2009

Expertise and Bias in Political Communication

T.K. Ahn
Korea University

Robert Huckfeldt
University of California - Davis, rhuckfeldt@ucdavis.edu

Alexander K. Mayer
University of California - Davis, akmayer@ucdavis.edu

John Barry Ryan
University of California - Davis, jbrryan@ucdavis.edu

Expertise and Bias in Political Communication

T.K. Ahn
Korea University

Robert Huckfeldt
University of California, Davis

Alexander K. Mayer
University of California, Davis

John Barry Ryan
University of California, Davis

ABSTRACT

Citizens minimize information costs by obtaining political information and guidance from other individuals who have assumed the costs of acquiring and processing political information. A problem occurs because ideal informants, characterized by the joint presence of political expertise and shared viewpoints, are often unavailable or rare within the groups where individuals are located. Hence, individuals must often look beyond their own group boundaries to find such individuals, but obtaining information from individuals located beyond their own groups produces additional information costs. Moreover, the availability of ideal informants varies across groups and settings, with the potential to produce (1) biases in favor of some groups at the expense of others, (2) varying levels of polarization among groups, and (3) context dependent patterns of informant centrality. The paper's analysis is based on a series of small group experiments, each of which involves two groups of seven subjects who communicate with one another via networked computers in order to obtain information on candidates. The aggregate implications of the experimental results are analyzed using an agent-based model.

Prepared for delivery at the Harvard Political Networks Conference, June 11-13, 2009.

A primary cost of political participation lies in the burdens associated with acquiring and processing political information. One way to minimize these costs is to obtain political guidance on the cheap, from other individuals who have assumed the costs of acquiring and processing the information. Hence, a central question in the analysis of political communication revolves around the criteria for selecting reliable sources of guidance. Downs (1957) argued that people looking for political informants should select experts who share their own political biases -- well informed individuals who share a common frame of reference.

A problem occurs because these ideal informants, characterized by the joint presence of political expertise and shared biases, may be unavailable or rare within some contexts, but inefficiently and redundantly abundant in others. Some individuals must often look beyond their own group boundaries to find such individuals, but obtaining information from individuals located beyond their own groups produces additional information costs. Individuals readily at hand -- people located in the same families, workplaces, churches, and so on -- often provide the most efficient sources of information. Other individuals are surrounded by high levels of expertise among informants who share their own political instincts – they have the luxury of ideal information sources who are readily available and close to home.

As a consequence, the centrality of participants within the political communication process is likely to vary both as a function of individual characteristics, as well as a function of the contexts where these individuals are located. In a setting where everyone is an expert, expertise is less likely to translate into a central role within the communication process. Alternatively, an expert who holds preferences that diverge from those of the group may be less central to the communication process than an individual who holds preferences that are dominant within the group.

Our paper explores the consequences of availability for the formation of political communication networks among cost conscious consumers of political information.
A primary purpose of this paper's analysis is to evaluate the importance of group membership as a constraint on the construction of communication networks. If individuals are located within groups where either expertise or shared preferences are rare, are they willing to pay the additional costs incurred by seeking out politically expert individuals who lie beyond the group? That is, are individuals able and willing to pay the additional information costs that allow them to escape the limitations of the information supply within their own groups? What are the implications for the centrality of political experts within communication networks? What are the implications for the formation of political communication networks, for the composition of information and preferences in the resulting networks, for levels of political polarization, for the diffusion of expertise, and for patterns of bias in political communication?

The analysis is based on a series of small group experiments, each of which involves two groups of seven subjects who communicate with one another via networked computers. The experiments involve two candidates, each of whom has a fixed position in a one-dimensional policy space. The goal of the experimental subjects is to cast a vote for the candidate who most closely matches their own predetermined positions on the same dimension, and subjects are rewarded with a cash incentive if the candidate closest to them wins the election. Information comes to the subjects in three different forms: publicly available information that is free but of

low quality; privately acquired information that may cost more but is of higher quality; and socially communicated information taken from other individuals. Individuals are able to obtain information from as many as two other subjects, but the information obtained from individuals within their own group is free, while information obtained from the other group is more costly. This analytic framework will provide an opportunity to examine the construction of social networks within and beyond the group boundaries.

Experts and Biases

An enduring problem lies at the heart of this analysis – the alternative and often competing criteria that individuals might employ in selecting political informants. In his *Economic Theory of Democracy*, Anthony Downs (1957) argues that socially communicated information provides a labor saving device that citizens might productively use to minimize information costs. Rather than collecting, processing, and evaluating political information themselves, individuals might employ free information taken from other individuals -- individuals who enjoy politics and receive a personal benefit from the process of becoming informed (Fiorina 1990). He argues that rational, goal oriented information seekers should select politically expert individuals who share their own political biases.

This paper considers several problems related to the Downsian recommendation. First, the relative salience of political expertise and shared biases between the informant and the recipient of information takes on importance because it may be difficult to locate expert informants who hold congenial viewpoints. A number of observational efforts have shown that the presence or absence of shared political preferences among and between citizens is a less than perfect predictor of the presence and frequency of political communication among citizens (Huckfeldt, Ikeda, and Pappi 2005; Huckfeldt and Mendez 2008). While individuals typically hold the preferences that are dominant within the groups where they are located, many of them are quite willing to talk about politics with individuals who do not share their own political preferences (but see Mutz 2006). Moreover, observational studies point toward political expertise – and the higher levels of political engagement that accompany it – as factors that stimulate political communication and discussion (Huckfeldt 2001).

These observational studies coincide, at least partially, with the formal argument of Calvert (1985) that rational individuals might profitably learn from the advice offered by informants holding heterogeneous political perspectives, given that they are able to identify the informants' biases. This individual level argument provides a striking parallel to the network argument of Granovetter (1973), that individuals are more likely to obtain new and innovative information when their patterns of interaction reach beyond the closely held confines of cohesive microenvironments where they spend most of their social interaction energies.

If there are benefits to heterogeneous communication networks, why does Downs argue one should exclusively speak with those who share the individual's biases? A game theoretical perspective would note that communication in these situations is largely cheap talk – informants can send any signal they desire without having to pay a cost to send the signal (Crawford and Sobel 1982). Consequently, the informants are free to dissemble in ways that will offer them an advantage unless an external factor compels them to provide information consistent with their

beliefs. Lupia and McCubbins (1998) argue informants will provide accurate information if there are sanctions for lying, if the information provided might be verified, or if the both members of the discussion dyad share the same biases because the incentive to dissemble is removed.

While these theorists are concerned with informants intentionally sending biased messages, Downs argues informants must necessarily provide biased information because they must withhold some information. If the individual and the informant share the same biases, then the informant will provide information biased in the same manner that the individual would have biased the information. Hence, even if the informant's messages are not intentionally misleading, there is reason to question information from people on the other side of the issues.

The Costs of Social Communication

A second problem relates to the extent that socially communicated information is, in fact, free. For many citizens, the path of least resistance is simply to accept whomever is available as a political discussion partner. After all, the Downsian logic regarding political discussion and its utility is that it is available on the cheap, bypassing the problem that almost any information cost is likely to swamp the very small expected benefits from political participation once they are down-weighted by the infinitesimally small probability that an individual vote will be decisive in affecting a political outcome. This begs the question as to how far individuals are willing to go in accepting significant costs in their search for political informants. That is, if individuals are seeking out informants as a labor saving device, are there practical limits on their willingness to expend resources in the search for the perfect informant?

This is a problem with far reaching implications. Consider, for example, a committed evangelical Christian with moderate to liberal political instincts. Even though politically progressive evangelicals constitute a not insignificant political force, their numbers within the larger evangelical community tend to be relatively small. Hence, when our liberal evangelical looks for a worship community, finding a church that shares her political instincts might be quite difficult. What costs is she willing to pay to be located among other evangelicals who are both politically progressive and politically expert? How far would she be willing to drive on Sunday mornings? Is she willing to screen her political discussions at a politically conservative place of worship?

As an empirical matter, both political preferences and political expertise are likely to vary across groups. Hence, an individual might find himself in a group that is full of political experts but lacking in individuals with her own political preferences. Alternatively an individual might find himself surrounded by fellow travelers but lacking even a shred of useful political knowledge.

In this general context, some individuals would seem to be particularly fortunate – surrounded by politically expert individuals with compatible political preferences. At a more general strategic level, however, this scenario contains its own problems. When an expert is surrounded by other experts with shared preferences, her influence is likely to be severely circumscribed due to her redundant contribution to the political mix of the group. For example,

liberal college professors and conservative bank officers often prove to be a dime a dozen – essentially interchangeable within the environments where (1) their particular preferences dominate and (2) the collective levels of expertise are often quite high.

