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Real and Perceived Attitude Agreement in Social Networks

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It is often asserted that friends and acquaintances have more similar beliefs and attitudes than do strangers; yet empirical studies disagree over exactly how much diversity of opinion exists within local social networks and, relatedly, how much awareness individuals have of their neighbors' views. This article reports results from a network survey, conducted on the Facebook social networking platform, in which participants were asked about their own political attitudes, as well as their beliefs about their friends' attitudes. Although considerable attitude similarity exists among friends, the results show that friends disagree more than they think they do. In particular, friends are typically unaware of their disagreements, even when they say they discuss the topic, suggesting that discussion is not the primary means by which friends infer each other's views on particular issues. Rather, it appears that respondents infer opinions in part by relying on stereotypes of their friends and in part by projecting their own views. The resulting gap between real and perceived agreement may have implications for the dynamics of political polarization and theories of social influence in general.

Keywords: homophily, similarity, attitudes, perception, networks

The *homophily principle*, that "like associates with like," is one of the more pervasive empirical regularities of the social world. With respect to a wide range of sociodemographic attributes, such as education, income, gender, race, and age, numerous studies have found that couples, friends, coworkers, and members of informal organizations all tend to be more similar than randomly selected members of the same population (Kossinets & Watts, 2009; Lazarsfeld & Merton, 1954; McPherson, Smith-Lovin, & Cook, 2001). Given this plethora of findings, it is tempting to conclude that the same principle applies to psychological attributes like beliefs and attitudes as well—a conclusion that is consistent with theoretical arguments that like-minded individuals may prefer to associate with one another (Festinger, 1957) and experimental findings that processes of social influence (Cialdini & Goldstein, 2004; Deutsch & Gerard, 1955) tend to breed conformity (Asch, 1955; Bond & Smith, 1996; Sherif, 1937). Moreover, a number of authors have argued recently that homophily with respect to political attitudes and beliefs is increasing in America, with individuals sorting themselves into like-minded communities that serve as echo chambers for their existing opinions (Bishop, 2008; Sunstein, 2009). In contrast with these studies, however, other empirical evidence shows that conflicting attitudes can persist within social networks (Huckfeldt, Johnson, & Sprague, 2004; Nowak, Szamrej, & Latané, 1990) and that beliefs themselves are poorly correlated across different issues (Baldassarri & Gelman, 2008).

Recently it has been suggested that these seemingly contrary findings may derive from a difference between real and perceived attitude agreement[1]—specifically that people estimate that they are more similar to their friends than they really are (Baldassarri & Bearman, 2007; Gelman, Park, Shor, Bafumi, & Cortina, 2008; Robbins & Krueger, 2005). If, for example, it is true that friends generally avoid discussing politics (as is frequently recommended for polite company), then in the absence of specific information to the contrary, survey respondents may systematically overestimate the probability that their friends agree with them, an example of the "false consensus" effect (Krueger & Clement, 1994; Marks & Miller, 1987; Ross, Greene, & House, 1977). Alternatively, individuals may discuss only those matters on which they expect to find agreement or discuss them only with friends with whom they expect to agree, either of which could generate a sample of opinions that is biased toward agreement. Or finally, individuals may moderate or misrepresent their true views when conversing with friends, precisely so as to avoid the appearance of disagreement, and thereby reduce the likelihood of conflict. Although different, all these mechanisms would lead people to perceive greater agreement among their friends and to perceive greater alignment of views on different topics (e.g., that if A agrees with B on topic X, then he also agrees with B on topic Y) than is actually present. As an empirical matter, however, the difference between real and perceived agreement among friends remains unresolved.

In principle, it is straightforward to measure the difference between real and perceived agreement, by using some variant of a network or snowball survey in which, for each pair of friends (u, v) and each topic (q), one records u's response to q, v's response

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[1] Because *attitude homophily* is, in effect, the same thing as *attitude agreement*, we use the terms interchangeably, where it is understood that the agreement we are discussing is between friends. Where we refer to agreement between nonfriends, we use the term *baseline agreement*.

to q, and u's perception of v's response to q. For example, in Laumann's (1969) study of urban men, roughly one in four respondents was asked to name at random one of three friends described in their responses to be contacted for a subsequent interview. Laumann reported on the accuracy of participants' knowledge of friends' demographic characteristics and some of their attitudes expressed in the survey responses. More recently, Huckfeldt, Sprague, and Levine's (2000) study of attitudes toward Presidential candidates, conducted during the 1996 United States Presidential election campaign, included a subsample of 892 interviewees who were asked to name up to five contacts and were asked to assess their level of political expertise; of those named, 1,475 were then subsequently interviewed. Another recent example is Levitan and Visser (2009), who recruited college freshmen randomly assigned to dorms for a study on attitudes and assessed their attitudes as well as their beliefs about their friends' attitudes. Twenty-six percent of the friends listed happened to also be in the study, so the perception of similarity and true similarity could be considered for a subset of the listed network members. Finally, related studies have been conducted in the survey methodology literature under the rubric of *proxy reporting*, in which one respondent's response is used as a proxy for that of a close social tie, such as a spouse (Bickart, Menon, Schwarz, & Blair, 1994; Menon, Bickart, Sudman, & Blair, 1995; Sudman, Bradburn, & Schwarz, 1995).

