., 2007; Esterling, Lazer, and Neblo, 2005) that may be important drivers of website quality.

## 4.1 Outcome variables

The dependent variables we use for this analysis are drawn from the 2006 and 2007 Congressional Management Foundation (CMF) coding of the official web site for each member of Congress. In the summers of 2006 and 2007, CMF coded each official website based on nearly 100 operational criteria. CMF trained teams of coders, who accessed and coded each official website based on nearly 100 operational criteria (see Druckman et al., 2007; Johnson, 2004; Owen, Davis, and Strickler, 1999; Stromer-Galley, 2000). CMF identified and defined the criteria using a number of sources regarding best practice standards for legislative websites, specifically by asking focus groups of citizens to spend time on a sample of sites, interviews and surveys with office staff and citizens, and by conducting web industry research (Burden and Hysom, 2007; Owen et al., 1999).

The descriptive statistics for the coded variables are listed in table 1, separately for the 2006 and 2007 panels. The coding for the 21 variables we use for this study, and the instructions given to the coders, are listed in appendix table 4. The appendix also reports on our analysis of intercoder reliability and the validity of the coding rules.

The dataset includes four items that measure the quality of issue information on each site. These are coder ratings of the quality of information regarding national issues, state and local issues, and issues of special importance to the member; and the presence of rationales that help explain the member's voting decisions.

We use seven items to measure the overall quality of constituency services on the website. These include coders' rating of the quality of casework FAQ answers, the presence of information on how to initiate casework with the member's office, whether the website includes an online casework initiation form, and the presence of links to federal agencies

Table 1: Descriptive Statistics

| | 2006 | | 2007 | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| National Issues | 0.46 | 0.50 | 0.44 | 0.50 |
| Member's Issues | 0.53 | 0.50 | 0.52 | 0.50 |
| State/Local Issues | 0.37 | 0.48 | 0.40 | 0.49 |
| Vote Rationales | 0.59 | 0.49 | 0.76 | 0.43 |
| Casework FAQs | 0.49 | 0.50 | 0.59 | 0.49 |
| Casework Initiation | 0.48 | 0.50 | 0.61 | 0.49 |
| Casework Form | 0.68 | 0.47 | 0.74 | 0.44 |
| Agency Links | 0.51 | 0.50 | 0.65 | 0.48 |
| Link to FirstGov | 0.45 | 0.50 | 0.53 | 0.50 |
| Grant Info | 0.79 | 0.40 | 0.85 | 0.36 |
| Info about District Resources | 0.33 | 0.47 | 0.25 | 0.43 |
| Video | 0.36 | 0.48 | 0.54 | 0.50 |
| Audio | 0.16 | 0.37 | 0.20 | 0.40 |
| Text Only | 0.07 | 0.26 | 0.05 | 0.21 |
| Blog | 0.05 | 0.22 | 0.11 | 0.31 |
| RSS Feed | 0.10 | 0.29 | 0.24 | 0.43 |
| Podcast | 0.04 | 0.20 | 0.07 | 0.26 |
| Navigation[†] | 3.50 | 0.88 | 3.37 | 0.92 |
| Readability[†] | 3.20 | 0.83 | 3.35 | 0.88 |
| Timeliness[†] | 3.14 | 0.91 | 2.81 | 1.01 |

[†]These items are subjective coder ratings, on a 0 to 5 scale.
See table 4 (appendix) for specifics on each item.
Number of incumbents in 2006 = 439; Number of returning incumbents in 2007 = 385.

and to FirstGov.gov (now `www.usa.gov`), and information about local district resources and services.

For items measuring the technical quality of each website, we include measures of whether or not the site contains video, audio, has a text only option, a blog, an RSS feed, and podcast capabilities. The final three items measure general technical properties of the website design, its navigability, its readability, its organization, and its timeliness, each measured on a five point scale.

## 4.2 Network Adjacency Data

We expect that the diffusion of the quality of members' websites will depend to some extent on informal social communication within the Congress. Following the discussion above, in this paper we measure informal networks by memberships in state delegations. To construct this network variable, we constructed a matrix with rows representing members, columns with labels identical to the rows, cells $[i, j]$ equal to one if members in row $i$ and column $j$ are in the same state, and cells equal to zero if members $i$ and $j$ are in different states.[9] The diagonal of this matrix is a zero vector. Our random effect model also requires a matrix of district adjacencies. This matrix is similar to the state delegation matrix, with the exception that the cells are equal to one if two members' districts are adjacent, and zero otherwise.[10]

For the spatial statistical models we describe below, it is possible for the precision of estimated correlation parameters to be a function of the average density of the adjacency matrix, where the average density is the total number of ones divided by the number of matrix cells. The average density of the state delegation adjacency matrix is 0.042, while the average density of the district adjacency matrix is 0.023. To test the robustness of our results below to variation in network density, we constructed a supplemented district adjacency matrix that equals one if two districts are either adjacent to each other or are within one district of each other (i.e., on a two step path). The average density of this supplemented district adjacency matrix is 0.064. Thus the two district adjacency matrices create density bounds below and above the state delegation density. In the models below, we

[9]The model requires each member to be connected to at least one other member, to avoid dividing by zero. To accommodate this, we assign the few members from states with a single congressional district to an adjacent state that is most similar. It is worth noting that the USGS data from which the district adjacencies are constructed include non-voting delegates from D.C., Puerto Rico and the Virgin Islands, but for some reason not the ones from Guam and American Samoa. Thus, our effective sample is 438 (435 regular members plus three non-voting delegates).