In summary, we are concerned with the contextual constraints that surround the choice of political informants and hence their centrality within political communication networks. How important is political expertise relative to shared preferences as a criterion for the selection of informants? Are either or both sufficiently important that individuals, in an effort to satisfy the criteria, would be willing to pay for information that would otherwise be free? What are the consequences that arise due to the distribution of expertise and preferences within and among naturally occurring groups? In particular, how do these distributions affect the search for information, as well as the influence of potential informants?

The Framework of the Experimental Design

Our experimental framework is designed to combine the advantages of small group dynamics with network representations of communication in the context of an experimental design. The experiments involve two groups of seven subjects who communicate with one another via networked computers. The experimental setting is based on a mock election with two "candidates" who are not real human subjects, but are represented as positions on a one-dimensional policy space. The policy space varies from 1 to 7, and each of the seven subjects has a unique integer position that remains constant across the rounds in an experimental session. The candidate positions are reset at each round, but Candidate A's position always lies in the interval between 1 and 6 inclusive, while Candidate B's position always lies in the interval between 2 and 7 inclusive. The goal of an experimental subject is to elect the "candidate" who most closely matches their own predetermined position on the same dimension, and subjects are rewarded with a cash incentive if the candidate closest to them wins the election at that round.

The exact positions of the candidates are not known to the voters, thereby creating an incentive to obtain information. The information comes to the subjects in three different forms: publicly available information that is free but of low quality; privately acquired information of higher quality with a variable cost that is randomly assigned to individual subjects; and socially communicated information taken from other individuals that has a variable cost. The public information is that one candidate's position lies somewhere between 1 and 6, and the other candidate's position lies somewhere between 2 and 7. Individual information costs are assigned to subjects at the beginning of the experimental session, and they are charged 0, 5, or 25 ECUs (Experimental Currency Units). Socially communicated information is free if it is obtained from an individual in the subject's own group, but it costs 10 ECUs if taken from an individual in the other experimental group..

At the beginning of each round of voting, subjects are endowed with 100 ECUs. Subjects are allowed to use up to 50 ECUs to purchase on the candidates' positions. After voting, if the winning candidate's position is closer to a voter than the losing candidate's position, the voter earns 50 extra ECUs. If the winning candidate's position is farther away from the voter's position than the losing candidate's position, 50 ECUs are subtracted from the voter's account. If the two candidates are equally distanced from the voter, then the voter neither gains

nor loses ECUs. A voter could thus earn 150 ECUs maximum in a round, but only if they did not purchase the information on the candidates' true positions. On the other hand, the minimum possible payoff for a subject in a period is 0 ECUs; this happens when a voter spends 50 ECUs on purchasing information and her favorite candidate loses the election. At the end of the experiment, the subjects are paid in cash the show-up fee plus their total earnings during the experiment. (One hundred ECUs equal a U.S. dollar.)

The Distribution of Information Costs and Preferences

In addition to manipulating individually held preferences and information costs, the distributions of preferences and information costs within groups were experimentally manipulated across experimental sessions. This creates four different distributional contexts, with three experimental sessions assigned to each context.

In the first context, both information costs and ideal points were distributed asymmetrically. The first group had right leaning preferences and high information costs. The second group had left leaning preferences and low information costs.

In the second context, information costs were distributed identically within groups, but ideal points were distributed asymmetrically. The first group had right leaning preferences, and the second had left leaning preferences.

In the third context, ideal points were distributed identically within the groups, but information costs were distributed asymmetrically. The first group had high information costs, and the second had low information costs.

Finally, in the baseline session, both information costs and ideal points were distributed the same in both groups.

In sessions where information costs were identical between the groups, two subjects paid nothing for information, two subjects paid 5 ECUs, and three subjects paid 25 ECUs. When information costs were distributed asymmetrically, one subject paid 5 ECUs in the first, high cost group, and 6 subjects paid 25 ECUs. In the second, low cost group, 4 subjects paid nothing for information, and 3 subjects paid 5 ECUs for each piece of information. In sessions where ideal points were distributed identically within the groups, one subject in each group held each of the positions from 1 through 7. In contrast, when ideal points were distributed asymmetrically: two subjects in the first right-leaning group were at position 7, 2 at position 6, 2 at position 5, and 1 at position 4. In the second, left-leaning group: 2 subjects were at position 1, 2 at position 2, 2 at position 3, and 1 at position 4.

The Experimental Procedure

The following steps occur during the experiment. At the beginning of the experiment, subjects are assigned their respective integer preferences on a one-dimensional policy space from 1 to 7. Two subjects are assigned to each of the seven policy points. Information costs are randomly assigned to subjects such that four subjects receive up to four pieces of information on

each candidate for free, four may purchase up to four pieces of information at a rate of 5 ECUs for each piece of information, and six may purchase up to two pieces of information at a rate of 25 ECUs for each piece of information. Once assigned, these positions and the information costs remain unchanged for each subject for the duration of the experiment. The subjects are accurately informed that Candidate A's position lies between 1 and 6, while Candidate B's position is set between 2 and 7. Then, in each of the approximately 15 rounds per session, the following steps occur:

1. The two candidates' positions are drawn from the respective intervals.

2. The subjects are given an opportunity to purchase information at the assigned cost. A single "piece" of information arrives in the form (*a*, *b*) where *a* and *b* are integer estimates of the candidate positions. With α and β as true positions, the signals *a* and *b* are randomly and independently drawn from uniform intervals [α - 3, α +3] and [β-3, β +3]. Subjects were told both how signals were drawn, thus reflecting on average the true candidate positions. Note that a signal of "-2" thus provided definitive information regarding a candidate's position.

3. After the subjects have received the information, they are asked to provide a prior judgment regarding where they believe each candidate's position to be. This information is not communicated to other subjects.

4. After being shown all the subjects' positions on the policy scale, the groups to which they belong, and the amount of information each has purchased, they are allowed to request information from two other subjects. If the potential informant belongs to their own group, the information is free, but if the potential informant belongs to the opposite group, the subject must pay 10 ECUs. The potential informants need not comply with the request, and they need not provide accurate information. If a subject agrees to provide information, the information provider sends a message in the form of (*a*, *b*) where *a* is the provider's message regarding the position of candidate A, and *b* is the provider's message regarding the position of candidate B. Communication costs, preferences, and group membership are randomly assigned to subjects at the beginning of the session, and they are is held constant across the rounds of the experiment.

5. After receiving information from one another, the subjects are provided a summary of the information they have received, and they vote for one of the candidates.

6. The outcome of the election is revealed to the voters. If the winning candidate's position is closer to a voter than the losing candidate's, 50 ECUs are added to the voter's account. If the losing candidate's position is closer to a voter than the winning candidate's, 50 ECUs are taken from the voter's account. The subjects are informed of their net earnings, which are accumulated across rounds.

7. The candidate positions are reset, and subjects proceed to the next round.

Thus, although the true positions of the two candidates are unknown, the voters have three potential sources of information on which to base their votes. First, the fact that the two candidates' positions are drawn from different intervals could potentially help a voter in the

absence of other forms of information, and this information should be particularly helpful to voters with more extreme positions. Second, voters are allowed to spend up to 50 ECU's to obtain unbiased but noisy information on the candidates' true positions. Third and finally, each subject has an opportunity to request information from two other subjects. Before they make these requests, all subjects are shown the policy positions of each subject, as well as the number of pieces of information each subject purchased.

Each bit of privately purchased information is drawn from uniform distributions with midpoints centered at the candidates' true positions and boundaries that are symmetrical to the midpoints. This means that individuals must make judgments regarding candidates based on unbiased but noisy information. In contrast, when individuals rely on the judgments of other subjects, they are not only depending on the volume of information that serves as the basis for *these* subjects' judgments, but also on the ability and willingness of the source to compile and communicate this information in an unbiased manner. To the extent that individuals inject bias into the information they communicate, the quality of the information is potentially degraded.

Proximate Effects of the Experimental Manipulations

The experimental manipulations involve the random assignment of ideal points, information costs, and group memberships to subjects. At the individual level, subjects are assigned a preference on the 1 through 7 scale, and they are assigned an information cost of either 0, 5, or 25 ECUs for each piece of information they purchase. At the aggregate level, they are assigned to groups that vary in the distribution of both ideal points and information costs, and they are given the opportunity to request information from individuals in their own group for free, as well as in the other group at a cost of 10 ECUs. The first questions that arise are related to the proximate consequences of these information costs for the acquisition of information.

