



Social penumbras predict political attitudes

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To explain the political clout of different social groups, traditional accounts typically focus on the group's size, resources, or commonality and intensity of its members' interests. We contend that a group's penumbra—the set of individuals who are personally familiar with people in that group—is another important explanatory factor that merits systematic analysis. To this end, we designed a panel study that allows us to learn about the characteristics of the penumbras of politically relevant groups such as gay people, the unemployed, or recent immigrants. Our study reveals major and systematic differences in the penumbras of various social groups, even ones of similar size. Moreover, we find evidence that entering a group's penumbra is associated with a change in attitude on group-related policy questions. Taken together, our findings suggest that penumbras are pertinent for understanding variation in the political standing of different groups in society.

social networks | interest groups | political attitudes

Calls for changes to the US immigration system have been a feature of American politics for several decades. In particular, activists have called for granting more visas for immigrants seeking to enter the country as well as for providing undocumented immigrants a path to citizenship. Yet, for years, strikingly little movement has been registered on these matters, either in terms of public opinion or in change of actual policy. In contrast, over the same time period, gay rights have undergone a major transformation in the country, with many states, and later the Supreme Court, recognizing same-sex marriage and with a large share of Americans expressing support for this change. The contrasting experience of these two hitherto socially discriminated groups—immigrants and gay people—raises a key question: what explains variation in the resonance and political standing of different social groups?

Earlier research studying the political influence of social groups has focused either on differences in the groups' resources or on features that affect their ability to overcome the collective action problem. In particular, large and dispersed groups are considered to face greater difficulties in wielding influence, due to the incentive of each individual member to free ride on the efforts of others (1). Other explanations have focused on the intensity and commonality of interests among the group's members as key dimensions in its ability to mobilize collectively and yield influence (2–5).

This study introduces a different dimension that we argue is pertinent to understanding the political standing of a social group: its penumbra, which we define as the set of people who have personal familiarity with members of the group, be it as relatives, friends, or acquaintances.* When group members routinely interact with people outside the group, these interactions can facilitate greater understanding of, and sympathy toward, the needs and interests of the group's members. Moreover, such interactions can reduce fear of and increase tolerance toward members of an out-group.

Perhaps the most widely known articulation of this notion is the intergroup contact hypothesis (6), which holds that extended contact allows for learning about the group, an understanding of its circumstances, and the creation of affective ties with its members. Such changes may also bring about a shift in views

toward the group's members (6–9). Indeed, positive contact experiences have been shown to reduce self-reported prejudice toward a range of socially disadvantaged groups, including Blacks, the elderly, gay men, and the disabled (10–12). Furthermore, research indicates that even unstructured contact can often change attitudes toward group members (8). Contacts with members of an out-group are necessarily positive, and in some instances such interactions could actually deepen apprehension or hostility.[†] We therefore conjecture that a systematic study of various penumbras can yield meaningful insight into the differences in the political standing of different social groups. Moreover, taking into account changes in individuals' membership in certain penumbra can help explain shifts in their political attitudes.

Unlike the concept of one's social network, which refers to the contacts and relationships of a certain individual, a penumbra refers to the circle of close contacts and acquaintances of a given group. For example, two social groups of similarly modest size may have penumbras that vary in crucial ways: a group's penumbra can be large in size or small, it can be geographically concentrated or dispersed, and it can be composed of mostly rich or poor people. This study is a systematic exploration of this concept and its potential political significance.

Significance

The political influence of a group is typically explained in terms of its size, geographic concentration, or the wealth and power of the group's members. This article introduces another dimension, the penumbra, defined as the set of individuals in the population who are personally familiar with someone in that group. Distinct from the concept of an individual's social network, penumbra refers to the circle of close contacts and acquaintances of a given social group. Using original panel data, the article provides a systematic study of various groups' penumbras, focusing on politically relevant characteristics of the penumbras (e.g., size, geographic concentration, sociodemographics). Furthermore, we show the connection between changes in penumbra membership and public attitudes on policies related to the group.

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*The term penumbra is used during a solar eclipse to describe the surrounding shades circling the dark shadow of the moon. Analogously, we consider the penumbra of the core social group to be the equivalent of the degrees of shadow (Fig. 1).

[†]Even when the contact is positive and associated with decreased hostility toward the members of the out-group, the interaction need not lead to a change in views on policies pertaining to the out-group. For example, ref. 13 found that following positive contact, the affective reactions of Whites toward Blacks had changed, but no change was registered in White subjects' attitudes on policies geared toward combating racial inequality in areas such as housing, jobs, or education.

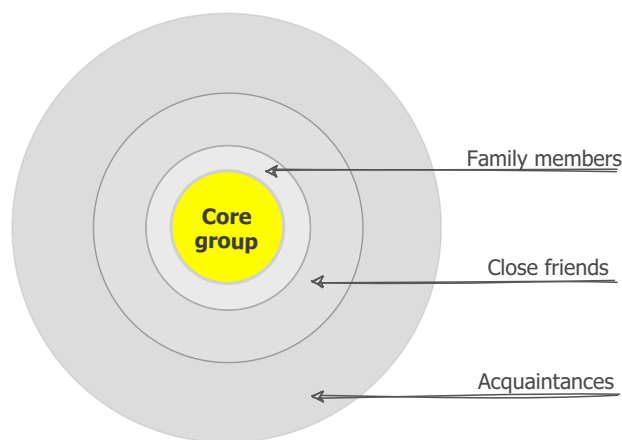


Fig. 1. Sketch of the social penumbra of a group in the population.

The study of penumbras and their political effects is challenging in part because of the lack of comparable data about the people who are familiar with members of various social groups of interest. We know little about the sizes of penumbras or their characteristics. Additionally, even if information on the penumbras was readily available, investigating the impact of membership in the social penumbra of the group on one's attitude toward the group is difficult because membership in the penumbra is not randomly assigned. People often know members of a social group because they choose to or because they make certain decisions about where they want to live or spend their time (8). These choices then make a person more or less likely to meet members of the core group. This means that the correlation between familiarity with a group's members and attitudes on issues related to that group does not necessarily reflect a causal relationship. Familiarity may not necessarily be the trigger for a person's attitude.

In this paper, we report findings from a study designed to better deal with those issues. We carried out a two-wave panel survey in which we asked a national sample of Americans a set of policy questions pertaining to a set of social groups (for example, assistance to the unemployed, same-sex marriage, and immigration restrictions). Later in the survey, we asked questions pertaining to their familiarity with members of these various social groups (for example, gay people, the unemployed, immigrants), probing them about the number of family members, close friends, and acquaintances they know within that group. A year later, we asked the same respondents the same set of questions, thus allowing us to track changes in membership in different penumbras and to investigate the empirical relationship between changes in penumbra status and attitudes on policies related to the relevant social group.