[10]Generating the matrix of district adjacencies takes some doing. We downloaded the GIS shapefile of congressional districts for the $109^{th}$ Congress from the USGS National Atlas website. Unfortunately, this shape file does not represent districts, but instead represents smaller polygons that, when aggregated, reconstruct a congressional district, and obviously adjacencies among these polygons are not of any use for this analysis. Aggregating the data up to the district level turned out to be a very complex task, requiring over a hundred lines of `R` code. The `R` script to do this is available from the authors on request.

find little difference in the estimates (or their precision) for district adjacency across these two distance measures, so below to simplify the discussion we only present the results on the former, single-step adjacency matrix.

For comparison, we also estimate the model below substituting an adjacency matrix constructed from cosponsorship data (Fowler, 2006). The labels of the cosponsorship matrix are identical to those of the district and state delegation matrices, with zero on the diagonal, and off diagonal elements of the $i^{th}$ row equal to one if member $i$ and member $j$ were frequent cosponsors, where "frequent" is more than one standard deviation above the mean number of $i$'s cosponsorships with all members. We also estimate the model substituting an adjacency matrix where the off diagonal elements are one if member $i$ and member $j$ are close to each other in `DW-Nominate` space (`http:\www.voteview.com`). We define two members as "close" in `DW-Nominate` space by first squaring the deviation between member $i$ and all other members, and then selecting the subset members that are in the lowest 12.5 percentile in distance from member $i$.[11]

## 4.3 Control variables

We hold constant two variables that previous work (e.g., Esterling et al., 2005) found to have an effect on the quality of legislative websites. Members who have longer terms in office tend to make less effective use of website technology.[12] To control for this, we include a measure that equals one if the member is a *Freshmen* in 2006 and zero otherwise (mean 0.096, standard deviation 0.295). In addition, the institutional context within Congress also can create advantages and disadvantages for members to undertake new initiatives. We control for the member's political party by including a variable that equals one if the member is a

[11]We chose the 12.5 percentile as this kept the density of this adjacency matrix similar to that of the other adjacency matrices.

[12]Members gain greater electoral security with longer tenure in office due to the well-known incumbent advantages (Jacobson, 1987, 26). Members with longer tenures in office have fewer incentives to seek out innovative ways to interact with constituents through their websites than those with shorter tenures. Members with longer tenures also are more likely to have well-established ways of communicating with constituents (Arnold, 2004) and thus are unlikely to place much effort in this new form of legislative communication.

*Republican* (the majority party in 2006) and zero otherwise (mean 0.533, standard deviation 0.499).

## 5 Estimation

We hypothesize that a member's use of website design features depends on the propensity of other members in her state delegation to also adopt those features, and these other members themselves are in the same estimation sample. Because of this stochastic dependence among members' websites, using ordinary probit to examine the relationship between a member's adoption practices and the average of the outcomes of the individuals that person interacts with would result in an estimate of social influence that would be biased upwards. The statistical literature on geographically connected processes has devised techniques to study spatial inter-dependencies in a way that appropriately accounts for these reciprocal effects (Anselin, 1988; Cliff and Ord, 1981; Doreian, 1980). For this paper we estimate network dependence with a conditionally autoregressive (CAR) model (Congdon, 2003, chapter 7) using Bayesian MCMC sampling to simulate a posterior distribution of all model parameters. The basic model is:

$$\left.\begin{array}{rcl}
O_i & \sim & \text{Categorical}(p_{i,1\ldots5}) \\
p_{i,1} & = & 1 - q_{i,1} \\
p_{i,2} & = & q_{i,1} - q_{i,2} \\
p_{i,3} & = & q_{i,2} - q_{i,3} \\
p_{i,4} & = & q_{i,3} - q_{i,4} \\
p_{i,5} & = & q_{i,4} \\
\text{logit}(q_{i,1}) & = & b_1 \cdot Freshman_{1,i} + b_2 \cdot Republican_{2,i} + a_i + s_i - \kappa_1 \\
\text{logit}(q_{i,2}) & = & b_1 \cdot Freshman_{1,i} + b_2 \cdot Republican_{2,i} + a_i + s_i - \kappa_2 \\
\text{logit}(q_{i,3}) & = & b_1 \cdot Freshman_{1,i} + b_2 \cdot Republican_{2,i} + a_i + s_i - \kappa_3 \\
\text{logit}(q_{i,4}) & = & b_1 \cdot Freshman_{1,i} + b_2 \cdot Republican_{2,i} + a_i + s_i - \kappa_4 \\
a_i & \sim & \phi(\overline{a}_i, 1) \\
\overline{a}_i & = & \rho_a \cdot \sum_{k=1}^{N_{ai}} (\text{Wa}_{ik})/(N_{ai}) \\
\text{Wa}_{ik} & \in & \{a_j : \text{j is adjacent to i}\} \\
N_{ai} & = & \#\{a_j : \text{j has an adjacent district to i}\} \\
s_i & \sim & \phi(\overline{s}_i, 1) \\
\overline{s}_i & = & \rho_s \cdot \sum_{k=1}^{N_s i} (\text{Ws}_{ik})/(N_{si}) \\
\text{Ws}_{ik} & \in & \left\{O'_j : \text{j is in the same state delegation as i}\right\} \\
N_{si} & = & \#\{s_j : \text{j is in the same state delegation as i}\}
\end{array}\right\} 1 \leq i \leq N$$

$$\begin{array}{rcl}
\rho_a & \sim & \text{Uniform}(0, 1) \\
\rho_s & \sim & \text{Uniform}(-100, 100) \\
b_1 & \sim & \phi(0.0, 1.0\text{E-}5) \\
b_2 & \sim & \phi(0.0, 1.0\text{E-}5) \\
\kappa_1 & \sim & \phi(-1, 0.1)C(-5, k_2) \\
\kappa_2 & \sim & \phi(\text{-}0.5, 0.1)C(k_1, k_3) \\
\kappa_3 & \sim & \phi(0.5, 0.1)C(k_2, k_4) \\
\kappa_4 & \sim & \phi(1, 0.1)C(k_3, 5)
\end{array}$$

We estimate the model separately for each dependent variable, $O_i$, listed in table 1. The set of equations contained within the outermost bracket give the model likelihood for a five category ordered dependent variable; the dichotomous outcome variables are also ordered so for these items we use the same equation but estimate only one threshold. The conditional probability of each outcome is taken to be a function of the two fixed effect control variables, *Term* and *Republican*, their estimated coefficients, **b**, a category-specific threshold $\kappa_j$, and the two random intercepts, $a_i$ and $s_i$.