Part A of Table 1 shows that individually levied information costs have a pronounced effect on the individual subjects' information purchases. Among those subjects for whom information is free, more than 60 percent request the maximum, and nearly 80 percent request three or four pieces of information. In contrast, subjects who must pay 5 ECUs for each piece of information are less likely to purchase information. Less than one-fourth request four pieces of information, and only about 40 percent request more than two pieces of information. Among those who must pay 25 ECUs, nearly 60 percent purchase 0 or 1 piece of information, with thirty-four percent purchasing two pieces -- the maximum allowed . In short, information costs translate directly into information purchases.

Part B of Table 1 addresses a second proximate consequence of information costs. Each individual can make two requests for information from other individuals, and this part of the table shows the number of information requests ***received*** by individuals. This includes requests received from other members of the same group, requests received from members of the opposite group, as well as the total number of requests. The summary statistics show that, over all the sessions, subjects received an average of 1.94 requests per round, with 1.68 requests coming from members of the same group and .26 requests coming from a member of the opposite group. In short, it would appear that the costs incurred communicating outside one's group are fairly prohibitive. While nearly 26 percent of the subjects failed to receive a request from their own

group in any particular round, nearly 80 percent failed to receive a request from the opposite group in any particular round. Hence, the cost of out-group communication produces a formidable barrier to the flow of information.

These proximate effects are not surprising in and of themselves. They merely show that the various incentives and disincentives perform as expected. Subjects are sensitive to information costs in making purchases, and the disincentives to cross-group communication encourage individuals to keep communication within their own groups. The larger questions concern the consequences of the proximate effects for the communication process.

One of the central questions regarding these proximate effects is whether they produce any variation in actual levels of expertise among the subjects. That is, are the subjects who purchase more information better able to make informed choices? We address this question in Part C of Table 1, where the subject's initial (or prior) judgment regarding the position of each candidate prior to communication is regressed on the candidate's true position, the number of pieces of information purchased by the subject, and the multiplicative interaction between the two. In the model, the data arranged so that both of a subject's estimates in a single round are separate cases.

The table shows a relationship between the prior judgment and the candidate's true position that is substantially enhanced by the number of pieces of information purchased by the subject. A subject's judgment regarding a candidate's position demonstrates a modest relationship among subjects who did not purchase any information (.34), but a substantial effect among those subjects who purchased four pieces of information (.87). In short, information costs produces a direct effect on information purchases, and information purchases produce an effect on the expertise with which subjects render judgments regarding candidates.

All these are only proximate effects, however. We would not expect individuals to purchase and communicate information based solely on information and communication costs. In the spirit of Downs (1957), Festinger (1957), Berelson et al. (1954), Katz and Lazarsfeld (1955), Katz (1957) and others, our expectation is that individuals will also take into account the political preferences of potential informants, the expertise of potential informants, and the range of informant alternatives that are available to them.

Complex Choices Subject to Alternative Contexts

Each of the subjects is able to request free information from the other six members of his or her own group, as well as to purchase information from the seven members of the opposite group for a cost of 10 ECUs. The price is charged against the purchaser's account, but it is not transferred to the subject who provides the information. Hence, there is a price for purchasing the information, but no profit to the subject providing it.

The first issue to be addressed is the set of characteristics and locations of the individuals who receive the requests. We address this issue in the context of network centrality (Freeman 1979), to locate the individuals who receive the most requests for information. In the language of social networks, this is a measure of "degree centrality," and as we saw in Table 1B, the

number of requests for information varies quite dramatically over the subjects. The number of requests per round varies from 0 to nine, with nearly a quarter of the subjects not receiving any information requests during a typical round, and nearly 20 percent receiving four requests or more. Which individuals are being asked to provide information?

The problem of centrality can be understood visually, on the basis of Figure 1, which graphically displays the maps of the communication networks in each of the twelve sessions spread across the four different contextual distributions of expertise levels and preferences. These network maps demonstrate higher levels of communication within rather than between groups, as well as more ties and more frequent contacts with subjects who purchase more information. In the analyses that follow, we address a range of factors related to these outcomes, as well as the consequence of these outcomes for the aggregate distribution of information.

Part A of Table 2 regresses the number of out-group and in-group requests for information on several explanatory variables – the amount of information purchased by the subject, the difference between the amount of information purchased by the subject and the mean amount purchased by the relevant group, the mean information cost in the group, the interaction between information purchased and mean information cost in the group, and the absolute distance from the individual subject's preference to the mean preference in the group.

Several factors stand out as particularly important. First, centrality within a subject's own group (the "in-group") is only enhanced by the individual's information purchases relative to the mean level of purchases in the group. This suggests that an abundance of experts creates a situation in which no particular informant is likely to become particularly central to the communication process.

Second, the number of requests received from the opposite group (the "out-group") is similarly driven by the difference between information purchased by the individual subject and the mean information level in the out-group. Once again, the centrality of the expert is defined relative to the information distribution within the group in question.

Third, out-group centrality is diminished by the mean information cost in the out-group. That is, subjects who have high information costs are less willing and able to invest in information taken from beyond the group. This would appear to place a group with high information costs somewhere between a rock and a hard place. Not only are the members of such a group unable to obtain information on their own, but they are also unable to pay the cost of reaching beyond their own group to acquire information from expert informants.[1] This is a severe limitation because, by definition, there are very few individuals in their own group who are expert.

Finally, there is little evidence here to support the importance of shared preferences. Subjects who lie closest to the group's mean preference are on average in a higher level of agreement with other group members. Perhaps surprisingly, the absolute difference between the

[1] Indeed, a high cost individual who purchases two pieces of private information is unable to purchase information from an out-group informant because she is limited to a total information cost of 50 ECUs.

subject's preference and the mean preference within the group in question generates coefficients that lie in the expected direction, but with meager t-values.

Part B of Table 2 reformulates the same problem in terms of mean information costs in groups, individual information costs, the amount of information purchased, and the absolute distance separating a potential informant's preference from the relevant group preference. The dummy variables in these models capture the various treatments that are due to the individual and group-level manipulation of costs, with controls for individual information purchased and the preference distance between the individual and the group.

In terms of in-group requests, the largest effect on centrality occurs among the moderate cost individuals in high cost groups. Recall that the high cost groups included 6 individuals who had high information costs of 25 ECUs, and only 1 moderate cost individual with information costs of 5 ECUs. Hence they become the key sources of information in these groups of subjects who are unlikely to pay the costs of moving beyond the group. These same subjects show large effects for out-group centrality as well -- in this instance because the out-group has low information costs and the moderate cost individual is apt to be the most expert subject in the in-group.

Finally, it is useful to compare the low cost individuals located in medium cost groups to the low cost individuals in low cost groups. These individuals are more likely to demonstrate high levels of in-group centrality in the moderate cost groups. Indeed, their in-group centrality score actually declines from the overall baseline in the low cost groups. In short, we see abundant evidence that context matters to the construction of these communication networks.

What Are the Criteria that Individuals Use in Selecting Informants?

In this analysis we switch the focus from the individual being selected as an informant to the individual who is making the selection. Under what circumstances are individuals willing to pay the price of locating informants beyond their own group – beyond their immediate circle of readily available associates. In this section, we look at the subjects' communication choices – whether or not they request information from particular individuals. Hence the analysis expands to include each dyad at every period of all the sessions, thereby increasing the number of observations to 22,932 potential dyads.[2]

Table 3 displays a logit model where the dependent variable measures whether one subject requests information from another subject, and where the characteristics of both the potential informant and the potential requestor are specified. Thus, we include a dyadic proximity measure which calculates the absolute difference between the ideal points of the potential informants and requestors. Several dummy variables are also included in the regression. The first measures whether the potential informants and requestors belong to the same group. A second measures whether the subject pays a medium information cost (5 ECUs),

[2] In order to avoid an underestimation of the standard errors on the model coefficients, we employ a clustering procedure where the clusters are the 168 subjects who participated in the experiment (Rogers 1993).

and the third measures whether the subject pays a high information cost (25 ECUs). Once again, the reader should note that the high cost individuals ***cannot,*** due to the construction of the experiment**,** purchase social information from the out-group if they buy two pieces of private information. A third measures the interaction between the first two – the joint incidence of the potential informant and the subject belonging to the same group and the subject paying a high information cost

Table 3 shows several discernible effects. As before, the information purchased by the potential informant produces an effect in which the subject is more likely to request information. The absolute distance between the ideal points of the potential informant and the requestor also produces an effect, where a request is less likely to be made as the distance increases. Finally, the dummy variables show that subjects are more likely to select informants who are members of their own groups – a result that is in keeping with the higher cost of communication between groups. And this effect is substantially enhanced among subjects who pay the highest information cost of 25 ECUs, but not among the subjects who pay 5 ECUs.