We find wide variation in both the size and the shape of key penumbras for core groups of comparable size. For example, about 3% of the US population identifies as gay or lesbian, about half the share of people with a mortgage "under water" at the time of our survey. Yet, the sizes of penumbras of the two groups go in the opposite direction, with 74% of respondents saying they knew at least one gay person and only 35% reporting that they knew someone whose mortgage is under water. Our analysis indicates that some of this difference could be explained by the fact that the penumbra of underwater mortgages is far more concentrated geographically than the penumbra of gays and lesbians. Yet, the difference may also be due to people's unawareness of the mortgage status of their friends and acquaintances. Indeed, this is part of our point: if a group such as underwater mortgage holders is hidden to much of the general population, this

will affect the extent to which their problem becomes salient and how it is perceived by the public. These differences thus suggest why specific policies such as same-sex marriage and debt forgiveness to mortgage owners, while directly affecting similarly sized groups, could resonate very differently across the broader population.

To assess this link between a group's penumbra and public attitudes on issues related to the group's interests, we exploit the panel design of the survey to track changes in familiarity with group members with views on policies related to the group. Indeed, we show evidence that entering a penumbra has in some instances a significant impact on group-related policy preferences (e.g., on gay people, Muslims, National Rifle Association [NRA] members).

Our study makes three contributions. First, it introduces the concept of penumbra as a relevant political characteristic of social groups, shifting the focus from the groups' members to features of the group's social circle (i.e., its outward contacts with nongroup members). Second, we provide a set of estimates of the penumbras of an array of different groups in society and highlight the significant variation in the penumbras' size and characteristics (e.g., in terms of income, education, political leanings). Finally, we provide preliminary evidence regarding the political significance of penumbras, demonstrating that a change in penumbra status is in some cases also associated with shifting views on policy matters related to the group in question.

Data and Empirical Approach

We measure penumbras using a two-wave internet panel survey designed by us and administered by YouGov. Three thousand respondents were interviewed in wave 1 in late August and September 2013; of them, 2,106 were reinterviewed in wave 2 a year later. YouGov aims for a sample of American adults using quota sampling on age, sex, and other demographics. Our wave 1 sample was unweighted, but weights are supplied for wave 2 to help deal with dropout. We report analyses on those respondents who completed both waves. We use survey weights when computing population proportions and averages; we do not use the weights for regression analyses that adjust for demographics.

We asked about penumbra membership in 14 social groups and attitude questions on 12 related policies, with some of the policy questions pertaining to more than one group. The groups include gays and lesbians, recent immigrants, NRA members, unemployed people, individuals currently taking care of an elderly family member, and others (*SI Appendix, Table S1*). The term social group can refer to very different kinds of aggregations of people. It can designate members of a certain social category that is based on a common attribute (e.g., of a certain age group or income bracket). Other social groups are defined by the interrelatedness of their members (e.g., gays and lesbians, NRA members). The debate over social group classification has been widely explored in the sociological literature (14, 15). For our purposes, it suffices to say that in theory, a penumbra can be of any social group, although penumbras of some groups are likely to be more meaningful than others. We return to the issue of meaningfulness in *Discussion*.

In selecting the set of social groups for study, we focused on dimensions that the literature indicates are potentially consequential for the impact that penumbra membership might exert on political preferences. These dimensions, cited earlier, include the size of the core group, whether membership of the group is voluntary or not, whether the ascriptive feature of the group is one associated with high or low social status, and whether the group is associated with the liberal or conservative camp. The advantage of exploring penumbras of groups that differ along multiple dimensions comes at a cost that we are

unable to systematically assess the impact of a specific dimension that characterizes the core group—for example, whether group membership is voluntary—on the influence of penumbra membership. This is a necessary trade-off given the aims of this study.

Penumbra membership was constructed by asking the respondents to report the number of people from the social group who are 1) close family, 2) close friends, and 3) other people they know. To add clarity, we defined the third category as “people that you know their name and would stop and talk to at least for a moment if you ran into the person on the street or in a shopping mall.” This does not address more tenuous connections such as interactions with strangers or people heard about from the news media, as our focus here is on personal social connections. Finally, we prompted the survey respondents with eight first names and asked them to count the number of people they knew with each name. The addition of names helps us measure the size of each respondents’ social network and also provides a check on the face validity of our estimates regarding the penumbra of the different social groups. We asked about the names Rose, Emily, Bruce, Walter, Tina, and Kyle, chosen to represent a balance of male, female, young, middle aged, and old, along with Jose and Maria to target the Hispanic population.

The policy questions we asked were directly relevant to at least one of the social groups of interest. For example, with respect to the immigrant penumbra, respondents were asked for their views on whether more or fewer immigrants should be permitted to live in the United States. To assess the policy attitudes of the gay penumbra, we asked respondents for their views about gay marriage. To tap into the views associated with knowing a gun owner, we asked all respondents about their position on a nationwide ban on assault weapons. On the eldercare penumbra, we asked about tax breaks for family expenditures on care provision for elderly family members. The exact wording of all of the questions appears in *SI Appendix*.

To estimate the degree to which social groups differ in the geography of their penumbras, we fit for each group a hierarchical model predicting penumbra membership across the 50 states. We fit the model, $\Pr(y_{ij} = 1) = \text{logit}^{-1}(\alpha_{\text{state}[i],j})$ for $i = 1, \dots, N$, $\alpha_{s,j} \sim N(\mu_j, \sigma_j^2)$ for $s = 1, \dots, 50$, where $y_i = 1$ if survey respondent i is in the penumbra of group j , $\text{state}[i]$ is an index variable for the state of residence of person i , and we are estimating hyperparameters μ_j, σ_j for each group. We fit the model in the Bayesian inference package Stan (16) so as to estimate the proportion of people in the penumbra, for each group and each state.

Results

Key Characteristics of Social Penumbras. We begin by examining the size of the penumbras of different social groups, as measured by the percentage of respondents who knew at least one person in a group. Fig. 2 illustrates graphically the differences in the size of both the core group (gray inner circles) and that of the penumbra, with concentric circles starting with close family and then extending to include close friends and acquaintances. As the figure makes clear, the penumbra is typically much larger than the core group. For example, less than 1% of American adults are in the active military, but nearly half of respondents know someone in the service.[‡] The gay/lesbian penumbra is also large in comparison with the size of the core group itself, with nearly

three-quarters of respondents reporting that they know someone among this group, which is estimated to comprise about 3 to 4% of the population.