Unfortunately the costs associated with interview-based methods typically preclude long batteries of questions about each of the named discussants. Thus, the scale and scope of such studies historically has been restricted either to a small number of questions (q) or a small number of dyads (u, v), or both (e.g., the proxy-reporting studies described above examine attitude similarity only for isolated dyads, not for multiple neighbors of the same respondent).[2] From a practical perspective, therefore, the social networking site Facebook offers some advantages for conducting large-scale network survey work. In particular, Facebook provides a readymade "social graph" on which third party developers can build applications, including surveys, through an Application Programming Interface (API; see http://www.facebook.com/apps/ for examples). By using the Facebook API, a survey tool can potentially reach thousands, or even millions, of respondents at very little cost and in a short period of time. Clearly one cannot guarantee either that a user's close friends will be named on their profile (because, for example, they are not members) or that friends who are named are necessarily the most relevant to a user's political beliefs and attitudes. However, previous work suggests that most Facebook ties reflect real, offline relationships (Ellison, Steinfeld, & Lampe, 2007). Moreover, it is possible to restrict attention only to ties that satisfy additional criteria, such as multiple mutual friends and shared affiliations, which are more likely to be salient to political attitudes. Finally, we note that traditional respondent-driven network samples are also subject to at least two potential sources of bias. First, which friends a respondent volunteers to be recruited can be biased by their memory or motivations (Tversky & Kahneman, 1973). And second, discussants are typically identified by asking respondents to name individuals with whom they discuss "important matters" (Huckfeldt, 2001), yet questions of this sort have been shown to yield highly variable results, depending on the respondents' interpretation of the question (Bearman & Parigi, 2004). Thus, although it is imperfect, collecting network-oriented data on Facebook represents a fast, convenient, and relatively reliable alternative to traditional survey methods.

Method

Our survey application was launched in January 2008 and was added by 2,504 individuals over the following 4-month period of the study.[3] After adding the application, subjects answered binary (yes/no) questions about their own attitudes, as well as about their friends' attitudes. Our study focused on political attitudes which were particularly relevant at the time of the study, during the early stages of the U.S. Presidential election campaign, and which individuals were therefore likely to have discussed with their friends. Forty-seven questions were adapted from the General Social Survey (GSS; http://www.norc.org/GSS+Website/) and organized into several categories: moral (10), civil rights (10), foreign affairs (10), economic (10), political engagement (five), and political affiliation (two). Although the substantive content of the questions was similar to that in the GSS, the wording was altered as necessary to apply to a respondent's friends, rather than the respondent him/herself. In the "foreign affairs" category, for example, a respondent might be asked, "Does [your friend] sympathize with the Israelis more than the Palestinians in the Middle East situation?" whereas in the "economics" category, they might be asked, "Would [your friend] pay higher taxes for the government to provide universal health care?"

In addition to asking questions about specific attitudes, we also asked subjects a number of questions to assess their (and their friends') levels of engagement with politics, asking, for example, about how frequently they read newspapers and whether or not they intended to vote in the 2008 Presidential election. We also asked about their overall political orientation—for example, "Does [your friend] identify more with the Democrats than the Republicans?" and "Does [your friend] identify more with liberal than with conservative ideology?" And we asked them if they discussed politics with particular friends, thus enabling us to test separately for the effects of interacting about political matters specifically. Subjects were given the option of skipping any question in case they did not know the person well enough to make an informed guess about their opinion, or if they did not believe their friend would have an opinion on the matter. In all cases, when answering questions about themselves, subjects could also skip questions or specify that they did not want their answer revealed to their friends. Finally, to make the application more entertaining and thereby improve response rates, we interspersed the political ques-

[2] We also note that the objectives of proxy-reporting studies are quite different from ours. In particular, whereas the former are motivated by the validity of proxy reports as a substitute for self-reports—as a means, for example of reducing the costs associated with survey-based market research (Menon et al., 1995)—we are primarily interested in the substantive issue of real versus perceived attitude agreement.

[3] Subjects were primarily recruited by (a) announcing the application on an internal e-mail list of Yahoo! employees, (b) e-mailing participants in a previous study who had requested to be notified about future experiments, and (c) purchasing Facebook advertising. In addition, there was a word-of-mouth effect, with subjects learning about the application through their friends.

tions with a number of light-hearted questions. For example, subjects might have been asked, "Would [your friend] rather drink wine over beer?" or "Would [your friend] rather have the power to read minds, instead of the power to fly?" In addition to livening up the application for users, we used the light-hearted questions to check for differences between respondent accuracy and perceptions on serious versus frivolous matters. As discussed later, in spite of the differences in subject matter, the patterns observed for the two sets of questions were surprisingly similar.

For the forty-seven political questions, we analyzed 12,163 complete response dyads (u, v, q) for 900 individuals, where complete means that (a) u and v both answered the same question q, (b) u also guessed about v's answer to q, and (c) either u or v declared whether or not the pair has discussed politics.[4] The mean number of political questions these users answered about themselves was 21.0 ($Mdn = 14$), and the mean number of guesses about others was 17.6 ($Mdn = 7$). For 59% of pairs surveyed, at least one person responded that the pair had discussed politics; and in 78% of these instances, the other member of the pair agreed. We also measured how well pairs of friends knew each other, determined by their number of mutual friends, a common indicator of tie strength (Granovetter, 1973; Marsden, 1984). Finally, for the light-hearted questions, we recorded 9,034 complete response dyads, covering 872 users.

Our population was relatively diverse in age and geographical location and was balanced by gender. Of the 2,504 users who added the application, about half of the users (56%) declared their age, with an average of 29 years (see Figure 1); and 40% (1,002 users) provided their current place of residence, from which we observe that the top U.S. states were California (20%) and New York (12%), followed by Texas (5%), New Jersey (5%), Illinois (5%), Florida (4%), Pennsylvania (4%), Michigan (3%), Maryland (3%), and Massachusetts (3%). Finally, 83% declared their gender, of which 51% were female. In spite of this demographic diversity, our sample population was not representative of the general U.S. population, as one might expect given the likelihood of biased selection both to Facebook as a whole and to our application. In particular, our respondents displayed a heavy liberal bias: 77% described themselves as more sympathetic to the Democratic versus the Republican party, and 79% claimed to have a liberal versus conservative outlook. Clearly these numbers are strikingly different from those for the general U.S. population; thus, we can draw no conclusions from our study regarding, say, the political views of Americans.

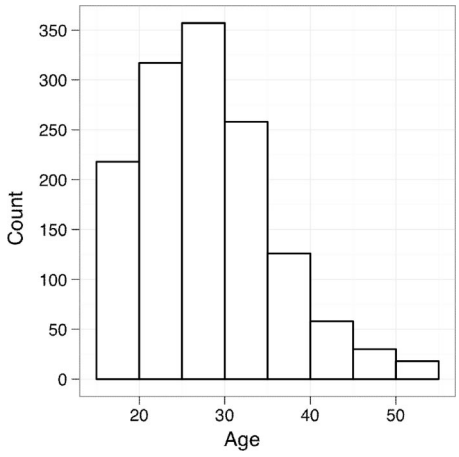

Figure 1. Distribution of respondent ages (average age is 29 years).