The magnitudes of effects are addressed in Table 3B, where the predicted probability of a communication request is shown as the consequence of the factors included in Table 3A. As before, the levels of information purchased by the potential informants are particularly important, producing dramatic increases in the probability of selection. The distance between the ideal points of subjects and informants is also important, but its effect is less pronounced. For example, if we consider the second and fourth rows of the table, we see that the potential informant's information purchases increase the probability from .10 to .57 and from .04 to .33 – approximately six and ten-fold increases. In contrast, reducing the distances between ideal points increases the probability from .04 to .10 and from .33 to .57 – approximately twofold increases.

The table also shows a pronounced negative effect on the probability due to communication across group boundaries – an effect that is enhanced for subjects with high information costs. The enhancement of the negative effect among high information cost subjects is best seen as the result of competition for scarce resources. The high cost subjects – subjects who must pay 25 ECUs for each piece of individually obtained information – exhaust their information budget after purchasing two pieces of information. Hence, they are unable to allocate additional ECUs to the purchase of communicated information from an informant who does not belong to their group. And we see evidence of these limitations in the unwillingness of high cost subjects to select informants from the opposite group.

While subjects prefer to select informants closer to them on the policy scale, under certain circumstances they are willing to accept messages from informants with divergent preferences. The model in Table 4A addresses to what extent the distance between dyad members affects the messages informants send. In the model, the message an informant sends about a candidate is regressed on the informant's initial estimate, the distance between the subjects, and the interaction of those two variables. This interaction tests whether the likelihood that an informant's messages reflect her true beliefs is conditional on the distance between the subjects.

As the model shows, when both dyad members have the same preference, subjects send messages that are representative of their true beliefs about the candidate positions. Subjects who receive messages from informants on the other side of the policy scale, however, risk receiving inaccurate messages. This is most clearly seen in the predicted messages in Table 4B. When dyad members are on opposite sides of the policy scale, informants send messages that do not perfectly reflect their initial estimates. The informants are somewhat constrained and do not wholly misrepresent candidate positions. If an informant believes a candidate's true position is 1, the informant is not going to send a message that the candidate's position is 7. An informant would not send that message because, if the receiver has any information, she will realize the message is not credible and choose to ignore the message.

In summary, these results establish the relative importance of various criteria that the individual subjects impose on their choice of an informant and how those choices affect the messages they receive. Informant expertise is particularly important, followed by (1) the proximity of the subject's preference to the preference of the potential informant and (2) and membership in the same group. As the informant moves away from the subject on the policy scale, the messages the informant sends are more likely to diverge from the informants true beliefs. The final step in the analysis is to consider the aggregate consequences of these individually imposed decisions.

Aggregate Consequences of Individual Level Effects

In these final analyses, we consider the aggregate consequences that arise as a consequence of the individual selection criteria that subjects impose on the construction of communication networks. The process we are describing is usefully and inevitably seen at multiple levels of meaning and measurement. Individuals make informant choices, which create patterns of interdependence among actors, which translate into a different fabric and pattern of relationships among and between groups within the larger aggregate population.

Interdependence holds the key to understanding the relationships between individuals and aggregates in this analysis. The aggregate is more than a simple summation of the individuals who are making decisions, and the individuals cannot be understood apart from the particular contexts in which they are located. To focus solely on groups and aggregates runs the risk of ecological fallacies, but to focus solely on individuals runs the risk of individualistic fallacies.

We are particularly interested in the relative distributions of preferences and information within groups for the level of communication between groups. Table 3 shows that individuals are more likely to communicate with experts who share their preferences, and they are less likely to pay the additional costs of communicating with individuals who lie beyond the boundaries of their own groups. The ideal informant is thus the fellow group member who is politically expert and shares their own preferences. But what if such an informant is unavailable – what if the individual must look beyond his own setting for an expert with shared preferences? What are the implications for the numbers and directions of ties between groups? What are the implications for the expertise of the aggregate? How do communication patterns influence the quality of information received by groups of varying preferences and expertise? And what are the implications for the dominance of particular groups as information sources?

An Agent-Based Model of Network Formation

We address these questions by constructing an agent-based model of network formation that extends the Table 3 results. Rather than two groups with seven subjects in each group, the model includes nine agents in four groups. Individuals are arranged in 4 quadrants on a 6 x 6 grid, such that each quadrant consists of a distinct group of nine individuals.

The baseline. In the baseline formulation, which corresponds to the fourth context in the experiment, each agent is assigned both a unique policy preference on a scale of 0 to 8, and between 0 and 4 pieces of information. The distribution of information is assigned randomly within the groups, where the probabilities of 0 through 4 pieces of information within each group approximates the marginal distribution of information shown among the subjects in Table: {0, 1, 1, 2, 2, 2, 3, 4, 4}. Thus the distribution of information and preferences is symmetric across the four groups, and the relationship between preferences and information levels is random within the groups.

Asymmetric preferences. In two alternative contexts, preferences are assigned asymmetrically, such that each group has a narrow range of preferences, and multiple agents share the same preference. The distributions across the four groups are: {0, 0, 0, 0, 1, 1, 1, 1, 2}, {2, 2, 2, 3, 3, 3, 3, 4, 4}, {4, 4, 5, 5, 5, 5, 6, 6, 6}, {6, 7, 7, 7, 7, 8, 8, 8, 8}. Thus, while the overall distribution of preferences corresponds to the baseline, it is highly skewed and asymmetric across the groups.

Asymmetric information. Similarly, information is also assigned asymmetrically in two contexts, such that each group has a narrow range of information levels, and multiple agents share the same information levels. In these asymmetrical information distributions, agents are randomly assigned information to produce the following distributions across the groups: {0, 0, 0, 0, 1, 1, 1, 1, 1}, {1, 1, 1, 2, 2, 2, 2, 2, 2}, {2, 2, 2, 2, 2, 2, 3, 3, 3}, {3, 4, 4, 4, 4, 4, 4, 4, 4}. As before, information is randomly assigned within groups so that information is independent from preferences within the groups. Hence, while the overall distribution of information in these two contexts corresponds to the baseline, it is highly skewed and asymmetric across the groups.

In summary, four contextual distributions are established: (1) asymmetrical preferences and asymmetrical information across the four groups, (2) asymmetrical preferences and symmetrical information across the four groups, (3) symmetrical preferences and asymmetrical information across the four groups, and (4) the baseline with symmetric preferences and symmetric information across the four groups. (See Appendix Table A1.)

All agents select two other agents from whom to obtain information, based on the logit model of Table 3. Each of the other 35 agents is thus assigned a probability of being selected that is proportional to the probability set by the logit model, and hence preference is given to agents within the same group, agents with similar preference assignments, and agents that possess more information. In the first formulation, the agents are not restricted in their ability to purchase information through social communication regardless of their own information level, thereby omitting the high cost factors from the model. This is equivalent to assuming that all the

agents have low and moderate information costs. The model is run for 100 iterations, for each contextual distribution, with each agent making two selections at each iteration, and hence the agents for a particular nine-agent group make a total of 1800 information selections.

Patterns of Communication among the Agents

Table 5 provides the proportion of requests that are directed from the agents within each group arrayed along the rows, to agents within all the other groups, arrayed along the columns. The table shows that the agents are most likely to select information sources within their own groups. This can be seen quite clearly by examining the main diagonals within each part of the table.

As would be expected, there is virtually no variation in the diagonal entries in the baseline distribution of Part D. That is, the in-group selection probabilities vary from .826 to .850, and all the other selection probabilities vary within very tight bounds of .047 to .067. In short, when the expertise and preference distributions are symmetric within the groups, all the agents face the same selection task using the same selection criteria.

In Part B of the table, when information is distributed symmetrically but preferences are distributed asymmetrically, the values in the main diagonal are even larger, varying from .886 to .910. In this instance, there is even less likelihood that an agent would reach beyond the group for an informant. That is, every group has the same information distribution, and preferences are highly clustered within the group. In such an instance, it is particularly straightforward task for an agent to implement the Downsian strategy of selecting an informant that is both well informed and holds a compatible political preference. Part B does, however, show slight but systematic variation in the out-group selection probabilities across out-groups. As the out-group grows more distant from the in-group, the corresponding selection probabilities grow smaller, corresponding to the corresponding increase distance in terms of preference distributions.