Yet, such ratios between penumbra and core group are rather unique. At the other extreme, relatively few people report knowing someone who had an abortion in the past 5 y, despite there being millions of women who fall into this category. This is probably due to the fact that women who have had abortions do not always reveal this fact to their acquaintances (17). This variation highlights a broader point: the sizes of penumbras can vary greatly not only due to differences in the size of the core groups themselves but also because of differences in the extent to which group members can be identified or reveal themselves as such (Fig. 2).

The figure also highlights the fact that some groups have a penumbra of a similar size (e.g., gun owners, gays and lesbians, people with serious health problems), but the core groups differ greatly. Gun owners, for example, constitute about 24% of the population, a figure about seven times the number of gays and lesbians in the United States (a group with a similarly sized penumbra).

Another important factor is the core group’s “shape” (i.e., its spatial dispersion). This could account for variation in the size of the penumbra, adjusting for the core group’s size. It could also help explain why some groups have a more geographically dispersed penumbra.

As shown in Fig. 3, some groups such as underwater mortgages, gun owners, and gays and lesbians show a fair degree of geographical concentration in their penumbras. Many people know underwater mortgage owners in the high-delinquency states such as California, Nevada, and Florida, while only a few know members of this group in states that did not experience the real estate bubble, such as Wisconsin or Kentucky. In contrast, penumbras of other social groups such as eldercare, seriously ill, and women who had abortions are essentially uniformly distributed across the country. These maps should be taken as showing general patterns, and particular state estimates can be noisy. We also estimate the SD of these state proportions, as reported in the last column of *SI Appendix*, Table S1.

In addition to the variation in size and shape, there are also distinct differences in the socioeconomic characteristics of the different penumbras. Fig. 4 and *SI Appendix*, Table S1 present a comparison of some of the characteristics, such as the prevalence of high-income individuals in each group’s penumbra and the share of Whites and of college-educated individuals. Such differences speak to the likely possibility that who is in the penumbra (e.g., opinion leaders, people with many social ties) matters to the group’s clout and influence. Indeed, as the comparisons of penumbra characteristics indicate, the heterogeneity is substantial. For example, the penumbras of welfare recipients, uninsured people, and unemployed people have the lowest share of upper-income individuals (20% or less) and also the lowest share of college-educated respondents. At the opposite end, the penumbras of NRA members, Muslims, and recent immigrants have a particularly high share of upper-income and well-educated people.

The fact that newly arrived immigrants and Muslims have a highly educated penumbra also corresponds with the fact that the more educated tend to hold substantially more favorable views of immigrants and immigration. It is an open question to what extent that is a causal relationship and in which way causality runs in this case. We return to this issue below by exploring how attitudes toward group-related policies shift with change in penumbra membership.

In sum, social groups—even ones with a similarly sized core—differ greatly in the size and key characteristics of their penumbras. Next, we turn to assess some political repercussions of penumbras and their membership.

[‡]This figure represents some combination of knowing people through one’s social network as well as uncertainty about classification; for example, one might count a friend who is no longer in active service, and this would be part of the calculation of the penumbra but not in the group size.

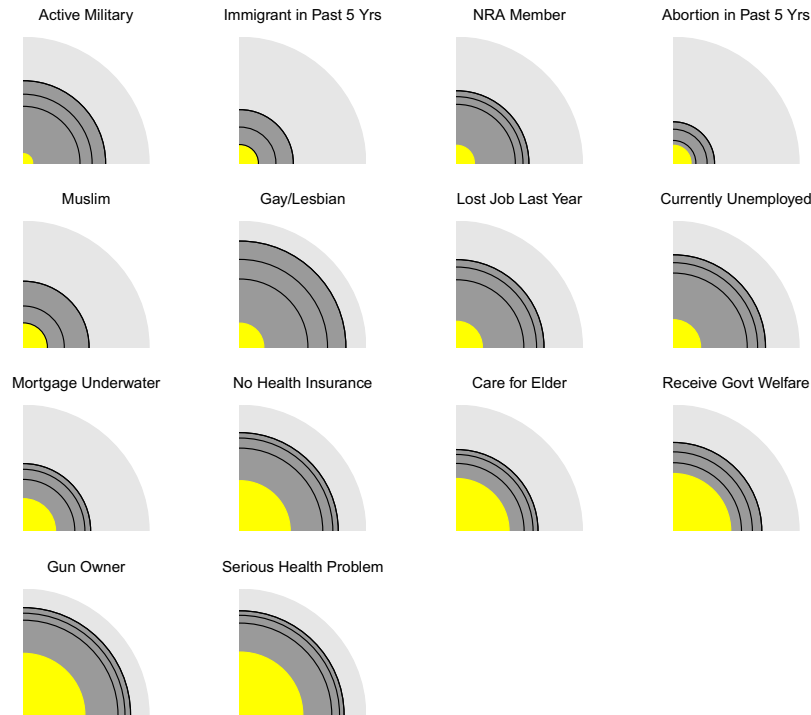


Fig. 2. Core groups and penumbra size. Groups asked about in our survey in increasing order of size. For each group, the area of the yellow circle indicates its size, and the concentric circles show its estimated penumbra: the percentage of survey respondents who report knowing at least one family member, close friend, or other acquaintance in the group. The light gray concentric circle denotes the rest of the US population that is not in the group's penumbra.

Penumbra Membership and Political Attitudes. We now shift from summarizing the penumbras to studying the views of their members. To what extent does being part of a certain social penumbra affect one's political attitudes? This section assesses the evidence regarding our contention that social penumbras can help

account for systematic variation and change in political attitudes. We begin by exploring two sets of correlations that suggest that penumbra membership is a factor in shaping political affiliations.