In the model, $a_i$ is a random effect that captures local-level unobservables, and $s_i$ is a random effect that captures dependence in each outcome variable among members of a state delegation holding $a_i$ constant. Inference for the social network effects are based on the parameter $\rho_s$, which is given a diffuse prior;[13] $\rho_s$ is the effect of a change in the propensity of a member's website to have a design feature ($O_i$) associated with the propensity of the websites of those that are in the member's state delegation to have the feature or characteristic. Because we control for district level heterogeneity via $a_i$, $\rho_s$ captures the causal dependence among the websites of members within a state delegation. The random intercept $a_i$ is assumed to have a normal prior, with mean a function of the random intercepts of the member's district adjacency set (this is known as a CAR prior, Congdon (see 2003, chapter 7)). The random intercept $s_i$ is assumed to have a normal prior, with mean a function of the outcomes ($O_i'$) of the member's state delegation.

We estimate this model in four ways.

1. Assuming the relevant state delegation network for member $i$ contains all other members in her state.

2. Assuming that the relevant state delegation network for member $i$ contains only other members in her state that are of the same party, or same state copartisans. For the few members with no copartisans in the state, we assume that the full state delegation is the relevant network.

3. Substituting the adjacency matrix constructed from cosponsorship data (described above) for the state adjacnecy matrix. For this model, we omit $a_i$ from the outcome equation. If $\rho_s$ in this model is positive, we cannot distinguish between a causal diffusion within the cosponsorships network and latent dependence due to omitted local level variables. If $\rho_s$ is not positive, then we can conclude there is no evidence of dependence, causal or otherwise, within cosponsorship networks.[14]

4. Using the same models as in 3, but this time substituting the `DW-Nominate` adjacency

[13]We use a uniform on [-100,100] distribution for the prior. We constrain the prior for $\rho_a$ to be positive and informative, uniform on [0,1], to ensure it captures local level dependence.

[14]To improve convergence, we use an informative uniform on [-1,1] prior. This should have no effect on the results since we only care about the existence of dependence in these models, not the magnitude.

matrix. The same caveats regarding causality apply to this model that apply to model 3, above.

We estimate all four of these models first assuming cross sectional dependence, modeling member $i$'s propensity to have the website feature in the 2006 data as a function of other members' propensity to have the same feature in 2006; $O_i = O_i^{2006}$ and $O'_j = O_j^{2006}$. We then consider over time dependence, modeling member $i$'s propensity to have the feature in 2007 as a function of other members' propensity to have the feature in 2006; $O_i = O_i^{2007}$ and $O'_j = O_j^{2006}$. An election intervened between the 2006 and 2007 panels. We set the 2007 outcomes of 2006 incumbents who did not return in 2007 to missing, and impute their 2007 outcomes under missing at random conditional on the fixed and random effect variables using the method of Tanner and Wong (1987).

For estimation, we use the MCMC Gibbs sampler in `WinBUGS` (Spiegelhalter, Thomas, Best, and Gilks, 1996). We assume diffuse priors for **b** to minimize the influence of the prior parameter distributions on the posteriors. We sample three chains and initialize each chain with overdispersed starting values. The chains show extremely good mixing using the Brooks-Gelman-Rubin diagnostic (Gelman and Rubin, 1992). Below we present summaries of the marginal posterior distributions of the model parameters.

# 6 Findings

One advantage of Bayesian estimation is that the results are reported in full marginal distributions, rather than as summaries of distributions in the form of point estimates and standard errors. Thus, one can evaluate the significance of parameter estimates by comparing their posterior distributions without relying on strict (frequentist) hypothesis tests. The results for models for the cross sectional (2006) analysis are in table 2. The cell entries indicate the probability of dependence for each outcome variable among members of a state delegation, holding constant local level unobserved variables. That is, each cell gives the density of the posterior probability distribution of the $\hat{\rho}$ parameter that lies above zero.

The bottom row of table 2 indicates the number of items that have at least a 90 percent probability of dependence within each network. Notice that by this criteria, dependence is most likely within the same state network (dependence for nine items), and this dependence is not amplified when the state delegation is restricted only to co-partisans (dependence for only five items). There appears to be dependence within state delegations among a wide range of items, including those measuring issue representation (material on iational issues, The member's priority issues, and her vote rationales), constituent needs (help with casework initiation) and the technical qualities of the websites themselves (audio, a text only feature), and the general technical qualities of websites (navigability, readability, and timeliness).

Figure 2 depicts the magnitude of the diffusion effects for six of the items for which diffusion was present in 2006. The dark line in each graph shows how the estimated change in probability that member $i$ adopts a design element changes as the proportion of her state delegation who also adopt that element increases (the light lines are random draws of parameter sets from the full posterior distribution and hence depict the uncertainty for each conditional probability, similar to a confidence interval). The "rug" in each figure shows the actual range of the proportion across state delegations, so estimates beyond the rug are out of sample.