In contrast, Parts A and C display significant variation in the size of the in-group selection probabilities. In Part A, where both preferences and information levels are distributed asymmetrically, the in-group selection probability increases from .815 to .976 as the level of information within the group increases. The agents in group 1 confront a particularly challenging task – they are located in a low information group with distinctive political preferences. If they choose informants to maximize expertise by selecting from group 4, they pay the price of selecting an informant with highly divergent preferences. Alternatively, if they make informant selections that maximize shared preferences by choosing an in-group agent from group 1, they are forced to select agents who are the least expert.

The agents in Part C confront a choice that is in some ways easier – while information is distributed asymmetrically, preferences are distributed symmetrically. Thus, all the agents in every group are able to find an expert informant in group 4 with preferences that approximate their own. Not surprisingly, the in-group selection probability for group 4 is particularly high, .954. The agents in group 1 – the group with the lowest information level – demonstrate the lowest in-group selection probability in the table, .621. And they show a correspondingly high probability (.248) of selecting an informant from the politically expert group 4.

It is important to emphasize that the individual level selection probabilities for the agents are all estimated on the basis of the same individual level model taken from Table 3. The differences we see in Table 5 are not predicated on the basis of individual level differences in the agents, but rather based on differences in the contextually determined choice set that is presented as a consequence of contextual variation in the distribution of information and preferences across groups. This does not mean, however, that the differences we observe in Table 5 are inconsequential.

Dynamical Implications of Contextual Variation

As we have seen, contextual variation in preference distributions and expertise distributions produce variations in information flows across groups. Moreover, these variations produce advantages and disadvantages for particular groups. In particular, groups with members who have access to more information tend to dominate the communication process, and this domination produces cumulative consequences for the aggregate distribution of information in the larger community.

Each of the four sets of group based selection proportions can be treated as a transition matrix in a Markov process.[3] We define the transition (communication) matrix as C, where

cij= the probability that someone from group i will take their next piece of information from group j

At some initial time point before a particular subject is a topic for communication, information is held individually but not communicated , and we treat this information as coming from the group to which the individual belongs. As an initial condition, information sources are thus distributed proportionally across the four groups {.25, .25, .25, .25}. Hence we correspondingly define:

g_{jt}= a row vector with four columns where the entries are the cumulative proportions of information in the population taken from groups 1 through 4 at time t.

The distribution of information sources after one round of communication (g_1) is thus equal to g_0C; after two rounds g_0C^2; and after n rounds g_0C^n.

The dominance of a politically expert group is based on the group members' increased access to information, but dominance is only realized through the communication process – and not simply realized but actually enhanced. While communication increases the volume of information available throughout a population, all information originates from a particular source, and we can think of the information as being distinctive to its source.

[3] In order to treat this as a Markov process, we must assume that the selection probabilities are constant in time. In fact, the relative constancy of the experimentally generated selection probabilities across rounds in the experiment supports this assumption.

The process thus described produces an equilibrium distribution of information, g*, identified according to its source. This equilibrium distribution is wholly a function of the transition probabilities, completely independent of the initial distribution of information. That is, the only behavioral information needed to identify the equilibrium for information sources is the matrix of transition probabilities. And the equilibria shown in the bottom row of each part to Table 4 are calculated by raising the transition matrix to successively higher powers until its rows converge to produce the equilibrium vector.

When information is distributed symmetrically across groups, the behavioral response of the subjects (and hence the agents) produces an egalitarian equilibrium vector for the population that is balanced across the groups. In contrast, when information is asymmetrically distributed across groups, the behavioral response of the subjects (and hence the agents) produces an equilibrium vector for the population that ***dramatically magnifies*** the initial informational inequalities.

What are the implications of including the high cost subjects in the analysis? Table 6 replicates Table 5 but includes high cost agents in the analysis. We do this by assigning agents holding 0, 1, and 2 pieces of information to the high cost category, proportionate to the distribution in the experimental results. These agents then select informants according to the full logic of Table 5, including the decreased likelihood of selecting a member of an out-group.

Table 6 shows that adding the high cost agents drives up the magnitude of the main diagonal, particular for entries that represent a high cost group. (See in particular groups 1 and 2 in Parts A and C of Tables 5 and 6.) Once again, the high cost groups that need additional information the most are least able to take advantage of expertise located in groups other than their own.

At the same time, the Table 6 equilibrium vectors in Part A and C are little changed from Table 5. The highest cost groups in the asymmetric information distributions account for little or none of the aggregate information, and the informational dominance of the lowest cost group is only modestly reduced.

In short, the low cost information groups play the dominant role in creating the aggregate distribution of information. And these tendencies toward exaggerated informational inequities are wholly a function of asymmetric information distributions in combination with the individual tendency to rely on informational experts that is documented in the experimental results presented earlier.

How Accurate is the Communicated Information?

Information and preference distributions can determine whether some groups dominate as informational sources, and they can also create inequalities in the quality of information communicated between groups. We examine the quality of messages sent by informants by again using estimates obtained from the experimental setting and extending them through the agent-based model. Using the experimental data, we use the estimates from Table 1C (modeling agents' priors according to the amount of information they've purchased, the true candidate

position, and an interaction) to determine agents' priors. Here, we consider two candidate configurations: polarized candidates, where candidate A is positioned at 1 and candidate B is positioned at 7; and convergent candidates, where candidate A is positioned at 3 and candidate B is positioned at 5.

We use the agents' priors to calculate the message sent by informants to requesters, based on the model in Table 4A (modeling message according to the distance between the informant and the requester, and an interaction). Using our estimates for priors and messages, we calculate the noise received by each agent in the agent-based model according to:

$$noise = \sqrt{(message - prior)^2}$$

Because subjects in the experiment and agents in the model receive information about two candidates, we calculate priors and sent messages for each candidate. Our estimate of the noise received by a particular agent requester from a particular agent informant is then the average of the noise estimates associated with each candidate.

These noise estimates allow us to investigate the quality of information communicated between groups, under the four configurations of preference and information distributions described above. To estimate the quality of information sent between groups, we simply average the noise calculations for all messages received by each group, according to the group where the messages originate. For example, if the agents in group 1 made five requests to agents in group 4, we estimate the noise associated with each of the five requests, and average these to obtain our final estimate of information quality sent by group 4 to group 1. The noise estimates for the communication between all groups in the high cost formulation are presented in Table 7 for polarized candidates (positioned at 1 and 7), and Table 8 for convergent candidates (positioned at 3 and 5).

Comparing Tables 7 and 8, it is clear that candidate polarization greatly increases the noise communicated between groups. When candidates are less polarized, individuals are more likely to communicate information that reflects their belief about the true candidate positions. Within each table, however, it is also clear that the information and preference distributions across groups have a strong effect on the accuracy of information transmitted between groups.

When preferences are distributed asymmetrically (Parts A and B of both tables), noise is greatly reduced by within-group communication. Under this condition, for both symmetrical and asymmetrical information distributions, individuals receiving information from outside of their own group receive much less accurate information compared to information originating within their own group. Because preferences are polarized across groups, within-group communication produces communication between individuals of similar preferences, greatly reducing noise. Compared to individuals who reach outside their own group when preferences are symmetrically distributed (Parts C and D of both tables), asymmetrical preference distributions lead to out-group information providers with divergent political preferences, who consequently communicate less accurate information.

Asymmetrical information distributions (Parts A and C), on the other hand, tend to reduce the noise originating from all groups except the group where information is most highly concentrated. For individuals in the group with highly concentrated information, information plays a much stronger role in determining individuals' priors about the candidates. Consequently, these individuals become more likely to skew their communications, dependent upon their priors and the distance to the individual requesting information. When we consider this result in relation to the equilibrium distributions discussed in the previous section, it becomes clear that asymmetrical information distributions advantage groups with high information concentrations in two ways: they become a dominant source of information for the community, but they also exert a strong influence on the quality of information received by different groups.