First, we analyze whether social groups differ systematically in terms of the partisan leanings of their penumbra. Fig. 5A shows

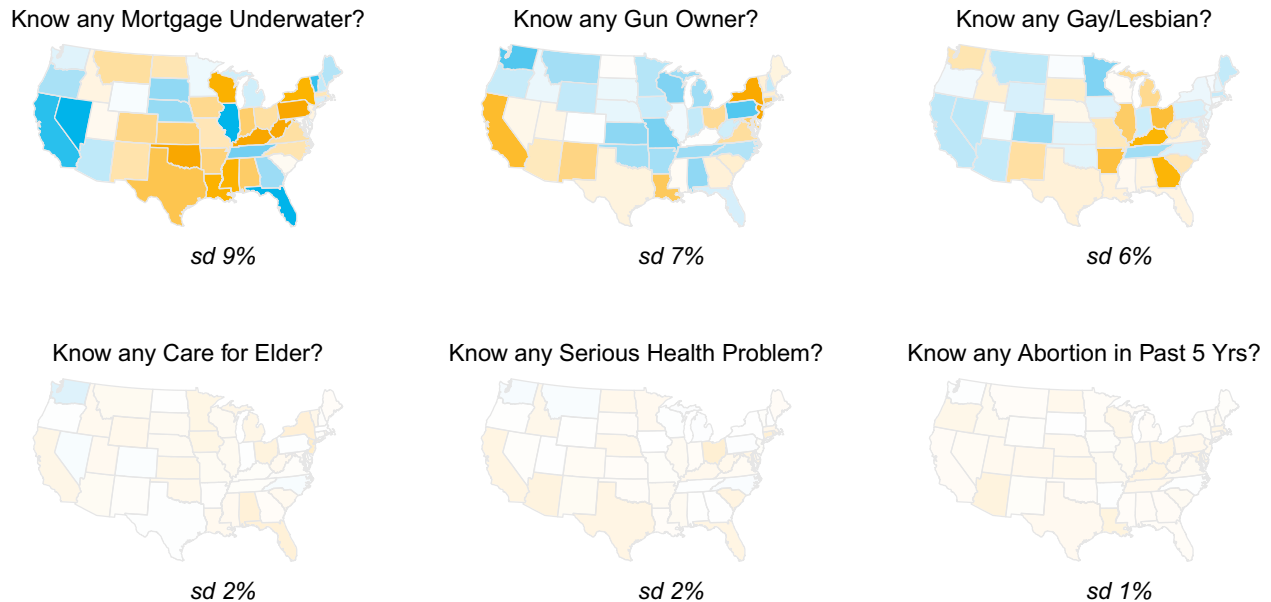


Fig. 3. Maps of the three most geographically dispersed penumbras, followed by three of the least dispersed penumbras for comparison.

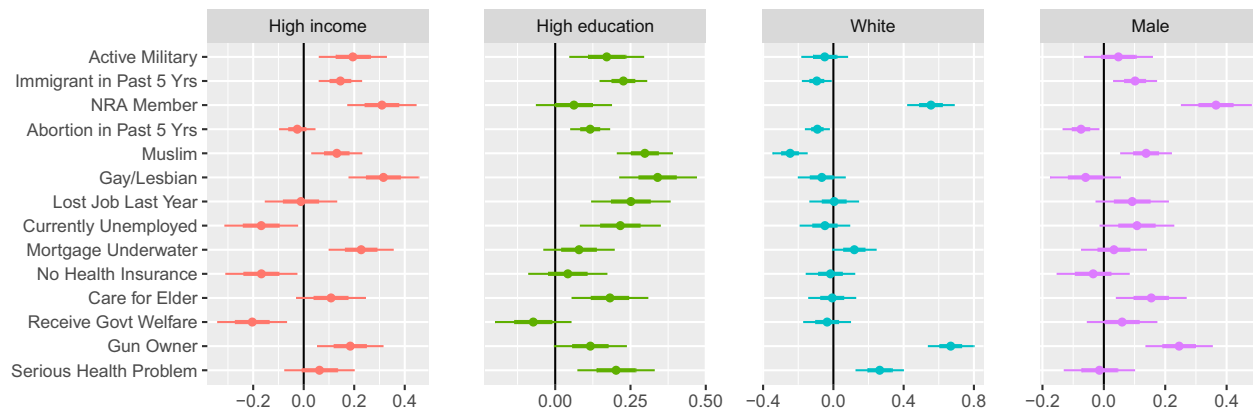


Fig. 4. Estimated coefficients \pm 2 SEs of regressions of penumbra score on indicators for education, income, sex, and race.

average penumbra sizes as a function of party identification. Patterns are what one might expect, with Republicans knowing more NRA members and people in the military and Democrats knowing more gays and people with no health insurance. Partisan differences are mostly larger among friends and acquaintances than among close family.

Next, we assess the association between penumbra membership and attitudes on policy questions directly related to the social group of interest. Fig. 5B shows the raw correlations of penumbra membership with attitudes on these policy issues. As the figure indicates, the results vary: the correlation between knowing NRA members and opposing a weapon ban or between knowing gay people and supporting same-sex marriage is strong. For other issues, the correlations are lower, and for some, the correlation is zero. Overall, the correlations tend to be larger for social issues and are much smaller (to nonexistent) for attitudes on economic issues such as unemployment benefits, mortgage foreclosures, tax breaks for caregivers, and public assistance.

This pattern is consistent with a range of findings in the study of American politics and public opinion, which finds that attitudes on economic issues are strongly aligned with partisanship and political ideology (18, 19). Hence, it makes sense that personal contacts are less important, as compared with one's ideology, in predicting economic attitudes. That said, we still find it surprising that there is zero correlation between knowing someone with an underwater mortgage and supporting mortgage relief or between knowing someone with serious health problems and views on health care spending.

It is difficult to interpret static correlations between penumbra membership and policy attitudes. We therefore seek to get more leverage on causality by exploiting the panel aspect of our study, examining changes in attitude that occur following changes in penumbra status. So, for each of our group penumbras and for each corresponding political issue question, we run a regression predicting change in issue attitude, given change in penumbra status. In the regression, we also adjust for attitude at wave 1 and key demographic and political background variables.

Our interest is in measuring the effect on issue attitudes of entering the penumbra. Hence, we restrict the sample to respondents who were not in the penumbra in wave 1. A change in penumbra status can arise in several ways. A person may for the first time meet and befriend someone who is a member of the core group. Alternatively, a friend can change status and become a new member of the core group (e.g., is laid off), thereby rendering their social circle part of the penumbra of unemployed people. Alternatively, that friend may have been a member of that core group all along but only later revealed as such (e.g., a

gay person coming out of the closet), or the respondent can be led into a penumbra due to personal circumstances (e.g., an economic reversal resulting both in meeting an unemployed person and in changing their view on relevant policy issues). Finally, personal or external events may make a certain core group salient and thus, lead people to notice that they are part of that group's penumbra (e.g., a court ruling on women's right to choose making it salient that a friend had had an abortion in the past). Thus, entry into the penumbra is not randomly assigned. Our identifying assumption, however, is that penumbra entry in a given period is orthogonal to the propensity to change attitude on the relevant policy question during that same time period. In many instances, although surely not in all, this seems to be a plausible assumption. For example, there is little reason to expect that people with a propensity to enter the eldercare penumbra in the coming year are more likely to change their attitudes on tax breaks for eldercare, other than through the penumbra entry itself.