The top four graphs in figure 2 indicate diffusion effects for quality of website content such as issue positions, vote rationales, and casework FAQs. For these measures, a one indicates the website was judged by the coder as having good quality and specific content on each of the dimensions. The probability of a member has high quality content when everyone else in the state had low quality content ranges from about 0.2 to about 0.4. For the national issues, member's issues and casework FAQs items, the actual proportion of the state delegations with high quality content varies from zero to one (or, close to one). Varying this proportion increases the propensity to have good quality national issue content by about 60 percent, member's issues by about 20 percent, and casework FAQs by about 40 percent, where each

Table 2: Probability of Diffusion in State Delegations, 2006 Cross Sectional Analysis

| | Same State | Same State Copartisan | Cosponsorship Network | Ideological Proximity |
|---|---|---|---|---|
| National Issues | 0.999* | 1.00* | 0.655 | 0.138 |
| Member's Issues | 0.943* | 0.925* | 0.394 | 0.396 |
| State/Local Issues | 0.003 | 0.009 | 0.391 | 0.406 |
| Vote Rationale | 0.981* | 0.581 | 0.557 | 0.435 |
| Constituent FAQs | 0.058 | 0.870 | 0.387 | 0.376 |
| Casework Initiation | 0.991* | 0.549 | 0.366 | 0.165 |
| Casework Form | 0.013 | 0.305 | 0.532 | 0.682 |
| Agency Links | 0.002 | 0.011 | 0.298 | 0.543 |
| Link to FirstGov | 0.113 | 0.048 | 0.196 | 0.330 |
| Grant Info | 0.811 | 0.715 | 0.466 | 0.843 |
| Info on District Resources | 0.081 | 0.863 | 0.287 | 0.397 |
| Video | 0.010 | 0.543 | 0.645 | 0.838 |
| Audio | 0.915* | 0.959* | 0.754 | 0.627 |
| Text Only | 0.933* | 0.519 | 0.492 | 0.471 |
| Blog | 0.740 | 0.142 | 0.517 | 0.503 |
| RSS Feed | 0.065 | 0.288 | 0.518 | 0.717 |
| Podcast | 0.531 | 0.350 | 0.508 | 0.573 |
| Navigation | 0.986* | 0.902* | 0.561 | 0.135 |
| Readability | 0.930* | 0.826 | 0.372 | 0.375 |
| Timeliness | 0.953* | 0.904* | 0.544 | 0.277 |
| Number of items $p > 0.75$ | 10 | 8 | 1 | 2 |
| Number of items $p > 0.90$ | 9 | 5 | 0 | 0 |

$N = 438$, $^*p(\widehat{\rho_s} > 0) > 0.90$

of these differences is statistically significant. In the sample, only about half of the state delegations had vote rationale content on their websites, but extrapolating outside of the sample indicates the diffusion effect is about the same magnitude as for the other content items.

The bottom two graphs depict two elements of website technology that show positive diffusion. In contrast, to the four content items, the probability that a member has audio or text only technology on their websites if no one else in their delegation has the technology is essentially zero. The range of the actual proportion of state delegation who also adopt these technologies varies only from zero to about half. Within this range, the propensity for a member to adopt one of these communication technologies increases, but only imperceptibly.[15] In comparing these to the first four graphs, it is apparent that most of the diffusion within state delegations centers on content rather than on the underlying communication technology of the website.

Returning to table 2, the entries in the second column indicate that dependence within the state delegation does not seem to be heavily conditioned on partisanship. The probability of diffusion is constant whether or not one takes into account partisanship within the delegation. This finding is consistent with Truman (1956, 1034) who notes that partisan divides are relatively absent in discussions among members of a state delegation. In addition, it is likely staff, rather than a member, who actually develop and support the website, and it may be that staff are less partisan-driven than members, at least when interacting with staff from the same state.

No dependence is evident within the cosponsorship network or within the network defined by ideological proximity. The second to last row indicates this pattern does not change when one relaxes the criteria to only a 75 percent probability. These findings suggest that most of the social influence within the institution is within state delegations as a whole, perhaps as true today as it was in the time of (Truman, 1956). That geographic state delegation networks appear to matter more than DC-based legislative networks such as copsonsorship or ideological distance is perhaps to be expected. The main purpose of the website is for the member to represent herself to her constituents, and representation in the U.S. Congress is geographic based rather than issue or ideologically based.

Table 3 gives the results for the over time (2006 to 2007) analysis. Notice that the results change very little from table 2. This indicates that diffusion within state delegations does not have a strong lag. Indeed, much of the dependence in the over time analysis is likely due to the path dependence within individual sites. Once a website adopts a given feature, it is unlikely to remove that feature.

[15] The $\rho_s$ parameter in each case is statistically signficant, but only because the impact of state delegation is only to move a member from a zero probability to something slightly larger than zero.