Summary and Conclusion

The evidence presented in this paper supports the Downsian (1957) expectation that individuals will seek out politically expert informants whose political biases coincide with their own. In particular, when choices are available, individuals construct communication networks that reflect their own preferences and draw on the highest levels of expertise that are available. The problem arises when the range of options available to an individual are constrained – when individuals are located in contexts where either their own preferences are poorly represented, or where the level of information is relatively low, or both. The implications of contextual variation for the construction of communication networks is quite important, not only for individuals and the information they receive, but also for levels of communication and polarization within and between groups, as well as for the diffusion of knowledge and information within larger populations.

The experimental framework in this paper randomly assigned information costs and preferences to individuals, as well as randomly assigning these individuals to groups that varied in the distribution of preferences and information. The proximate effects of individual assignment are that (1) subjects with lower information costs are more likely to purchase a higher volume of political information, and (2) subjects look for informants who are, most importantly, better informed and, secondarily, hold preferences similar to their own.

The search for informants is made more complex by the location of individual subjects (as well as simulated agents) within groups. Candidate information taken from an informant located within their own group is free, but information taken from an informant located in the opposite group is costly. This cost imposes a constraint on the search for informants, particularly among those subjects who were previously assigned a high cost for the individual acquisition of information. As a consequence, communication tends to be more frequent within groups than between groups, but the rates of in-group and out-group interaction are subject to variation due to variations in the distribution of information and preferences within groups.

We believe that this construction is a reasonable approximation of the real world. That is, given sufficient time and resources, any individual might carry on an extended search for associates. Unfortunately, time and other resources are typically scarce, and hence individuals often carry out truncated searches within boundaries constrained as a matter of cost and

convenience. That is, we draw our associates from the pools of individuals who are readily available. There are, of course, exceptions to this pattern – internet dating services provide an excellent example – but the exceptions are typically exceptional, and other observational studies affirm the importance of availability in the construction of communication networks (Huckfeldt and Sprague 1995).

The constraints operating on communication make individuals and their communication networks vulnerable to the locally defined supply of potential informants. In Finifter's (1974) classic study of lunch time habits among autoworkers at overwhelmingly Democratic work places, she demonstrates the ability of Republican autoworkers to segregate themselves into politically congenial lunch groups. This ability to voluntarily associate with politically likeminded colleagues provided a low cost mechanism to avoid the contextual constraints within which they were imbedded, but these sorts of options are not always available.

The distributions of preferences and information levels within groups are shown to carry important consequences for individuals, but perhaps more importantly they generate important aggregate consequences as well. First, group boundaries on communication redefine political expertise in terms that are relative to particular settings. An autoworker who reads the New York Times may be more likely to be considered an expert by her colleagues, but a political science professor with the same reading habits is less to be considered an expert among her colleagues. And this means that network centrality in the flow of information is affected by the distribution of information within the network.

Second, when individual levels of information are asymmetrically distributed across groups, the likelihood of communication between groups is enhanced, even though the resulting patterns of communication may foster heterogeneous streams of information.

Third, communication across groups is less likely when information is distributed symmetrically. This is particularly the case when preferences are clustered within groups – that is, when preferences are distributed asymmetrically.

Finally, the social segregation of political preferences carries unavoidable consequences both for the political heterogeneity of communication within networks and for the quality of information transmitted between groups. Unless individuals are willing to pay a steep cost in their search for like-minded informants, they will be more likely to interact with individuals who hold politically divergent positions when they are located in groups where they are exposed to diverse opinions. Alternatively, politically homogeneous groups are likely to produce politically homogeneous networks, unless the information level is particularly low, thereby encouraging individuals to look beyond the group for information. Under these conditions, however, such individuals become vulnerable to receiving less reliable information from politically dominant groups.

References

Berelson, Bernard R., Paul F. Lazarsfeld and William N. McPhee. 1954. *Voting: A Study of Opinion Formation in a Presidential Campaign.* Chicago: University of Chicago Press.

Calvert, Randall L. 1985. "The value of biased information: A Rational Choice Model of Political Advice." *Journal of Politics*, 47:530-555.

Crawford, Vincent P. and Joel Sobel. 1982. "Strategic Information Transmission." *Econometrica,* 50(6):1431–1451.

Downs, Anthony. 1957. *An Economic Theory of Democracy.* New York: Harper Row.

Festinger, Leon. 1957. *A Theory of Cognitive Dissonance*. Palo Alto, CA: Stanford University Press.

Finifter, Ada. 1974. "The Friendship Group as a Protective Environment for Political Deviants." *American Political Science Review*, 68: 607-625.

Fiorina, Morris P. 1990. "Information and Rationality in Elections." In *Information and Democratic Processes*, ed. John A. Ferejohn and James H. Kuklinski. Urbana: University of Illinois Press.

Fischbacher, Urs. 2007. "z-Tree: Zurich Toolbox for Ready-made Economic Experiments." *Experimental Economics*, 10: 171-178.

Freeman, Linton C. 1979. "Centrality in Social Networks: Conceptual Clarification," Social Networks 1: 215-239.

Granovetter, Mark. 1973. "The Strength of Weak Ties." *American Journal of Sociology*, 78: 1360-1380.

Huckfeldt, Robert. 2001. "The Social Communication of Political Expertise." *American Journal of Political Science*, 45: 425-438.

Huckfeldt, Robert, Ken'ichi Ikeda and Franz Urban Pappi. 2005. "Patterns of Disagreement in Democratic Politics: Comparing Germany, Japan, and the United States." *American Journal of Political Science*, 49: 497-514

Huckfeldt, Robert and Jeanette Morehouse Mendez. 2008. "Moths, Flames, and Political Engagement: Managing Disagreement within Communication Networks," *Journal of Politics*, in press.

Huckfeldt, Robert and John Sprague. 1995. *Citizens, Politics, and Social Communication: Information and Influence in an Election Campaign*. New York: Cambridge University Press.

Katz, Elihu and Paul F. Lazarsfeld. 1955. *Personal Influence: The Part Played by People in the Flow of Mass Communication*. Glencoe, IL: Free Press.

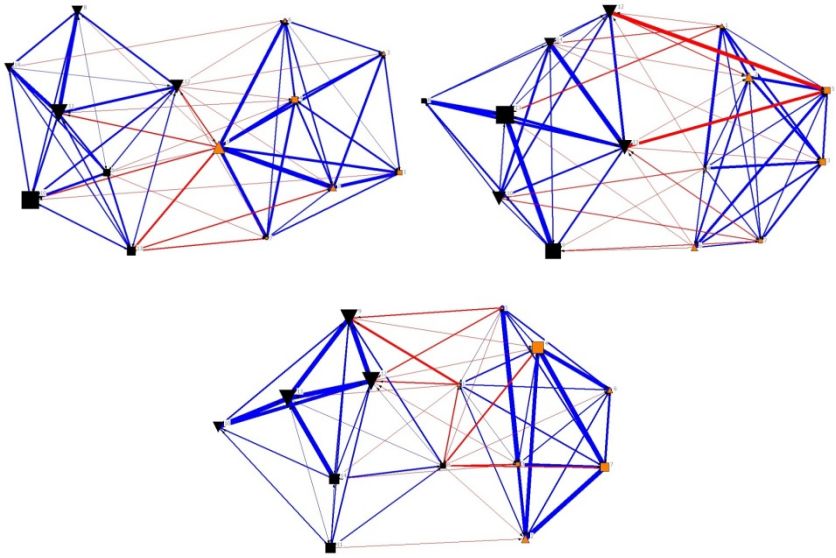
Katz, Elihu. 1957. "The Two Step Flow of Communication: An Up-to-Date Report on an Hypothesis." *Public Opinion Quarterly*, 21:67-81.

Mutz, Diana C. 2006. *Hearing the Other Side: Deliberative Versus Participatory Democracy*. New York: Cambridge University Press.

Rogers, William. 1993. "Regression Standard Errors in Clustered Samples." *Stata Technical Bulletin*, 13:19-23.

Figure 1. Network diagrams by alternative distributions of information and preferences. Each diagram is a separate session involving multiple rounds with two groups of seven subjects.