We emphasize, however, that the nature of our study does not require our population to be representative in terms of their actual beliefs for our results to have external validity. The reason is that our main interest is not attitudes per se, or even levels of agreement between friends, but rather agreement between friends measured relative to the baseline agreement (McPherson et al., 2001) of our population. Thus, even if the sample population as a whole is biased with respect to overall agreement (or lack of diversity), the difference between friends and strangers within the same population is still informative. In other words, the effects we are interested in concern not the baseline beliefs or perceptions of the population but the marginal effect of friendship on (a) real and (b) perceived similarity relative to pairs drawn randomly from the same (i.e., sample) population. By studying only this marginal effect of friendship, we can effectively net out much of the bias present in our sample, thereby improving the external validity of the results. As discussed in the next section, we also employed some statistical techniques that effectively bound the remaining bias and find it to be small.

Results

Real Attitude Agreement

To address our question regarding real versus perceived attitude agreement in social networks, we first consider the relationship between *actual attitude agreement*, quantified as the probability that two friends agree on a particular issue (q), and *baseline agreement* (McPherson et al., 2001), defined as the same probability for pairs drawn at random from our population. Analyzing first the raw data, Figure 2A shows that actual agreement was greater than baseline agreement for all political questions: On average, friends agreed with each other 75% of the time, whereas randomly matched pairs agreed only 63% of the time. From these raw estimates, it seems clear that the marginal effect of friendship is, on average, around 12%, consistent with the conventional wisdom that friends agree more than strangers (Bishop, 2008; McPherson et al., 2001; Sunstein, 2009). We note, however, that the probability that two friends will agree on a particular issue is likely to depend on at least three factors: (a) the strength of the tie between them, (b) whether or not the pair discussed politics, and (c) the overall level of agreement on that question over the sample population. For all three reasons, estimates based on the raw data may be somewhat misleading.

[4] In addition to the set of complete dyads, we also analyzed two much larger sets of partial dyads, for which we have some information about the opinions or perceptions of individuals but lack the full set of responses required for a complete dyad. The first set consists of dyads (u, v, q), such that u answered the question q, and u guessed about v's answer to q, but v did not answer the question. In total, there were 28,001 of these partial dyads, covering 1,349 distinct users. The second set of partial dyads (u, v, q) is incomplete in that v answered the question q, and u guessed about v's answer to q, but u did not answer the question. In total, there were 20,771 of these partial dyads, covering 1,011 distinct users.

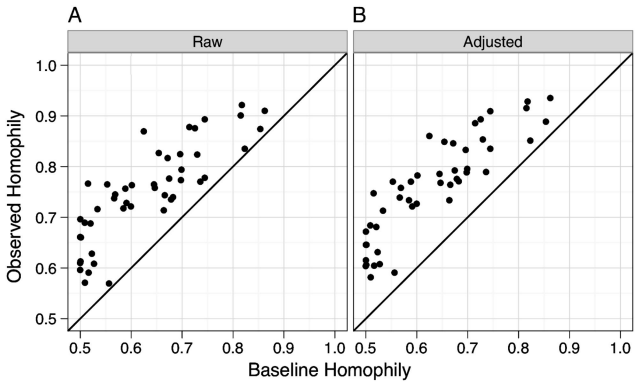

Figure 2. Plot of actual agreement between friends versus baseline agreement (i.e., between random pairs) for all questions. Each symbol represents the average observed agreement between friends and the baseline agreement for the sample population for a given question. A is based on the raw data, whereas B displays estimates adjusted via the regression model.

To correct for these sources of variation, we first fit a logistic regression to our data and then used the model itself to estimate various properties of interest. For example, many questions of interest to sociologists and political scientists record agreement levels close to 50% in the overall U.S. population. Because we find that randomly selected members of our sample population agree, on average, 63% of the time, there is clearly less potential for increased agreement in our sample than in the world at large; thus, it seems likely that our raw marginal effect of friendship will be systematically biased downward. By substituting the appropriate value for overall agreement in our model, we can therefore estimate the probability that two friends will agree on a hypothetical "perfectly divisive" question (i.e., one that attracts 50% agreement). Likewise, we can estimate the probability of agreement between a hypothetical typical pair of friends—defined as friends who share 10 mutual friends and who have a 50% chance of having discussed politics—thereby obtaining a more representative estimate than a simple average of the raw data. Finally, we can use our model to estimate how the probability of agreement would change if one member holds, say, a particularly unpopular (minority) view, or if the tie between friends is particularly strong or weak, without necessarily requiring that our population exhibit representative fractions of these variables. In later sections, we estimate similar models for perceived agreement and the probability that a respondent will correctly guess a friend's opinion as a function of whether or not they actually agree or disagree.[5]

In estimating these regression models, we also wish to account for two additional sources of bias in our data. First, some individuals answered many more questions than others; thus, to the extent that these individuals were not representative of the sample population, the resulting raw estimates would be biased. And second, it is also possible that different questions were answered more frequently by some types of individuals than by others (although this is less likely), once again leading to biased estimates. To account for both sources of potential bias, we therefore fit multilevel logistic regression models, also known as hierarchical logistic models (Gelman & Hill, 2007). Multilevel/hierarchical models can be viewed as a compromise between two extreme approaches to the data, where at one extreme, we would pool responses across all dyads (i.e., fit standard logistic regression), and at the other extreme, we would compute coefficients independently for each individual and each question. The main advantage of hierarchical logistic models in this context is that they are designed to find the optimal level of pooling, accounting for the variance across respondents and questions.[6]