Fig. 5C shows the results. The scale tells us that the estimated effect for each penumbra/issue combination is small. On average, we see a positive effect (the issues have been aligned so that we expect to see a positive coefficient in each case) of about 0.05, consistent with entrance to the penumbra having a 5% chance of shifting a respondent by one point on the one to five scale. The wide CIs indicate uncertainty about the relative magnitudes and even the signs of the effects of entering different penumbras. The groups for which the coefficients seem most clearly positive are NRA members (and attitudes toward bans on guns), the Muslim penumbra (and opposition to airport screening), currently unemployed (and attitudes on unemployment insurance benefits), and elderly care penumbra (and support for tax breaks for caregivers).

Considering all of the estimates in Fig. 5C together, there is no evidence that any of the effects are negative; rather, it appears that there are small average effects of entering the penumbra, but with available data, one cannot reliably identify which effects are larger than others.

To address four possible threats to identification, we perform placebo checks: 1) refitting our model in time-reversed order to address the possibility that the results are artifacts of measurement error, 2) permuting issue questions while maintaining their ideological direction to address the possibility that we are just capturing general liberal-conservative ideology, 3) repeating our analysis using different measures of penumbra membership and considering different interactions and data-exclusion rules, and 4) comparing with self-perceived changes in positions as a test for demand effects. As we discuss in *SI Appendix*, the results from the robustness checks support our main claims.

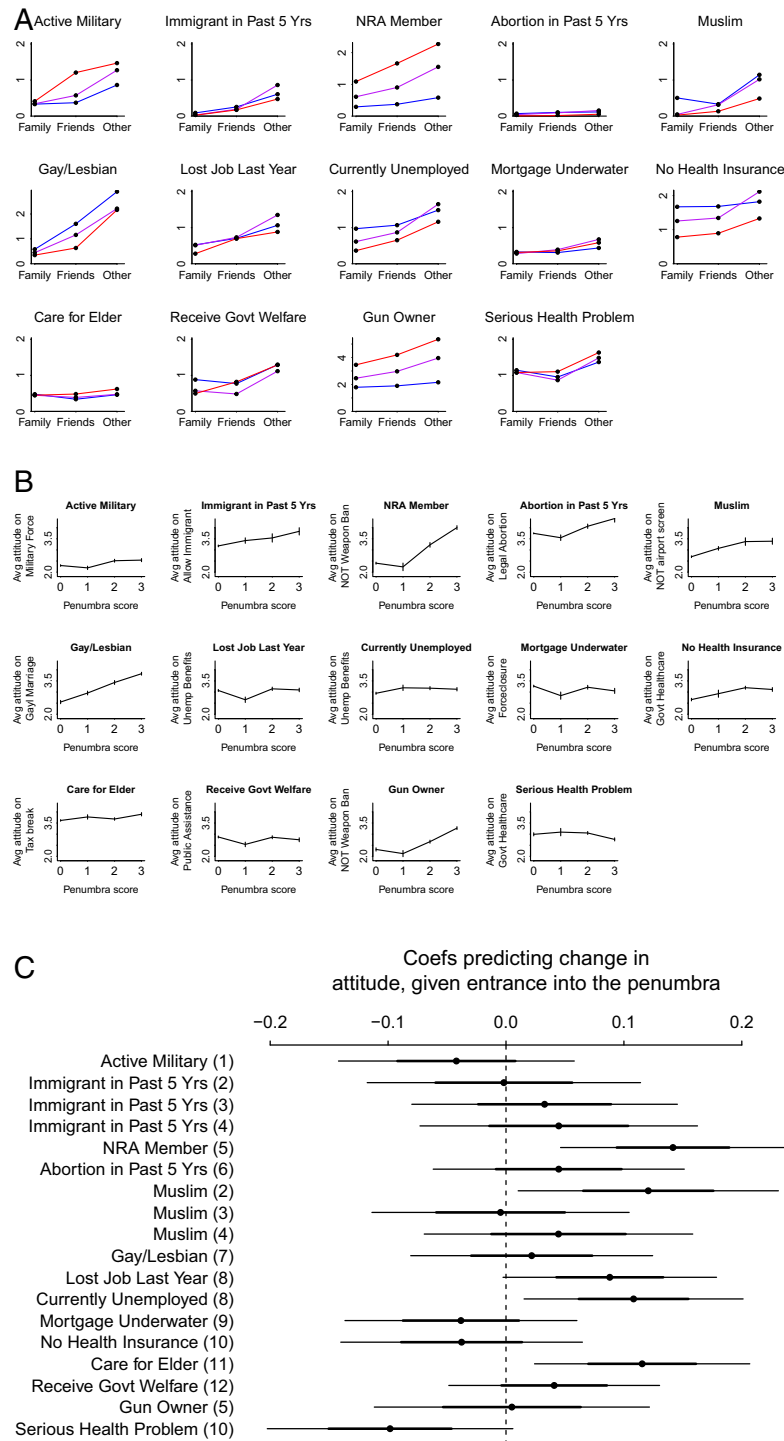


Fig. 5. Membership in penumbra and political preferences. **A** presents the average (Avg) number of people known in each group, by party identification (ID) (*SI Appendix* has the wording of the policy questions). **B** presents the correlation between membership status in the penumbra and issue attitude on group-related policy. **C** presents the estimated effect of entering a penumbra during the year on a group-related policy question. The coefficients are obtained from a regression that adjusts for attitude in wave 1 and demographic variables. Numbers in parentheses denote the policy question respondents were asked (*SI Appendix* has the numbered question list).

Discussion

Being in a group's penumbra tends to be positively correlated with positive attitudes on related political issues, but these cor-

relations are high only for some of the groups we have studied. Using our panel study, we estimate that these correlations represent, at least in part, a causal relationship. Overall, we estimate

that entering a group's penumbra has a small but positive effect on attitudes on related political questions. It is quite likely that the change in attitudes occurs over a longer period than we have examined in our panel, in which case our analysis represents a floor estimate of the true effect of entering a penumbra.

It is also possible that the largest effect of entering a penumbra is to increase the salience of certain issues rather than to directly change attitudes. In this case, groups' resonance in society may increase when its penumbra grows, without public opinion shifting in favor of group-related policies. For example, that Muslims have become a widely discussed social group in many Western countries may mean that more people become aware when their acquaintances are Muslim, and its penumbra would grow. Even so, this larger penumbra would not necessarily lead to a more pro-Muslim stance in society as a whole: either because members of the penumbra will not become more pro-Muslim or because this shift would be offset by shifts among those outside the Muslim penumbra. Similarly, there is debate within the prochoice community as to the potential political effects of more women revealing their abortion histories to their larger social networks. Further research is needed on the conditions under which changes in the penumbra are likely to translate into more favorable outcomes and political influence for a group.