A. First context: Asymmetric Preferences and Asymmetric Information



B. Second context: Asymmetric Preferences and Symmetric Information

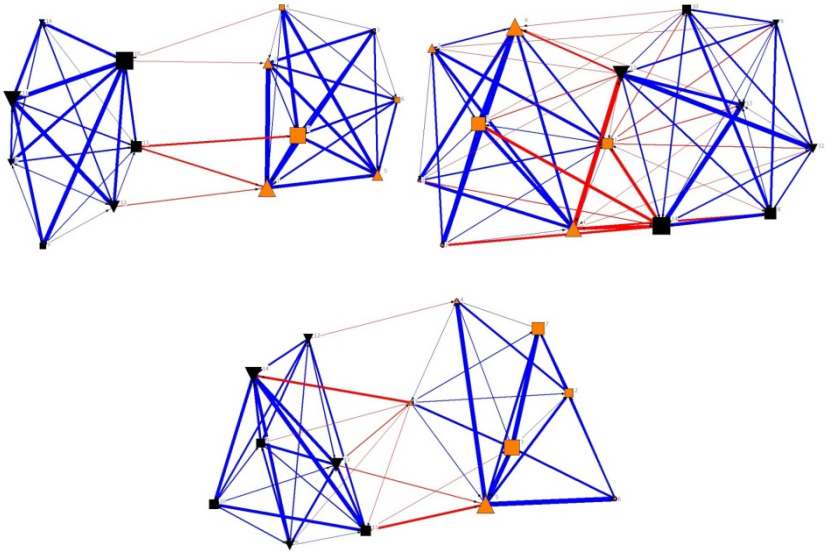
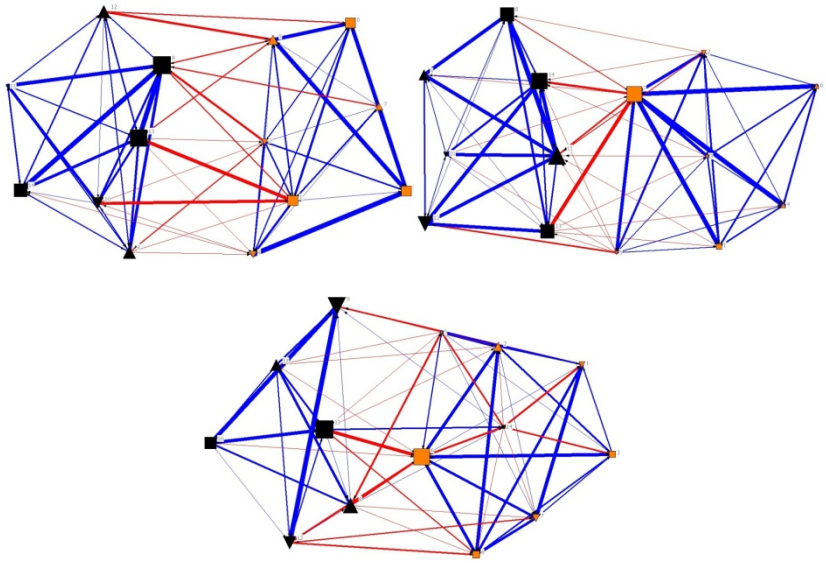
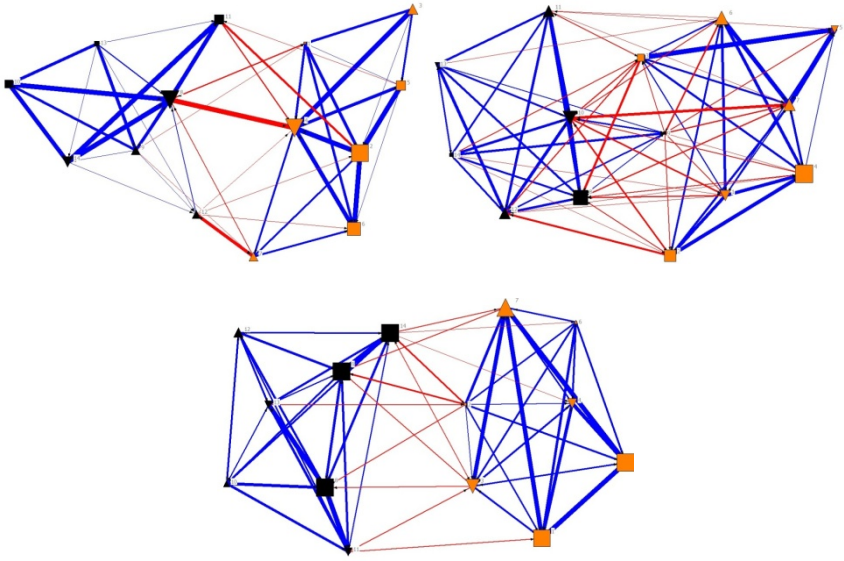


Figure 1 (continued).

C. Third context: Symmetric Preferences and Asymmetric Information



D. Fourth context: Symmetric Preferences and Symmetric Information



Key: dark nodes=group 1; light nodes =group 2; size of nodes=amount of information purchased; width of edges (lines)= number of requests; arrow head=direction of request; dark lines=within group communication; light lines= between group communication; down triangles=preferences 1-2; squares=preferences 3-5; up triangles=preferences 6-7. In color, dark is blue, and light is orange.

Table 1. Proximate consequences of information costs.

A. Individual information purchases by individual costs.

Information Purchased	Information Costs (ECUs) 0	5	25	Total
0	2.18%	8.33	21.96	12.41
1	4.76	12.10	37.17	20.75
2	13.69	38.89	40.87	32.54
3	16.87	18.06	0.00	9.98
4	62.50	22.62	0.00	24.32
N=	504	504	756	1,764

B. Communication requests received from within and between groups.

Requests	in-groups	out-groups	total
0	25.7	78.5	22.4
1	27.0	17.9	26.1
2	19.8	3.1	18.0
3	13.3	.5	14.7
4	10.0	.1	10.2
5	3.6		5.7
6	.6		2.0
7-9			.9
N=	1,764	1,764	1,764
mean=	1.68	.26	1.94

C. Prior judgments regarding candidates' positions by information purchased, candidates' true positions, and their interaction. Standard errors are adjusted for clustering on subject.

	coefficient	t-value
private information purchases	-.46	10.14
candidate true position	.35	9.65
purchases X true position	.13	10.76
constant	2.41	18.08
N =	3528	
R^2, s.e. of estimate =	.38, 1.35	

Table 2. Information requests received from in-groups and out-groups.

A. By characteristics of subjects and relevant groups.

	In-Group Requests	Out-Group Requests
information purchased by subject	.17	-.09
	(.92)	(.99)
information purchased minus mean information purchased by group members	.49	.25
	(2.88)	(3.16)
mean information cost in group	.003	-.03
	(.02)	(4.41)
information purchased X mean cost in group	.01	-.001
	(1.75)	(.29)
absolute distance from individual preference to mean preference in group	-.06	-.01
	(1.06)	(.60)
constant	1.11	.87
	(2.10)	(3.71)
N=	1764	1764
Subjects=	168	168
R2=	.43	.14
SE of regression=	1.11	.50

B. By treatment groups with controls for information purchases and individual preference relative to group's mean preference.

Mean group cost	Individual subject cost		
High	5	1.05	.61
		(2.78)	(2.89)
High	25	.62	.16
		(5.56)	(2.90)
Medium	0	.88	.01
		(4.76)	(.16)
Medium	5	.49	.11
		(2.22)	(1.71)
Medium	25	(excluded baseline)	
Low	0	-.42)	-.01
		(2.33)	(.09)
Low	5	-.31	-.09
		(1.68)	(2.09)
Information purchased		.69	.13
		(14.24)	(7.87)
Distance from individual preference to mean group preference		-.06	-.01
		(1.09)	(.86)
Constant		.13	-.03
		(1.04)	(.73)
N =		1764	1764
Subjects=		168	168
R2=		.43	.15
SE of estimate=		1.11	.50

Table 3. Factors affecting the subject's selection of information.

A. Whether subject chooses a potential informant. Standard errors are adjusted for clustering on subject.

	Coefficient	t-value
Potential informant's information purchase	.62	15.40
Distance between ideal points of subject and potential informant	-.17	4.37
Whether potential informant belongs to same goup as subject (dummy coded)	1.88	5.77
Whether subject pays medium information cost (dummy coded)	.08	.26
Medium information cost X same group	-.25	.59
Whether subject pays high information cost (dummy coded	-1.03	3.28
High information cost X same group	1.39	3.62
Constant	-4.07	13.50
N=	22932	
Subjects=	168	
χ^2,df,p =	545,7,.00	

B. Predicted probabilities of selection based on estimates in Part A.

Subject Information Cost	Distance between subject/informant ideal points	same group?	potential informant information purchase Low (0)	High (4)
low/medium	0	no	.02	.17
low/medium	0	yes	.10	.57
low/medium	6	no	.01	.07
low/medium	6	yes	.04	.33
high	0	no	.01	.07
high	0	yes	.14	.66
high	6	no	.002	.03
high	6	yes	.05	.41

Table 4A. Informant messages by initial estimates and distance between dyad members. O.L.S. model with standard errors are adjusted for clustering on subject.