Specifically, to estimate the probability that u agrees with friend v on question q, we fit the response dyads (u, v, q) to a model of the form:

$$Pr(w_i = 1) = logit^{-1}(\mu + \lambda_u[\mathrm{i}] + \eta_q[\mathrm{i}] + \alpha_q[\mathrm{i}] \times discuss_i + \beta_q[\mathrm{i}] \times strength_i + \gamma_q[\mathrm{i}] \times overall.agreement_i), \quad (1)$$

where the binary response variable w_i equals 1 if u agreed with v on question q in the ith response dyad and w_i equals 0 otherwise, μ is the overall intercept, and $\lambda_u[\mathrm{i}] \sim N(0, \sigma_\lambda)$ and $\eta_q[\mathrm{i}] \sim N(0, \sigma_\eta)$ are adjustments to the intercept for each user and each question, respectively. We also include $\alpha_q[\mathrm{i}] \sim N(\mu_\alpha, \sigma_\alpha)$ as the coefficient for a dummy variable indicating whether u and v discuss politics, $\beta_q[\mathrm{i}] \sim N(\mu_\beta, \sigma_\beta)$ as the coefficient for the number of mutual friends between u and v and $\gamma_q[\mathrm{i}] \sim N(\mu_\gamma, \sigma_\gamma)$ as the coefficient for *overall.agreement*, the fraction of users in our dataset that agreed with user $u[\mathrm{i}]$ on question $q[\mathrm{i}]$. After fitting the model to the data (see Table 1), we can estimate the probability of agreement for given values on any of the variables. Figure 2B shows the adjusted results for agreement between friends versus baseline agreement, where *strength* was set to 10, in line with the average number of mutual friends observed in our sample, and *discuss* was set to 0.5. As is visually apparent from the two figures, the model-adjusted agreement (76%) is almost identical to the raw agreement (75%). In other words, whether or not we correct for variance in the data, we find that friends, on average, are about 13 percentage points more similar with respect to their attitudes than strangers.

Although this estimate corrects for variability in response rates and tie strength, it does not account for the overall bias in our data discussed previously—namely that individuals in our sample tend to agree more on average (63%) than do members of the overall U.S. population. Clearly, friends' propensity to agree on any given issue is strongly related to global agreement on that issue: If the vast majority of people agree on issue X, then it is likely that friends will tend to agree on X as well. Because all of our questions exhibited greater than the 50% theoretical lower limit of overall population agreement, it follows that if we had instead asked only questions on which our respondents were perfectly divided at 50% each way, we would expect agreement between friends to be less than the 76% we actually observed. In addition to this obvious

[5] For all our models, we also report the value and significance of the coefficients (see Tables 1 and 2); however, our emphasis is on estimating effect sizes, not on interpreting the coefficients.

[6] We also performed two robustness checks on our estimates. First we recomputed all estimated effects using standard logistical regression models (i.e., assuming complete pooling), finding almost identical results. And second, we recomputed our raw results (e.g., agreement, perceived agreement) by first averaging the quantity of interest over each individual and then computing the average across individuals, again finding almost identical results.

Table 1
Coefficients for Regression Models Corresponding to Real Agreement (Equation 1), Perceived Agreement (Equation 2), and Accuracy (Equation 3)

	Real agreement		Perceived agreement		Accuracy	
Covariate	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*
Intercept (μ)	-1.47^{**}	0.11	-1.00^{**}	0.13	-0.22	0.12
Discuss politics (α)	0.26^{**}	0.06	0.20^{*}	0.075	0.30^{**}	0.061
Tie strength (β)	0.13^{**}	0.004	0.005	0.003	0.013^{**}	0.003
Overall agreement (γ)	3.91^{**}	0.15	4.21^{**}	0.13	2.01^{**}	0.16

* $p \leq .05$. ** $p \leq .01$.

effect it may also be the case that our estimate of the marginal effect of friendship (i.e., 13%) may change as well—in other words, that the estimate is biased not only by variance in response rates and tie strength but also by the overall level of agreement of the questions we asked in the survey.

To correct for this additional source of bias, we use the regression model, Equation 1, to compute the expected results of a hypothetical survey composed entirely of perfectly divisive questions, setting the *overall.agreement* parameter in the model to 0.5. Furthermore, as above, to find these estimates for a typical friend, *strength* was set to 10 and *discuss* was set to 0.5. Following this procedure, we compute a normalized agreement of 67%—meaning, in other words, that for some hypothetical question on which members of our sample agree 50% of the time, the typical friend would be expected to agree, on average, 67% of the time. Although many questions of interest are not perfectly divisive in this sense, a number of important issues (e.g., party affiliation) do exhibit close to 50% agreement across the entire U.S. population. Thus, although we still cannot claim this result is representative outside of our particular sample, it supports our earlier speculation that the difference between friends and strangers may be somewhat larger than is apparent in our sample data—a marginal effect of 17 percentage points.[7]

Finally, as discussed earlier, we can also use our model to estimate agreement for "strong ties" and "weak ties", respectively, where strong ties are defined to have 20 mutual friends (*strength* = 20) and to have discussed politics (*discuss* = 1), and weak ties are defined to have no mutual friends and not discuss politics. Again setting overall agreement to 50%, Figure 3 (dashed line) shows that agreement for weak ties (62%) is considerably lower than average (67%), and agreement for strong ties (73%) is higher by about the same amount. Merely discussing politics, moreover (i.e., holding the number of mutual friends fixed at its average value of 10) corresponds to 70% agreement, three percentage points above average.

To summarize our findings with respect to real attitude agreement, these results can be read in one of two ways. On the one hand, friends clearly agree more than strangers, and the effect is large—17 percentage points on average and 23 points for close friends who discuss politics. On the other hand, even close friends still disagree almost 30% of the time—a result that seems consistent with previous findings on disagreement—and acquaintances may disagree on nearly 40% of issues. Thus, although our findings are consistent with claims that Americans exhibit homophily with respect to their political beliefs, it is not clear that these levels of attitude agreement would, on their own, prevent a typical individual from being exposed to a diverse range of opinions.