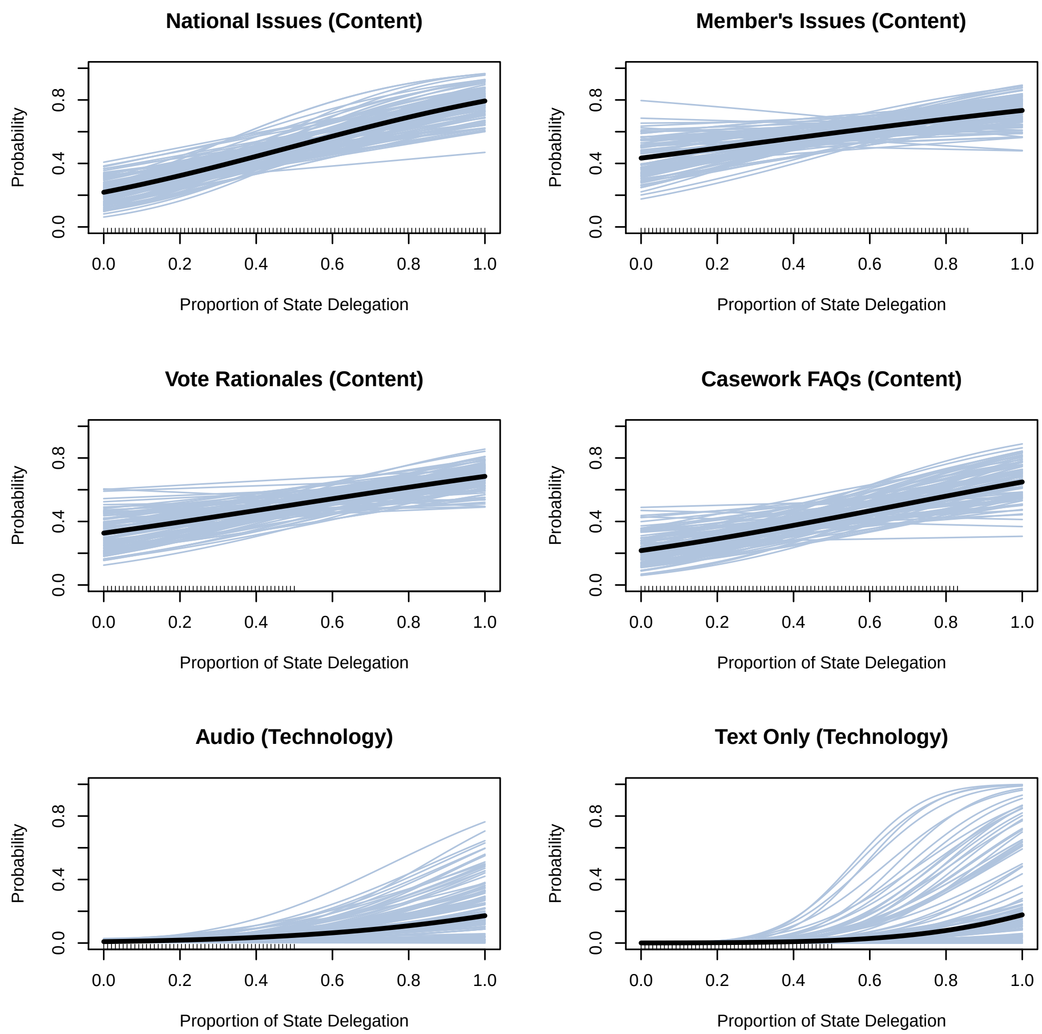


Figure 2: Diffusion Effects

The dark line shows the expected probability that a given member's website will have the design feature, conditional on the proportion of her state delegation that also has the feature. The light lines give the range of uncertainty for these estimates. The rug on the domain axis indicates in-sample variation for each item.

Table 3: Probability of Diffusion in State Delegations, 2006 to 2007 Over Time Analysis

| | Same State | Same State Copartisan | Cosponsorship Network | Ideological Proximity |
|---|---|---|---|---|
| National Issues | 0.997* | 1.00* | 0.570 | 0.267 |
| Member's Issues | 0.975* | 0.980* | 0.498 | 0.502 |
| State/Local Issues | 0.435 | 0.189 | 0.357 | 0.330 |
| Vote Rationale | 0.800 | 0.762 | 0.378 | 0.623 |
| Constituent FAQs | 0.764 | 0.994* | 0.383 | 0.391 |
| Casework Initiation | 0.774 | 0.724 | 0.496 | 0.385 |
| Casework Form | 0.282 | 0.556 | 0.480 | 0.769 |
| Agency Links | 0.961* | 0.890 | 0.451 | 0.362 |
| Link to FirstGov | 0.851 | 0.165 | 0.486 | 0.609 |
| Grant Info | 0.832 | 0.468 | 0.455 | 0.679 |
| Info on District Resources | 0.917* | 0.835 | 0.516 | 0.451 |
| Video | 0.100 | 0.749 | 0.696 | 0.665 |
| Audio | 0.637 | 0.939* | 0.553 | 0.676 |
| Text Only | 0.987* | 0.715 | 0.491 | 0.458 |
| Blog | 0.986* | 0.825 | 0.573 | 0.556 |
| RSS Feed | 0.073 | 0.459 | 0.557 | 0.531 |
| Podcast | 0.752 | 0.771 | 0.424 | 0.540 |
| Navigation | 0.960* | 0.821 | 0.359 | 0.374 |
| Readability | 0.531 | 0.813 | 0.426 | 0.215 |
| Timeliness | 0.693 | 0.666 | 0.739 | 0.741 |
| Number of items $p > 0.75$ | 12 | 12 | 0 | 2 |
| Number of items $p > 0.90$ | 7 | 4 | 0 | 0 |

$N = 438$, $^{*}p(\widehat{\rho}_s > 0) > 0.90$

Recall that $\rho_a$ captures any dependence that may occur among adjacent congressional districts. If we observe dependence at this level, the model cannot distinguish dependence that might come from causal diffusion processes among the offices in adjacent districts, and a spurious dependence that might come from unobserved confounding variables that vary geographically. The absence of dependence at this level, however, indicated by a $\widehat{\rho}_a$ with probability mass near zero, can rule out diffusion as well as the presence of any district level variables that determine the content or quality of websites. We find little to no evidence of dependence at the district level. For example, in the 2006 cross section, out of the 21 regressions of the first column of table 2, none of the $\widehat{\rho}_a$ parameters have a greater than 90 percent chance of exceeding the mean of the prior distribution (0.5), and only three have greater than a 75 percent greater than the prior mean (only the items: casework form, link to FirstGov, and Video), or what one would expect to observe simply from random variation.