	Coefficient	T-value
Initial Estimate	.82	30.02
Distance Between Dyad Members	.32	5.15
Estimate * Distance	-.07	4.83
Constant	.66	5.83
N	5,650	
R^2, M.S.E.	.43, 1.36	

Table 4B. Predicted informant messages based on estimates in Table 4A.

		Informant's Initial Estimate of Candidate's Position						
		1	2	3	4	5	6	7
Distance Between Dyad Members	0	1.48	2.30	3.13	3.95	4.77	5.59	6.41
	1	1.73	2.47	3.22	3.97	4.72	5.46	6.21
	2	1.97	2.64	3.32	3.99	4.66	5.33	6.01
	3	2.21	2.81	3.41	4.01	4.61	5.21	5.80
	4	2.46	2.98	3.51	4.03	4.55	5.08	5.60
	5	2.70	3.15	3.60	4.05	4.50	4.95	5.40
	6	2.94	3.32	3.69	4.07	4.44	4.82	5.19

Table 5. Agent-based simulations of cross-group communication for low and medium cost subjects: group transition rates with implied equilibria.

A. distributions: asymmetrical preferences; asymmetrical information

		Source of Information				
		group 1	group 2	group 3	group 4	Σ
source of request	group 1	.815	.044	.043	.098	1.00
	group2	.001	.847	.056	.097	1.00
	group3	.000	.018	.864	.118	1.00
	group4	.000	.007	.017	.976	1.00
	equilibrium	.00	.05	.13	.83	

B. distributions: asymmetrical preferences; symmetrical information

		Source of Information				
		group 1	group 2	group 3	group 4	Σ
source of request	group1	.910	.046	.028	.016	1.00
	group2	.043	.886	.046	.026	1.00
	group3	.030	.039	.886	.044	1.00
	group4	.020	.023	.044	.913	1.00
	equilibrium	.25	.24	.25	.25	

C. distributions: symmetrical preferences; asymmetrical information

		Source of Information				
		group 1	group 2	group 3	group 4	Σ
source of request	group1	.621	.041	.090	.248	1.00
	group2	.003	.775	.058	.164	1.00
	group3	.002	.027	.839	.132	1.00
	group4	.002	.014	.022	.962	1.00
	equilibrium	.01	.07	.14	.79	

D. distributions: symmetrical preferences; symmetrical information

		Source of Information				
		group 1	group 2	group 3	group 4	Σ
source of request	group1	.838	.052	.059	.051	1.00
	group2	.052	.850	.051	.047	1.00
	group3	.055	.053	.826	.067	1.00
	group4	.053	.061	.047	.839	1.00
	equilibrium	.25	.28	.24	.26	

Table 6. Agent-based simulations of cross-group communication for all subjects: group transition rates with implied equilibria.

A. distributions: asymmetrical preferences; asymmetrical information

		Source of Information				
		group 1	group 2	group 3	group 4	Σ
source of request	group 1	.951	.011	.011	.027	1.00
	group2	.000	.911	.024	.065	1.00
	group3	.000	.014	.898	.088	1.00
	group4	.000	.005	.024	.971	1.00
	equilibrium	.00	.07	.19	.74	

B. distributions: asymmetrical preferences; symmetrical information

		Source of Information				
		group 1	group 2	group 3	group 4	Σ
source of request	group1	.939	.029	.017	.014	1.00
	group2	.033	.913	.037	.017	1.00
	group3	.023	.033	.918	.026	1.00
	group4	.007	.020	.032	.941	1.00
	equilibrium	.25	.23	.25	.24	

C. distributions: symmetrical preferences; asymmetrical information

		Source of Information				
		group 1	group 2	group 3	group 4	Σ
source of request	group1	.853	.007	.025	.114	1.00
	group2	.000	.887	.027	.086	1.00
	group3	.001	.011	.894	.094	1.00
	group4	.002	.014	.029	.955	1.00
	equilibrium	.01	.10	.21	.67	

D. distributions: symmetrical preferences; symmetrical information

		Source of Information				
		group 1	group 2	group 3	group 4	Σ
source of request	group1	.888	.036	.031	.045	1.00
	group2	.038	.888	.041	.032	1.00
	group3	.024	.037	.904	.034	1.00
	group4	.032	.037	.032	.900	1.00
	equilibrium	.21	.24	.26	.26	

Table 7. Agent-based simulations of noise in cross-group communication for high cost subjects: candidates positioned at 1 and 7.

A. distributions: asymmetrical preferences; asymmetrical information

		Source of Information			
		group 1	group 2	group 3	group 4
source of request	group 1	.31	.55	.98	1.71
	group 2	-	.42	.68	1.27
	group 3	-	.65	.49	.88
	group 4	-	.82	.69	.61

B. distributions: asymmetrical preferences; symmetrical information

		Source of Information			
		group 1	group 2	group 3	group 4
source of request	group 1	.50	.79	1.22	1.68
	group 2	.81	.51	.80	1.21
	group 3	1.17	.77	.51	.78
	group 4	1.78	1.19	.81	.50

C. distributions: symmetrical preferences; asymmetrical information

		Source of Information			
		group 1	group 2	group 3	group 4
source of request	group 1	.52	.52	.58	.87
	group 2	-	.69	.70	.86
	group 3	0.26	.52	.81	.89
	group 4	0.26	.54	.64	1.05

D. distributions: symmetrical preferences; symmetrical information

		Source of Information			
		group 1	group 2	group 3	group 4
source of request	group 1	.85	.84	.82	.84
	group 2	.81	.86	.92	.78
	group 3	.76	.80	.87	.77
	group 4	.72	.88	.91	.87

Table 8. Agent-based simulations of noise in cross-group communication for high cost subjects: candidates positioned at 3 and 5.

A. distributions: asymmetrical preferences; asymmetrical information

		Source of Information			
		group 1	group 2	group 3	group 4
source of request	group 1	.10	.18	.33	.57
	group 2	-	.14	.23	.42
	group 3	-	.22	.16	.29
	group 4	-	.27	.23	.20

B. distributions: asymmetrical preferences; symmetrical information

		Source of Information			
		group 1	group 2	group 3	group 4
source of request	group 1	.17	.26	.41	.56
	group 2	.27	.17	.27	.20
	group 3	.39	.26	.17	.26
	group 4	.59	.40	.27	.17

C. distributions: symmetrical preferences; asymmetrical information

		Source of Information			
		group 1	group 2	group 3	group 4
source of request	group 1	.17	.17	.19	.29
	group 2	-	.23	.23	.29
	group 3	0.09	.17	.27	.30
	group 4	0.09	.18	.21	.35

D. distributions: symmetrical preferences; symmetrical information

		Source of Information			
		group 1	group 2	group 3	group 4
source of request	group 1	.28	.28	.27	.28
	group 2	.27	.29	.31	.26
	group 3	.25	.27	.29	.26
	group 4	.24	.29	.30	.29

Appendix

Table A1 shows the asymmetric and symmetric distributions both for agent preferences and for agent information levels. Part A of Table 5 and 6 employs asymmetrical preference distributions and asymmetrical information distributions. Part B employs asymmetrical preference distributions and symmetrical information distributions. Part C employs symmetrical preference distributions and asymmetrical information distributions. Part D employs symmetrical preference distributions and symmetrical information distributions.

Table A1. Symmetrical and asymmetrical preference and information distributions across groups.

A. symmetrical preference distributions across groups

Group 1			Group 2		
0	1	2	0	1	2
3	4	5	3	4	5
6	7	8	6	7	8
Group 3			Group 4		
0	1	2	0	1	2
3	4	5	3	4	6
6	7	8	6	7	8

B. asymmetrical preference distributions across groups

0	0	0	2	2	2
0	1	1	3	3	3
1	1	2	3	4	4
4	4	5	6	7	7
5	5	5	7	7	8
6	6	6	8	8	8

C. symmetrical information distributions across groups, randomly assigned within groups

0	1	1	0	1	1
2	2	2	2	2	2
3	4	4	3	4	4
0	1	1	0	1	1
2	2	2	2	2	2
3	4	4	3	4	4

D. asymmetrical information distributions across groups, randomly assigned within groups

0	0	0	1	1	1
0	1	1	2	2	2
1	1	1	2	2	2
2	2	2	3	4	4
2	2	2	4	4	4
3	3	3	4	4	4