Perceived Attitude Agreement

Next, we consider our second question regarding the awareness of diversity by examining the difference between actual and perceived agreement, quantified as the likelihood that a respondent *u* guesses that their friend *v* holds the same opinion as themselves about issue *q*. Once again starting with the raw data, Figure 4A shows that respondents consistently perceived their friends as agreeing with them more than they actually did across all political questions, confirming previous claims that friends are less similar than they think they are (Baldassarri & Bearman, 2007). In quantitative terms, averaging across all dyads, perceived agreement was 80%, versus 75% actual agreement. To understand this difference better, we again fit the response dyads (*u, v, q*) to a model of the form:

$$Pr(y_i = 1) = logit^{-1}(\mu + \lambda_u[\mathrm{i}] + \eta_q[\mathrm{i}] + \alpha_q[\mathrm{i}] \times discuss_i + \beta_q[\mathrm{i}] \times strength_i + \gamma_q[\mathrm{i}] \times overall.agreement_i). \quad (2)$$

This model is the same as in Equation 1, only here the binary response variable y_i equals 1 if *u* guessed that *v* agreed with him or her on question *q* in the *i*th response dyad and equals 0 otherwise.

As before, we estimate the effects on perceived agreement of discussing politics, tie strength, and overall agreement (see Table 1), and then use the model to compute corrected values of perceived versus real agreement (see Figure 4B). A comparison between Figures 4A and 4B indicates that the difference between real and perceived agreement is greater for typical ties than is indicated by the raw data. In addition to controlling for variability, we again use the model to predict perceived agreement for a hypothetical perfectly divisive question and for a typical friend by setting the *overall.agreement* to 0.5, *strength* to 10 (the average number of mutual friends in our sample), and *discuss* to 0.5. Normalized in this way, we estimate perceived agreement for the typical friend on a perfectly divisive question to be 78%, compared

[7] In fact, because our sample exhibits homophily on attributes such as race, occupation, and so on that correlate with political attitudes, 50% agreement in the general population would likely correspond to greater than 50% agreement in our sample; consequently, this estimate of 67% is still a lower bound.

with 67% actual agreement. Finally, we note an interesting difference between real and perceived agreement for strong and weak ties. Clearly, one would expect that individuals who are close friends and who discuss politics would be more similar than friends on average (Laumann, 1969), as we indeed find. However, as shown in Figure 3, we also find that although perceived agreement for strong ties is higher than for weak ties (80% vs. 75%), the difference between perceived and real agreement is much smaller (7% vs. 13%).

To summarize our results so far, it appears that much of the diversity of opinions that exists in social networks is not apparent to their members. Moreover, the difference between real and perceived agreement is almost twice as large for weak ties as for strong ties. In other words, friends consistently overestimate their similarity with one another, but the relative insensitivity of perceptions to tie strength leads them to do so much more for casual acquaintances than for good friends. It may not be surprising, of course, that one can estimate the beliefs of close friends more accurately than those of casual acquaintances, about whom one presumably has less information. However, given that people often have more invested in close relationships, they may also be less willing to admit disagreement. Thus, it is interesting that study participants overestimate similarity so much more with casual acquaintances than with close friends. As indicated graphically in Figure 3, in fact, the difference between perceived and real similarity for weak ties (13%) is almost as large as the (real) difference between friends and strangers (17%). In other words, errors in the perception of agreement can be as large as the actual agreement effect itself, a finding that may help explain some of the more dire recent assessments of attitude agreement in the United States (Bishop, 2008; Sunstein, 2009).

Accuracy, Sensitivity, and Specificity

Another way to measure the difference between real and perceived agreement is in terms of how accurately respondents perceive their friends' true attitudes and beliefs, as well as how

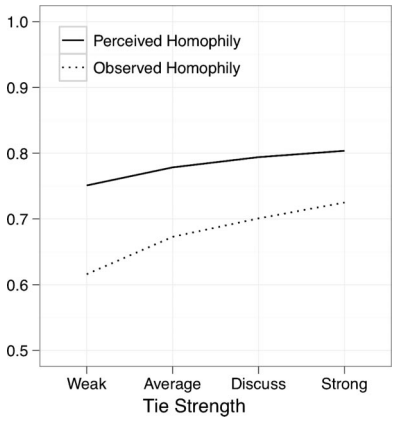

Figure 3. Estimated effects of tie strength on observed agreement and perceived agreement. A pair of friends are defined to be "weak" ties if they have no mutual friends and they do not discuss politics, "average" indicates 10 mutual friends, "discuss" indicates 10 mutual friends and that the pair discusses politics, and "strong" indicates 20 mutual friends and that the pair discusses politics.

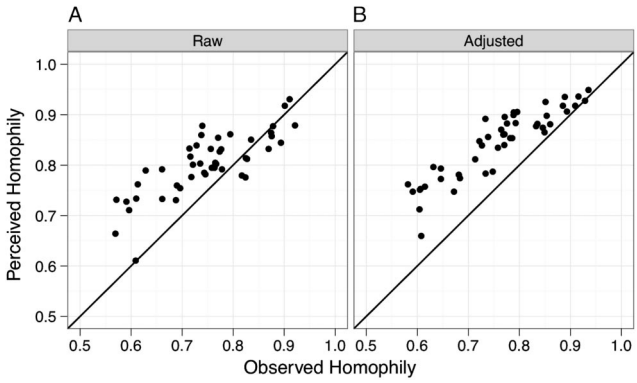

Figure 4. Average perceived agreement versus the average actual agreement between friends; each symbol corresponds to a single question. A is based on the raw data, whereas B displays estimates adjusted via the regression model.

accuracy varies with tie strength (Hoch, 1987). As before, we investigate this question by fitting the response dyads (*u, v, q*) to a model of the form:

$$Pr(z_i = 1) = logit^{-1}(\mu + \lambda_u[\mathrm{i}] + \eta_q[\mathrm{i}] + \alpha_q[\mathrm{i}] \times discuss_i + \beta_q[\mathrm{i}] \times strength_i + \gamma_q[\mathrm{i}] \times overall.agreement_i), \quad (3)$$

where the model is the same as in Equation 1, except that the binary response variable z_i equals 1 if u correctly guessed v's response to q (see Figure 5 and Table 1). We once again normalize baseline agreement to 50%. As Figure 6 shows, we find that participants correctly predicted a typical friend's responses approximately 74% of the time, a result that lies between accuracy for political attitudes in Levitan and Visser's (2009) study (91%) and accuracy on political affiliation (51%) in Laumann's (1969) study. Moreover, we find that the difference in accuracy between