These findings regarding local-level dependence reinforce those from other studies that find relatively few district-level *observed* variables that are predictive of website quality (Adler, Gent, and Overmeyer 1998, 591; Cooper 2004, 352; Druckman et al. 2007; Druckman et al. 2009, 17; Ferber, Foltz, and Pugliese 2005, 147). The lack of all dependence at this level demonstrates the absence of *unobserved* causal variables. This independence is not especially surprising. Citizens in all districts, whether agricultural or industrial, rich or poor, liberal or conservative, care about maintaining accountability, and make demands for member services. The results show that all members face uniform incentives driving the quality of websites, and any variation in website quality (as well as responsiveness to social network diffusion) is likely idiosyncratic in the member's own interest in web technology, along with exposure to such idiosyncrasies in her state delegation.

Finally, the model also includes a fixed effect dummy variable, equal to one if the member is a Republican and zero otherwise. Descriptively, we find that Republicans are more likely to have a number of the items on their website, including a rationale for their votes, constituent FAQs, a casework form, audio, and a text only feature. Democrats did not have a statistically higher propensity on any of the items. There are any of a number of reasons for this difference between the parties. One set of explanations focus on parties as formal organizations, including a stronger interest among the party leaders in the quality of rank and file websites (Adler et al., 1998, 586), or a difference in the propensity of Republicans and Democrats to take an interest in electronic representation, or the effect of minority party status. Alternatively, one could consider parties to be themselves informal social networks, networks in which web design practices may diffuse. And indeed, as we show in section 2, the offices themselves are most likely to name same-party websites as "especially good."

The model cannot distinguish explanations based on parties as organizations from parties as social networks, however, for reasons we discuss in footnote 6. We are able to test whether the extent of diffusion within state delegations differs between the two parties. To test this, we re-estimate the model of column one of table 2, changing the likelihood function slightly so that $\rho_s$ is estimated separately for each party.[16] We find only only one (out of 21) of the difference in the $\rho$ parameters for each party were significantly different, or about what one would expect by chance. In addition, the point estimates for the $\rho$ parameter for each party show no consistent pattern, sometimes $\hat{\rho}$ is higher for Democrats, and sometimes for Republicans.

Overall, we find little support for *differential* party effects, either parties as organizations or parties that organize informal communication among members. Such a finding does not rule out the presence of within-party diffusion, and indeed, as we note in our descriptive analyses in section 2, the offices themselves suggest otherwise. Instead, we suspect that website design diffuses equally well within each political party.

The outcome equation also includes a fixed effect variable indicating whether the member was a freshman in 2006. This variable also shows little explanatory power, and inconsistent results among the point estimates, with one set of exceptions. Freshmen websites were significantly more likely to be rated highly for navigability, readability, and timeliness. These three variables capture the coders' qualitative sense of the technical merits of a website. That freshmen are rated higher on these dimensions suggests that websites have a bit of a slicker design when they are recently created from scratch.

# 7 Discussion

The above analyses provide insight into the pathways of innovation within Congress. We find a significant possibility of diffusion within state delegations across a variety of measures of legislative website quality. At the same time, we find little evidence of diffusion in networks

[16] We modify the right hand side of the equation for $\bar{s}_i$ as $\rho_{s.repub} \cdot \sum_{k=1}^{N_s i}(\mathrm{Ws}_{ik})/(N_{si}) \times \textit{Republican} + \rho_{s.dem} \cdot \sum_{k=1}^{N_s i}(\mathrm{Ws}_{ik})/(N_{si}) \times (1 - \textit{Republican})$.

defined by substantive policy concerns, cosponsorship networks and networks defined by ideological proximity. In addition, we find that much of the diffusion is centered on website content, such as issue content and content focused on constituent casework, rather than the communication technology itself. That state delegation drives website content suggests that much of the motivation to develop and improve these legislative websites is driven by accountability in the electoral connection to local interests. At the same time, however, we do not detect any geographically distributed, district-level variables that drive website content. Instead, the quality of a legislative website appears to be idiosyncratic across members. Taken together, this suggests that the need for high quality content relevant to legislative accountability appears to be mostly a normative understanding among members in a state delegation, rather than a reflection of any variation among localities in demand for good quality websites. This cohesion in a "small group" is consistent with previous research on social network effects within state delegations (Deckard, 1972; Kessel, 1964; Padgett, 1990; Truman, 1956).

We find that the underlying communication technology for these websites, such as the presence of blogs, podcasts, RSS feeds, video and the like, is neither driven by district level variables nor by diffusion; we also observe low marginal levels of adoption of various technologies. That offices are not self-reflective regarding this technology suggests that website technology is a mere afterthought at best. That communication technology exists does not necessarily imply that legislators have the capacity or incentives to adopt them for democratic governance (as in Bimber, 2003; Druckman et al., 2007; Fountain, 2001).

# 8 Conclusion

These results that much of the communication regarding representation occur within state delegations, and this gives some insight into how Congress practices democratic representation. In addition, the results suggest the presence, to some degree, of deliberation among members on the design of the institution itself. To some extent, offices appear to be purposefully learning best practices regarding website content from each other.

Finally, we note that the methods used in this paper to net out the effects of local level unobservables are general, and could be applied to net out a wide range of confounding variables in any test of behavioral hypotheses in any district-based legislature. We show how to leverage spatial representation in a random effect framework for estimating causal effects, whenever adjacent districts can serve as repeated observations to control for local-level unobservables.