The dramatic increase in the use and membership of online social network platforms (e.g., Facebook, Instagram) may also have important implications for the penumbras of social groups.

Specifically, penumbras may now include people who have no personal contact with a member of the core group but nonetheless, follow a member online and come to feel close to that individual, even without personal acquaintance. Similarly, our study does not track second-degree membership, such as friends of friends, in penumbras. Thus, future research should examine whether and how indirect and online contacts influence the penumbras that people effectively feel a part of.

Conclusion

This study calls for considering penumbras when analyzing the social and politically relevant characteristics of groups in society. By providing measurements of key characteristics of a wide range of penumbras and demonstrating their potential relevance for explaining policy attitudes—and in some cases, attitude change—we hope to have advanced this objective. Indeed, we conjecture that penumbras can help account for a wide array of other phenomena, ranging from intergroup relations to variation in media attention to certain events and from fundraising success to the formation of political coalitions. The present study hopefully lays the foundation for future work on these important issues.

Data Availability. Anonymized (Stata, SPSS, and R files) data have been deposited in the Open Science Framework (<https://osf.io/kjeh2/>).

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A. Survey Items

A. Penumbra membership. We asked about the following 14 groups: Currently Unemployed, Lost Job Last Year, NRA Member, Gun Owner, Serious Health Problem, No Health Insurance, Receive Government Welfare, Immigrant in Past 5 Yrs, Muslim, Gay/Lesbian, Abortion in Past 5 Yrs, Active Military, Mortgage Underwater, Care for Elder, and the following 8 names: Walter, Rose, Bruce, Tina, Kyle, Emily, Jose, Maria.

We asked the question as follows: “How many people do you know among your close family, your close friends, or among other people you know, who fit the following criteria please enter a number: [Reminder again: by ‘other people you know’ we mean individuals you both know their name and would stop and talk to at least for a moment if you ran into them on the street or in a shopping mall.]” Respondents entered their responses on a 14×3 grid.

B. Issue attitudes. The questions used to assess the impact of penumbra status and attitudes on group-related policy issues were as follows (also indicating the two questions that have been reverse-coded in our analysis to correspond to positive attitudes for the targeted penumbras):

1. Which comes closest to your point of view: As a general rule, do you think the United States should be willing to use military force around the world, or the United States should be very reluctant to use military force?
2. Do you think the number of immigrants from foreign countries who are permitted to come to the United States to live should be increased, decreased, or left the same as it is now?
3. Do you support or oppose allowing illegal immigrants to remain in the country and eventually qualify for U.S. citizenship, if they meet certain requirements like paying back taxes, learning English, and passing a background check?
4. As a means of preventing terrorist attacks in the United States, would you support or oppose requiring Muslims, including those who are U.S. citizens, to undergo special, more intensive security checks before boarding airplanes in the U.S.? (reverse coded)
5. Would you support or oppose a law requiring a nationwide ban on the sale of assault weapons? (reverse coded)
6. Do you think abortion should be legal in all cases, legal in most cases, illegal in most cases, or illegal in all cases?
7. Congress is considering whether to extend the federal unemployment benefits for workers who have exhausted their state unemployment benefits but still cannot find a job. Others worry that such an extension of benefits would add to the national debt. Do you favor or oppose continuing federal unemployment benefits?
8. Do you agree or disagree: Homosexual couples should have the right to marry one another.
9. As you may know, the rate of Americans losing their homes through bank foreclosures has risen sharply during the financial crisis. Do you think it would be better for the economy if:
 - A. The federal government introduces new regulations to prevent this from happening
 - B. The federal government does not introduce new regulations and instead allows problems in the housing market to be resolved on their own
10. Do you agree or disagree with the following statement: “It is the responsibility of the federal government to make sure that all Americans have healthcare coverage”?
11. From what you have read or heard, is the U.S. spending too much, too little, or about right on public assistance programs to the poor?
12. Some are calling for the government to provide tax breaks for family expenditures on care provision for elderly family members. Others worry that such tax breaks would add to the national debt. Do you support or oppose providing tax breaks for care provision to the elderly?

B. Survey data

We measure penumbras using a two-wave internet panel survey designed specifically for studying this phenomenon. The 140 survey was administered by YouGov. 3,000 respondents were 141 interviewed in wave 1 in late August and September, 2013; of them, 2,106 were re-interviewed in wave 2 a year later. YouGov aims for a representative sample of American adults using quota sampling on age, sex, and other demographics. Our wave 1 sample was unweighted, but weights are supplied for wave 2 to help deal with dropout. We report analyses on the 1700 respondents who completed both waves of the survey. We use survey weights when computing population proportions and averages; we do not use the weights for regression analyses that adjust for demographics.

Table A.1. Key Characteristics of Penumbras.

Groups asked about in our social penumbra survey, listed in increasing order of their approximate sizes in the population; see Supplementary Information for sources. We used our survey data to estimate the size of the group's penumbra (the percentage of people who know at least one person in the group), along with the characteristics of survey respondents in each group's penumbra. "Geographic concentration" refers to the estimated variation in penumbra proportions across states; see Section E.

Group	% of U.S. adult population who are in the		% of people in the penumbra who are			
	group	penumbra	top third of income	college educated	non-Hisp white	Geographic concentration
Active military	0.6%	46%	26%	31%	71%	4%
Immigrant in past 5 yrs	1.9%	18%	34%	44%	70%	6%
NRA member	2.0%	41%	29%	35%	81%	5%
Abortion in past 5 yrs	2.0%	10%	24%	30%	67%	1%
Muslim	3.4%	30%	29%	40%	65%	3%
Gay/lesbian	3.6%	74%	25%	31%	71%	5%
Lost job in past year	4.2%	49%	21%	30%	71%	3%
Currently unemployed	4.7%	55%	20%	29%	69%	3%
Mortgage underwater	6.6%	35%	27%	31%	75%	9%
No health insurance	16%	60%	19%	27%	67%	4%
Cares for elderly person	17%	46%	23%	30%	71%	2%
Receive govt welfare	21%	49%	16%	24%	69%	5%
Gun owner	24%	77%	24%	29%	76%	7%
Serious health problem	25%	74%	22%	29%	72%	2%

All responses greater than 30 were truncated to 30 (these were 0.4% of responses in wave 1 and 0.4% in wave 2, but mostly not from the same people), and then we imputed nonresponses y_{ij} deterministically with $\bar{y}_{i..}\bar{y}_{.j}/\bar{y}_{...}$, rounded to the nearest integer. For the data we saved, there was an 0.4% rate of nonresponse in wave 1 and a 12% rate in wave 2.