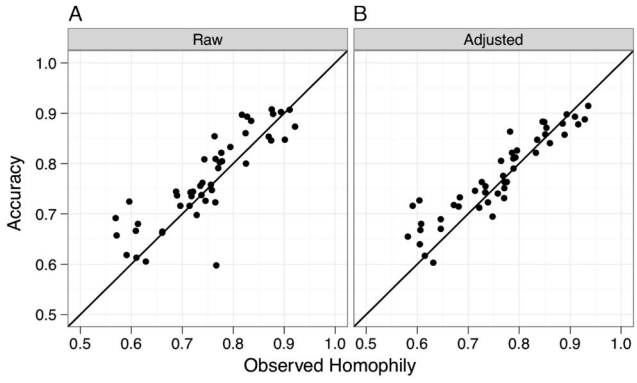

Figure 5. Predictive accuracy and true agreement between friends. Plot of average accuracy versus average agreement between friends, for all questions (where each symbol corresponds to a single question. A is based on the raw data, whereas B displays estimates adjusted via the regression model.

strong ties (79%) and weak ties (68%) is 11%—mirroring that for real agreement—and that discussing politics alone typically boosts accuracy by six percentage points, from 71% to 77%. We emphasize this last result for two reasons: First, discussing politics does indeed correlate with greater awareness of friends' political attitudes, consistent with the view that deliberation is associated with understanding;[8] but second, this improvement is a relatively small contribution to overall accuracy. Apparently, in other words, most of what people know about each other does not come from discussing politics.

In the following section, we examine in greater detail the issue of how friends do infer each other's views. Before proceeding, however, it is helpful to pay special attention to instances in which they disagree. Awareness of disagreement, moreover, has special substantive significance, as the benefits of deliberation would seem to accrue most in instances where people actively discuss their disagreements. To quantify this effect, we separately estimate respondent sensitivity p(correctly guessing given their friends in reality agree with them) and specificity q(correctly guessing given their friends in reality disagree with them), using the following model:

$$Pr(z_i = 1) = logit^{-1}(\mu + \lambda_u[\mathrm{i}] + \eta_q[\mathrm{i}] + \alpha_q[\mathrm{i}] \times discuss_i + \beta_q[\mathrm{i}] \times strength_i + \gamma_q[\mathrm{i}] \times overall.agreement_i + \delta_q[\mathrm{i}] \times reality.agree). \quad (4)$$

This model is identical to the overall accuracy model, Equation 3, discussed previously, except that an additional parameter $\delta_q[\mathrm{i}] \sim N(\mu_\delta, \sigma_\delta)$ has been added to indicate whether or not u and v in reality agree (see Table 2). Once again, we use the fitted model to adjust for variance in the data. As Figure 6 indicates, we find that when individuals in reality agree with their friends, they guess correctly about 90% of the time (high sensitivity); but when they disagree, they guess correctly only about 41% of the time (low specificity). As expected, both sensitivity and specificity are higher for strong ties and lower for weak ties, but it is notable that specificity remains low (46%) even for strong ties. In other words, when friends disagree, more often than not they are unaware of this disagreement, even when they are good friends who say they discuss politics.

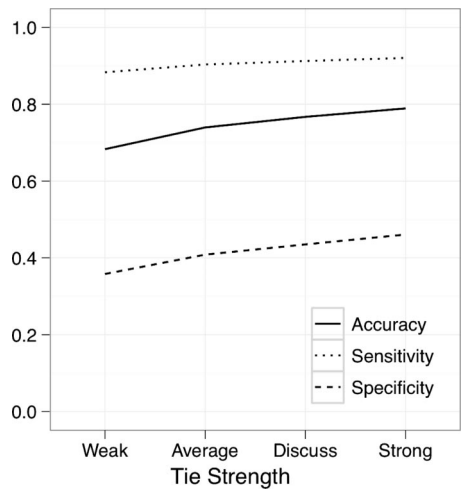

Figure 6. Estimated effects of tie strength on accuracy. Sensitivity and specificity indicate accuracy in instances where pairs of friends in reality agree, and in reality disagree, respectively.

Table 2
Coefficients for Equation 4, Corresponding to Sensitivity and Specificity

	Accuracy	
	Estimate	*SE*
Intercept (μ)	-0.61^{**}	0.13
Discuss politics (α)	0.25^{**}	0.073
Tie strength (β)	0.010^{*}	0.003
Overall agreement (γ)	.041	0.17
Dyad agreement (δ)	2.64^{**}	0.11

To put these numbers in context, recall that, in addition to asking serious questions about politics, we also asked a number of light-hearted questions about matters that were mostly trivial or silly (e.g., "Would [your friend] rather have the power to read minds or to fly?"). We do not present a detailed analysis of these questions here, but all measures of agreement were lower than for the serious questions, as indeed one might expect, given how unlikely many of them are to be active matters for discussion. What is more surprising, however, is that the 9% difference between perceived agreement (70%) and real agreement (61%) for the perfectly divisive light-hearted question was about the same as for the perfectly divisive question about politics (11%). Overall accuracy was lower (66%), as was sensitivity (83%). Specificity, however, remained effectively unchanged (41%). In other words, participants were no more likely to be aware of disagreements regarding serious matters of politics, religion, and culture than they were for silly matters of obviously low salience.

Analysis of Awareness

Superficially, the results of the previous section would seem to support the view that friends don't talk about politics and so should not be expected to know each other's opinions. No doubt, this view is partly correct, but it fails to explain why friends who say they do talk about politics—and who do indeed know more about each other's views—are still so poor at detecting disagreement. Nor is the observation easily explained in terms of friends simply avoiding topics on which they might disagree—they may, of course, do exactly that, but it is unclear how they would do it without perceiving the disagreement in the first place. That is, even if it is true that friends who already agree with each other are more likely to discuss politics than those who don't, this effect would not explain why neither group is aware of their disagreements. Rather, it seems that even when friends do talk about politics, they are not discussing many of the actual issues, like immigration, tax policy, or the war in Iraq, suggesting that whatever strategy our respondents are using to predict their friends' views, it is generally not based on knowledge obtained through discussion.