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# Appendices

## A Reliability

Because the data come from two different years, we must assess intercoder reliability both within each year as well as across the two years. There were a total of 8 coders involved in each year. Each CMF coder evaluated ten common web sites in each of the two years. Coders received extensive training and then evaluated all web sites in a randomized order, not knowing which ten web sites were the common web sites. The error rates within each year were very low across the items, ranging from as low as 8.2 percent to as high as 15.0 percent, when one would expect about a 50 percent error rate by chance. To assess over time reliability, two of the coders happened to participate in each year's coding effort. In the 2007 coding, we asked these two coders to code an additional ten websites that were archived from 2006. The error rates never exceeded 20 percent across the items. On only one item (out of over 100 items) did there appear to be a drift in the standard for evaluation between the two years, where both coders rated one item (vote rationales) slightly higher in 2006 than in 2007. Overall, the within year and over time reliability of these data appear to be good, reflecting the extensive training each coder received.

## B Validity

The analysis of dependence within state delegations helps to net out any spurious dependence among geographically-proximate units by holding constant local level variables (via a random effect). This method, however, cannot account for spurious dependence that arises from the coding process itself. In the data collection coders were randomly assigned to evaluate websites. Because of this, idiosyncratic biases of the coders could not drive the state-level dependence we observe in tables 2 and 3. But it is possible that all coders share some bias or biases in response to observable traits or characteristics of the websites. For example, it might not be hard to imagine a group of coders who have, say, (conscious or subconscious) predispositions that assume northeastern or west coast websites are more sophisticated than southern or midwestern websites. While these predisopositions should not affect the objective codes, such as the presence of certain types of links or audio, they could affect the subjective ratings of the quality of the issue content, the navigability, readability, and so on.

To address this, we developed a test for the presence of these biases. We first created three factors using objective codes for constituent interest content (constituent FAQs, help with casework initiation, a casework form, links to federal agencies, link to FirstGov.gov, grant information on district resources) to create one quality factor, and the objective codes for the technical features of the website (video, audio, text only, blog, rss feed, and podcast) to create another factor. We regressed these two factors, along with indicators for the member's gender and political party and Census region (NE, MW, S, W), on the more subjective measures: Navigation, Timeliness, and Readability. None out of 18 ($6 \times 3$) tests were significant for region; gender and political party were not significant at in any equation (although both came close to significance for timeliness).

We also regressed these factors and fixed variables on a factor constructed from the issue ratings (national issues, member's issues, state/local issues and vote rationales). In this latter test, there were slight differences by region in the rated quality of the website's issue content (the midwestern sites were rated as slightly lower than those in the northeast and the west), but this test is less indicative of bias in the codings, since there may indeed be differences in issue content among the regions even after netting out the constituent and technology factors. If biases were to appear in the issue content, it would most likely be due to the coder's own subjective disagreement with the content itself; Neither party nor gender were significant in the issue ratings equation, however.

Table 4: Item Coding Rules

| Item | Scale | Coding Rule |
|---|---|---|
| **Issue Factor Items** | | |
| National Issues | 1-5 | To what extent does the site provide information about major national issues (e.g. education, budget, taxes, defense/foreign affairs, healthcare, workforce, economy, energy, agriculture, transportation, trade, social security, medicare, etc.)? 1=National issues are only addressed through press releases in the press release section (if a site has a press release section, it will score at least a 1); 2=National issues are addressed through a sparse issues section (less than 5 national (versus Member or district/state) issues); 3=The issue section contains at least 5 national issues that are addressed through a paragraph or two of narrative OR through links to further information (i.e. press releases); 4=The issue section contains more than 5 national issues that are addressed through a paragraph or two of narrative or links to further information within the site (i.e. press releases); 5=The issues section contains at least 10 national issues addressed through informative narratives AND links to further information on and/or off the site. (Recoded: $1-3=0$; $4-5=1$) |
| Member's Issues | 0-1 | The site provides issue information or features (not links to features off the site, but information on the site) related to issues the Member is active on. To count as member issues, the issues must be highlighted in the biography and more information on the highlighted issues must be available in the issues/legislation section. If there is no issues section, there can not be Member's issues on the site. |
| State/Local Issues | 0-1 | The site provides issue information or features (not general interest, but issue-related) related to issues of specific interest to the district or state. If national issues are addressed at the local level, it does not count here. This is more for geniuinely local issues like highways or location-specific issues (Yucca mountain, national parks in district/state, road projects, etc.). |

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**Table 4 – continued from previous page**

| Item | Scale | Coding Rule |
|---|---|---|
| Vote Rationales | 0-5 | To what extent does the site provide information about why a Member voted a certain way on certain legislation? This information might be included in the issues section or as a separate section (or not at all). Press releases and e-newsletters do not count, unless they're featured on the home page, since we're looking for information that's easy to find and access online. It ONLY counts where there is reference to specific legislation (H.R. 1234 or a specific bill title), how the Member voted, AND the Members reasons for voting that way. Discussing bills the Member introduced does not count as vote rationale. 1=Vote rationales are addressed only through press releases or features on the home page; 2=Some of the issue sections/writeups contain vote rationales; 3=Most of the issues sections contain vote rationales; 4=All of the issues sections contain vote rationales; 5=All of the issues sections contain highlights of key votes and the Member's vote rationales. (Recoded: $0 = 0; 1 - 5 = 1$) |
| **Constituent Factor Items** | | |
| Answers to Casework FAQs | 0-5 | To what extent does the site help constituents understand what the office can do for them and how to get answers to their questions? (this does not have to be in the form of question and answer) 1=The only has a contact my office for assistance message; 2=In the services section, the site has a contact my office for assistance message and links to agency home pages or very basic information (a couple of sentances); 3=In the services section, the site provides limited guidance (e.g. a paragraph on types of cases the office handles); 4=In the services section, the site provides sections on more than four types of casework services (e.g. passports, social security, veterans benefits, business assistance, student loans, etc.) with extensive information and/or links to specific information on agency Web sites; 5=In the services section, the site provides sections on more than four types of casework services and incorporates links to specific agency pages and/or contact information INCLUDING information about local resources for assistance. (Recoded: $0 - 2 = 0; 3 - 5 = 1$) |