Table A.1 give some summaries of the groups in our study and their penumbras. The penumbras are mostly much larger than the groups, which makes sense given that any person can have many friends and family members. In addition, we suspect that some of the groups are overestimated (e.g., respondents are perhaps including among “active military” people who are in the reserves), while others such as “receive government welfare” and “serious health problem” are not precisely defined. The group for which the ratio of penumbra size to group size is smallest is abortion; there, we suspect that many respondents have friends and family members who had abortions, but the respondents are not aware of this (Cowan, 2014).

C. Group sizes in population: Sources

Figure 1 of the paper includes rough estimates of the percentages of adult Americans belonging to each group whose penumbra was asked about in the survey. The estimates were based on a base of 250 million adults and the following numbers for each group around the time of the first wave of the survey:

- 11.8 million currently unemployed, from the Bureau of Labor Statistics Economic News Release, 5 Jul 2013: “The number of unemployed persons, at 11.8 million, and the unemployment rate, at 7.6 percent, were unchanged in June. Both measures have shown little change since February.” https://www.bls.gov/news.release/archives/empst_07052013.htm

- 10.5 million lost jobs in previous year, from the Bureau of Labor Statistics Job Openings and Labor Turnover Archived News Releases. <https://www.bls.gov/bls/news-release/jolts.htm#2012>

Source found from Molly’s Middle America, 24 Jan 2013: “2012 Gross Number of Total Separations: 49,676,000; Gross Number of Layoffs and discharges: 20,546,000; Gross Number of Quits: 25,132,000; Gross Number of ‘Other’ separations: 3,997,000. <http://mollysmiddleamerica.blogspot.com/2013/01/how-many-people-lost-their-jobs-in-2012.html>

Also see Louis Jacobson and Molly Moorhead, Polifact, 16 Jan 2012: “there is no useful statistic for ‘Americans (who) have lost their jobs’ during a given time period. The labor force is fluid, so people who lose their jobs often move quickly into another one. Instead, economists use the concept of net jobs gained or lost.” <http://www.politifact.com/truth-o-meter/statements/2012/jan/16/mitt-romney/mitt-romney-tweets-more-americans-have-lost-their-/>

- 5 million members of the National Rifle Association, from Gregory Korte, USA Today, 4 May 2013: “Efforts to pass gun-control legislation have only made the National Rifle Association stronger, as the membership rolls now surpass a record 5 million.” <http://www.usatoday.com/story/news/politics/2013/05/04/nra-meeting-lapierre-membership/2135063/>

- 24% of Americans own guns, from Drew Desilver, Pew Research Center, 4 June 2013: “A Pew Research Center survey conducted in February found that 37% of households had an adult who owned a gun—24% said they owned a gun, and 13% said someone else in their household did.” <http://www.pewresearch.org/fact-tank/2013/06/04/a-minority-of-americans-own-guns-but-just-how-many-is-unclear/>

- 25% of Americans with a serious health problem, a rough estimate as “serious health problem” has no clear definition. See the Centers for Disease Control and Prevention Chronic Disease Overview: “As of 2012, about half of all adults—117 million people—had one or more chronic health conditions. One of four adults had two or more chronic health conditions.” <http://www.cdc.gov/chronicdisease/overview/>

- 40 million Americans with no health insurance in 2013, from Kaiser Family Foundation Key Facts about the Uninsured Population, 29 Sep 2016: “As of the end of 2015, the number of uninsured nonelderly Americans stood at 28.5 million, a decrease of nearly 13 million since 2013.” <http://kff.org/uninsured/fact-sheet/key-facts-about-the-uninsured-population/>

- 52.2 million Americans on government welfare, from Shelley K. Irving and Tracy A. Loveless, U.S. Census Bureau, May 2015: “In 2012, approximately 52.2 million people, or 21.3 percent of the population, participated in one or more major means-tested assistance programs, on average, each month.” <https://www.census.gov/content/dam/Census/library/publications/2015/demo/p70-141.pdf>.

Source found from Rich Exner, Cleveland.com, 28 May 2015, http://www.cleveland.com/datacentral/index.ssf/2015/05/1_in_5_americans_receive_gover.html.

- 4.8 million adults immigrated to the U.S. in past 5 years, from Jie Zong and Jeanne Batalova, Frequently Requested Statistics on Immigrants and Immigration in the United States, Migration Policy Institute, 26 Feb 2015, “Twenty-nine percent of the 41.3 million foreign born in the United States in 2013 entered between 2000 and 2009.” <https://web.archive.org/web/20150901173805/http://www.migrationpolicy.org:80/article/frequently-requested-statistics-immigrants-and-immigration-united-states>.

We calculated 4.8 million = (0.29 * 41.3 million in 10 years) * $\frac{5 \text{ years}}{10 \text{ years}}$ * $\frac{250 \text{ million adults}}{310 \text{ million people}}$.

- 8.5 million Muslim adults in the U.S., from Frequently Asked Questions about Muslims, Frontline, 2013, “Estimates range that between five to 12 million Muslims live in the United States,” <https://web.archive.org/web/20131102062347/http://www.pbs.org/wgbh/pages/frontline/shows/muslims/etc/faqs.html>.
Our estimate of 8.5 million is in the middle of that range.
- 9 million gay and lesbian Americans, from Gary J. Gates, How Many People are Lesbian, Gay, Bisexual and Transgender?, Williams Institute, April, 2011: “Drawing on information from four recent national and two state-level population-based surveys, the analyses suggest that there are more than 8 million adults in the US who are lesbian, gay, or bisexual, comprising 3.5% of the adult population. In total, the study suggests that approximately 9 million Americans—roughly the population of New Jersey—identify as LGBT.” <http://williamsinstitute.law.ucla.edu/research/census-lgbt-demographics-studies/how-many-people-are-lesbian-gay-bisexual-and-transgender/>.
- 5 million Americans who have abortions in the past 5 years, from Induced Abortion in the United States, Guttmacher Institute, “Approximately 926,200 abortions were performed in 2014, down 12% from 1.06 million in 2011,” <https://www.guttmacher.org/fact-sheet/induced-abortion-united-states>. We computed 5 million as approximately 1 million different women per year.
- 1.4 members of the active military, from United States Armed Forces, Wikipedia, 4 May 2017: 1,429,995 in the United States Army, Marine Corps, Navy, Air Force, Coast Guard, https://en.wikipedia.org/wiki/United_States_Armed_Forces#Personnel
- 16.5 million Americans with mortgage under water, from Kathy Orton, Number of underwater homeowners continues to decline, Washington Post, 5 Sep 2013: “According to the housing data company RealtyTrac, there were 10.7 million U.S. homeowners who owed at least 25 percent more on their mortgages than their homes were worth as of the beginning of September. However, that number has been dropping. It was down from 11.3 million in May and 12.5 million in September 2012.” <http://www.washingtonpost.com/blogs/where-we-live/wp/2013/09/05/number-of-underwater-homeowners-continues-to-decline/>. We calculated 16.5 million = 11 million households * 1.5 adults per household.
- 43.5 million Americans caring for elderly, from Selected Caregiver Statistics, Family Caregiver Alliance, 31 Dec 2012 : “43.5 million of adult family caregivers care for someone 50+ years of age,” <https://web.archive.org/web/20140511040207/https://caregiver.org/selected-caregiver-statistics>

D. Demographic compositions of penumbras

Figure 4 of the paper shows coefficient estimates, predicting penumbra membership from indicators for education, income, sex, and race.