[8] Naturally, friends who talk about politics may simply know each other better; thus, no causation can be asserted.

What strategy are they using then? One possibility is that respondents have a general impression of each friend—as someone with whom they generally agree or disagree—that is based in part on observable attributes, like education and occupation, and in part on discussions they have had about certain matters; and this general impression is then used to infer their views on matters they have not actually discussed. Although plausible, this hypothesis implies an empirical prediction that guesses about agreement should be correlated, meaning that if u guesses "agree" with v on one issue X, he or she is more likely than average to guess "agree" with v on issue Y as well. In contrast, as shown in Figure 7, we found that the overall pairwise correlation of perceived agreement on issues is close to zero (0.08) and remains small even within question category (e.g., foreign affairs; ranging from 0.04–0.15). Correlation of perceived agreement on political affiliation with perceived agreement on specific issues is higher, as one might expect, but still only 0.17. Apparently, therefore, respondents do not primarily base their guesses on their overall level of perceived agreement with specific friends.

Another possibility is that respondents simply guess "agree" more than they should—in fact, as Figure 5 indicates, overall accuracy is not very different from the mindless strategy of "always guessing agree" (corresponding to the diagonal line). A strategy of this kind would be expected to work reasonably well overall (Hoch, 1987; Kenny & Acitelli, 2001) but very badly in instances of disagreement, as we indeed see. However, there are, in fact, two ways in which the effect could arise, which we refer to as the *projection* and *stereotyping* hypotheses, respectively. The *projection* hypothesis assumes that respondents believe that their friends think the same as they do (Krueger, 2007; Krueger & Stanke, 2001), ignoring general information that they have about their friends. Conversely, the *stereotyping* hypothesis assumes that respondents do not use their own beliefs to infer their friends' beliefs but, instead, make inferences based on their friends' general characteristics.[9] Using a stereotyping strategy, for example, knowing that my friends are mostly educated, affluent, urban-dwelling young professionals, and assuming that the majority of such people support a liberal political agenda, it is reasonable for me to assume that my friends are liberals, regardless of my own views. Alternatively, I may know that friends tend to have similar attitudes; thus, if I hold liberal views, it is likely that my friends do too—a social projection approach.

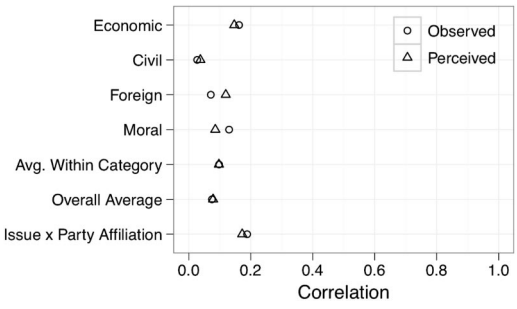

Figure 7. Average real and perceived pair-wise correlation of agreement on issues for each of the four substantive issue categories. The final row corresponds to average correlation of agreement on issues and agreement on party affiliation.

Previous work on proxy reporting (Bickart et al., 1994; Menon et al., 1995; Sudman et al., 1995) has not differentiated between these two hypotheses, in part because it is not always possible to do so: If, as is often the case, respondents are embedded in highly homogenous networks of opinions, then the two strategies will yield indistinguishable answers. However, in instances where individuals are not surrounded by like-minded others, the two strategies lead to different results—specifically, minority opinion holders should predict agreement less often than their majority peers if they are using a stereotyping strategy and no differently if they employ projection. To give a hypothetical example, a politically conservative member of an Ivy League sociology department may suspect that he is surrounded by liberal-minded colleagues and therefore assume that his friends are likely to disagree with him: a stereotyping approach. Alternatively, if he employs a projection approach, he will tend to assume that they agree with his views, in which case he would underestimate their liberal mindedness.

To differentiate between projection and stereotyping effects, we exploit the presence in our sample of majority and minority opinion holders, where minority opinion holders are defined to be those with whom 40% of our sample agrees, and majority opinion holders to be those with whom 60% of the sample agrees.[10] Specifically, estimates for majority and minority opinion holders were obtained by varying the *overall.agreement* variable in the regression models (see Equations 1–4). Our results suggest that respondents use a combination of both the projection and the stereotyping strategies. To begin with, Figure 8 shows that both those in the minority and the majority were more similar to their friends than to strangers: Whereas minority opinion holders by definition agreed with only 40% of the population, they typically agreed with 58% of their friends; and majority opinion holders typically agreed with 75% of their friends, whereas they agreed with only 60% of the population. Those in the minority typically agreed with far fewer of their friends than did those in the majority, implying that they maintain more diverse groups of friends than majority opinion holders—a result that has been found previously for observable attributes like race (Blau & Schwartz, 1984).

With regard to perception of agreement, we see that people in the minority typically believe that 70% of their friends agree with them—a 12% increase over actual agreement—and people in the majority typically believe that 84% of their friends agree with them—a 9% bump over actual agreement. Minority opinion holders, that is, are clearly aware that their friends are more likely to

[9] Our distinction parallels the similarity contingency model (Ames, 2004), in which prevalence estimates for an unknown attribute of a group are constructed using projection and stereotyping, with perceived similarity to the group moderating the extent to which projection is used over stereotyping. In our case, however, rather than gauging attitudes of an abstracted group, study participants estimate their friends' attitudes. Although it is generally believed that stereotypes are not applied to close individuals (Brewer, 1988), prior work suggests that people do not always have accurate knowledge of the attitudes of close others (Kenny & Acitelli, 2001; Lerouge & Warlop, 2006) and that insufficient individuating information can actually increase the use of stereotypes (Yzerbyt, Scahdron, Leyens, & Rocher, 1994).

[10] We choose these values because they reflect the most extreme differences in distributions of political affiliations observed across U.S. states (Gelman et al., 2008).