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| Item | Scale | Coding Rule |
|---|---|---|
| Guidance on Casework Initiation | 0-1 | The site clearly explains how and why a constituent can initiate a casework request. Needs to give constituents at least a bit of context about how the office can help, what casework is, and/or how to open a case. Just providing a form doesn't count. |
| Casework Form | 0-1 | The site provides a form (can be pdf) for constituents to fill out to initiate a casework request. The privacy release form is the same thing as a casework form. It will usually be provided in PDF because it requires a physical signature so the Member can get personal information about the case from the relevant agency. |
| Agency Links | 0-1 | The site provides links to agency Web sites in a section other than the constituent services section (e.g. a links or resources page). This is for links included in another section. If they are included in the casework section, it does not count for this. |
| Link to FirstGov | 0-1 | The site includs a link to FirstGov (the federal government portal). A link to FirstGov for kids does count. |
| Grant Info | 0-1 | The site provides information on how to get government grants. Student Loan info does not count. |
| Information about District Resources | 0-1 | In the services section, the site includes information about local resources for assistance (links in the the district/state section or a links page count only if they are to services, not towns, sports venues, educational institutions, etc.). Links must be to services – places where the constituent can get help. Best place is for this to be included in the casework section, but OK if it's included in district section, as long as it's to SERVICES. Links to state and local government only counts if it's to specific agencies, verus the governor's office, the state government portal, or municipal pages. |
| **Technology Factor Items** | | |

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| Item | Scale | Coding Rule |
|---|---|---|
| Video | 0-1 | The site provides video clips (welcome messages do not count – think substance (floor speeches, committee hearings, etc.) |
| Audio | 0-1 | The site provides audio clips (welcome messages do not count – think substance (floor speeches, committee hearings, etc.) |
| Text Only | 0-1 | The site allows option for a text-only screen for faster downloading |
| Blog | 0-1 | The site includes a blog (counts even if it's not a real blog that accepts comments) |
| RSS Feed | 0-1 | The site includes an RSS feed (sometimes hard to tell – when in doubt, don't include it) |
| Podcast | 0-1 | The site includes a podcast (audio updates automatically sent to subscribers) |
| Navigation | 1-5 | How easy is it to move about the site? Navigation is about movement through the site, and it includes link text but not information location. This is about the menus and links. Organization is about whether or not information is where you would expect it to be. 1=navigation is dependent on back button and home page (no navigation bar); 2=navigation links are confusing (language doesn't make it clear what you'll find), navigation options are so abundant that it's hard to find what you're looking for, navigation changes on every page and/or some of the main navigation links go off site or to pdf files; 3=navigation may be cluttered, but it's clear what you'll be getting at the other end; 4=it is easy to navigate through site and easy to understand what you'll get when you click on a link; 5=navigation is clear and easy, and the site provides additional navigation features on most pages (such as links within text (e.g. links to bill text are included on issue pages) or section or page-specific navigation tools that make navigation easier (e.g. breadcrumbs or links to additional related information)). (Recoded: $1-3=0$; $4-5=1$) |

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| Item | Scale | Coding Rule |
|---|---|---|
| Readability | 1-5 | How easy is it to read the content of the site? This is not about content, but about whether it's easy to scan pages, whether there are bullets, headers, and clear links; whether the contrast between the foreground and background makes the text legible; and whether there are short pages and paragraphs. A site where you have to read or scroll down ten screens on most pages is not that readable. 1=on most pages, the contrast between the text and the background or changing fonts and font sizes make the pages difficult to read; 2=on many pages, the sheer volume of information (e.g. really long text or really long lists of links) makes the pages difficult to read; 3=generally, the information on the site is easy to read; 4=generally, the information on the site is written for the Web, with short paragraphs, bullets, headings, internal links, etc. that makes it easy to read and scan through; 5=the information throughout the site is written for the Web (Recoded: $1-3=0$; $4-5=1$) |
| Organization | 1-5 | Organization is about whether or not information is where you would expect it to be or whether you have to hunt around for it. Movement through the site is navigation. How well is the site organized? 1=the site appears thrown together with no thought, rhyme, or reason; 2=some thought seemed to go into how the site was organized, but it is difficult to figure out the organization scheme and difficult to find the information you're looking for; 3=the site is organized well enough that you can usually find what you're looking for with only one or two false starts; 4=the site is organized well enough that you can usually find what you're looking for within three clicks (no false starts); 5=the site is organized well enough that you can usually find what you're looking for within three clicks AND you usually have access to additional information from other sections of the site (the site is cross-referenced) (Recoded: $1-3=0$; $4-5=1$) |

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| Item | Scale | Coding Rule |
|---|---|---|
| Timeliness | 1-5 | How up to date is the site? 1=everything on the site is clearly old, even press releases; 2=press releases are up to date (within the last month) and everything else is old; 3=press releases are up to date and everything else is too generic to tell the age; 4=press releases and issues are up to date (press within the last month and issues obviously from the 109th Congress); 5=everything is clearly up to date and it is clear that the office makes an effort to include timely information on the site (Recoded: $1-3=0$; $4-5=1$) |