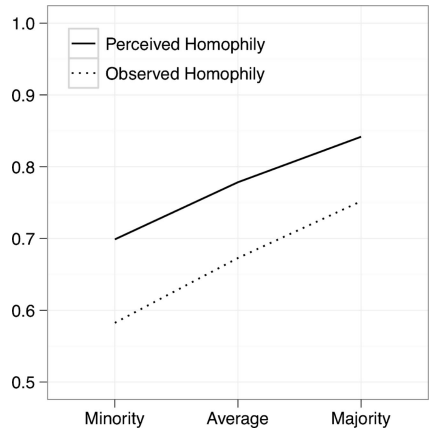

Figure 8. Comparison of observed and perceived agreement for minority and majority opinion holders. "Minority" corresponds to hypothetical participants with whom 40% of the general study population agrees, and "majority" corresponds to hypothetical participants with whom 60% of the population agrees.

disagree with them, and they attempt to adjust for their minority status, as would be expected if they were using stereotypes. Nevertheless, they still overestimate how much their friends actually agree with them—even more so than do majority opinion holders—thus, they also appear to exhibit a propensity to anchor off of their own views when predicting the views of others. One result of this latter propensity is that minority opinion holders are less accurate (70%) than those in the majority (78%), a difference of 8% (see Figure 9).

In summary, our results suggest that although respondents exist in largely homogenous networks, they are still exposed to considerable disagreement; however, they are surprisingly bad at perceiving this disagreement. Although they are reasonably accurate in reporting their friends' views about political matters, their high overall accuracy is largely an artifact of their general tendency to agree, not of issue-specific awareness. In particular, although we find that friends do sometimes talk about politics and that friends who talk about politics do know more about each other's views, the effect of discussing politics has a relatively small impact, and respondents are typically unaware of differences of opinion in their social circles. Respondents, moreover, do not seem to base their perceptions of their friends' views on issue-specific discussions but, rather, on some combination of their own opinions (projection) and of general knowledge about their friends (stereotyping), a pattern that applies equally to majority and minority opinion holders.

Discussion

The tendency of politically like-minded individuals to cluster together has long been associated with negative social consequences, such as political polarization (Abramowitz & Saunders, 2008; Bishop, 2008; DiMaggio, Evans, & Bryson, 1996; Sunstein, 2009) and alienation (Adar & Adamic, 2005). In light of this concern, our results can be read both in positive and negative light. On a positive note, we find that although attitudes do exhibit a high degree of agreement, consistent with previous studies (McPherson et al., 2001), social networks are probably not as homogenous as the people in them think they are. Individuals, in other words, are indeed surrounded by like-minded others but are also probably surrounded by a greater diversity of opinions than is sometimes claimed (Bishop, 2008; Sunstein, 2009). On a negative note, however, we find that although friends who say they talk about politics do indeed know more about each other's opinions—including when they disagree—the benefits of discussion seem to be small. Instead, most of what people "know" about their friends they seemingly infer from indirect evidence—either by invoking stereotypes of their friends or by projecting their own views onto their friends—rather than from actual discussions about the issues themselves. As a result, even relatively good friends who say they talk about politics are typically unaware of the issues on which they disagree. If the basis of a healthy polity is that ordinary people educate themselves politically through deliberation with their friends and neighbors, the observation that, in fact, little of this discussion is sufficiently detailed that friends know each other's views on matters like immigration, tax policy, or the Iraq war is one that is worth understanding better.

Although tentative, the conclusion that friends generally fail to talk about politics, and that when they do, they simply do not learn much from their conversations about each other's views, is supported by anecdotal evidence from our study participants, some of whom reported that their experience with the application was occasionally jarring, precisely because they felt that they should have known what their friend (or in some cases, spouse) thought about some particular issue and were disconcerted to discover, upon being asked, that they did not. Correspondingly, users found that the guesses of their friends and coworkers about their own beliefs and attitudes were surprisingly inaccurate, in ways that caused them to question how they were really perceived by others. Thus, the relatively low level of awareness that we measure quantitatively in our results appears to have been noticeable to our users as well and to have had a palpable impact on their experience.

In addition to implications for political discourse, our findings may also have implications for theories of interpersonal influence more generally. Many survey (Katz & Lazarsfeld, 1955), observational (Fowler & Christakis, 2008), and experimental (Asch,

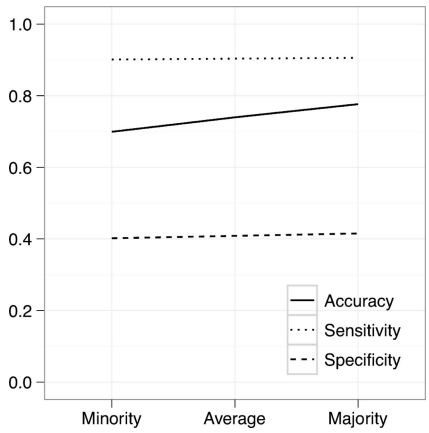

Figure 9. Comparison of accuracy for minority and majority opinion holders.

1955; Bond & Smith, 1996; Sherif, 1937) studies have supported the claim that individuals are influenced by the attitudes of their peers, and this influence is often asserted to play an important role in domains as varied as politics (Lazarsfeld, Berelson, & Gaudet, 1948) and marketing (Keller & Berry, 2003). Although we do not dispute that when individuals are made aware of their differences, they may indeed influence each other, our results suggest that many such differences go undetected (also see Jussim & Osgood, 1989). If a necessary precondition for social influence is the awareness of the orientation of the influencer, and if, as our results suggest, when individuals contemplate the opinions of their peers, they are either seeing a reflection of their own opinions (i.e., projection) or of general stereotypes, then the extent to which peers influence each other's political attitudes may be less than is sometimes claimed.

Finally, we close by noting that another way to view our results is in terms of differences between reality and perception (Berger & Luckman, 1966), where the gap we report is not the usual application of generic stereotypes to abstracted strangers (Adar & Adamic, 2005) but arises at the granular and concrete level of specific attitudes and specific friends. We also note that progress in understanding the relationship between reality and perception—and the consequences of each—will require survey and experimental designs that can account for the actual networks in which individuals are embedded. Social networking platforms like Facebook, therefore, in addition to being interesting phenomena in themselves, provide potentially important environments for conducting social science research.

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