Figure A.1 displays the relationship between respondents’ income and penumbra membership. As the figure indicates, the unemployed, people with no health insurance, and those receiving welfare are groups whose penumbras are significantly more concentrated among lower-income Americans. Otherwise, higher income groups have larger penumbras, which is consistent with other research on social networks (Zheng, Salganik, and Gelman, 2006). It is relevant to various political debates that the penumbras of the military, gays, immigrants, and gun owners are much larger among high-income respondents, in each case with the income disparity being largest in the outside ring of the penumbra, the people who know someone in this group other than through close friends or family.

E. Statistical models

In Figure 2 of the paper we present the geographic distribution of some of the groups across the U.S. Due to space constraints, we presented the information pertaining to only some of the groups we studied. In Figure A.2 we include all the groups.

We fit for each group a simple hierarchical model predicting penumbra membership across the 50 states. The model is, $\Pr(z_{ij} = 1) = \text{logit}^{-1}(\alpha_{\text{state}[i],j})$ for $i = 1, \dots, N$, $\alpha_{s,j} \sim \text{normal}(\mu_j, \sigma_j)$ for $s = 1, \dots, 50$, where $z_i = 1$ if survey respondent i is in the penumbra of group j , $\text{state}[i]$ is an index variable for the state of residence of person i , and we are estimating hyperparameters μ_j, σ_j for each group j . We fit the model in the Bayesian inference package Stan separately for each group and use this to estimate the proportion of people in each penumbra in state. We also estimate the standard deviation σ_j of these state proportions. In fitting the model we use uniform priors on the hyperparameters μ_j, σ_j , which is acceptable because 50 states give enough data to estimate between-state variation from the data alone.

The top three rows of Figure A.2 show, for each group j , the posterior mean of the relative size of each penumbra by state, along with the posterior mean of σ_j , the standard deviation of the corresponding membership probabilities across states. Before discussing the results, we emphasize that the estimates for individual states are noisy.

The penumbra maps are shown in decreasing order of geographic dispersion. For comparability, we performed the same analyses and created the same maps for a group that is known to have substantial geographical variation—frequent religious attenders—as well as for the penumbras of four of the first names in our study. As the bottom rows of Figure A.2 show, there is appreciable cross-state variation among church attenders, while there is little geographic concentration of the penumbra of the names, with the unsurprising exceptions of Maria and Jose.

For our other graphs the statistical analyses were more straightforward: we calculate weighted averages using survey weights provided by YouGov and perform unweighted regressions adjusting for age, sex, education, party identification, and indicators

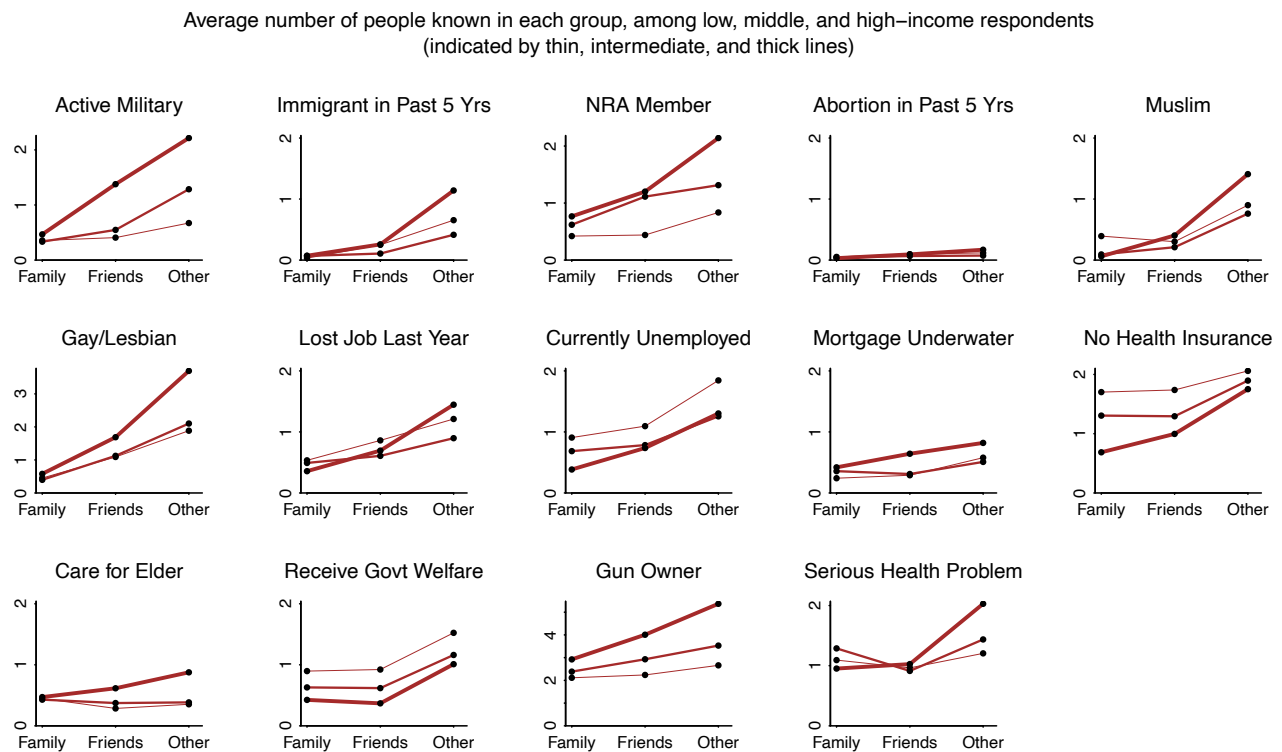
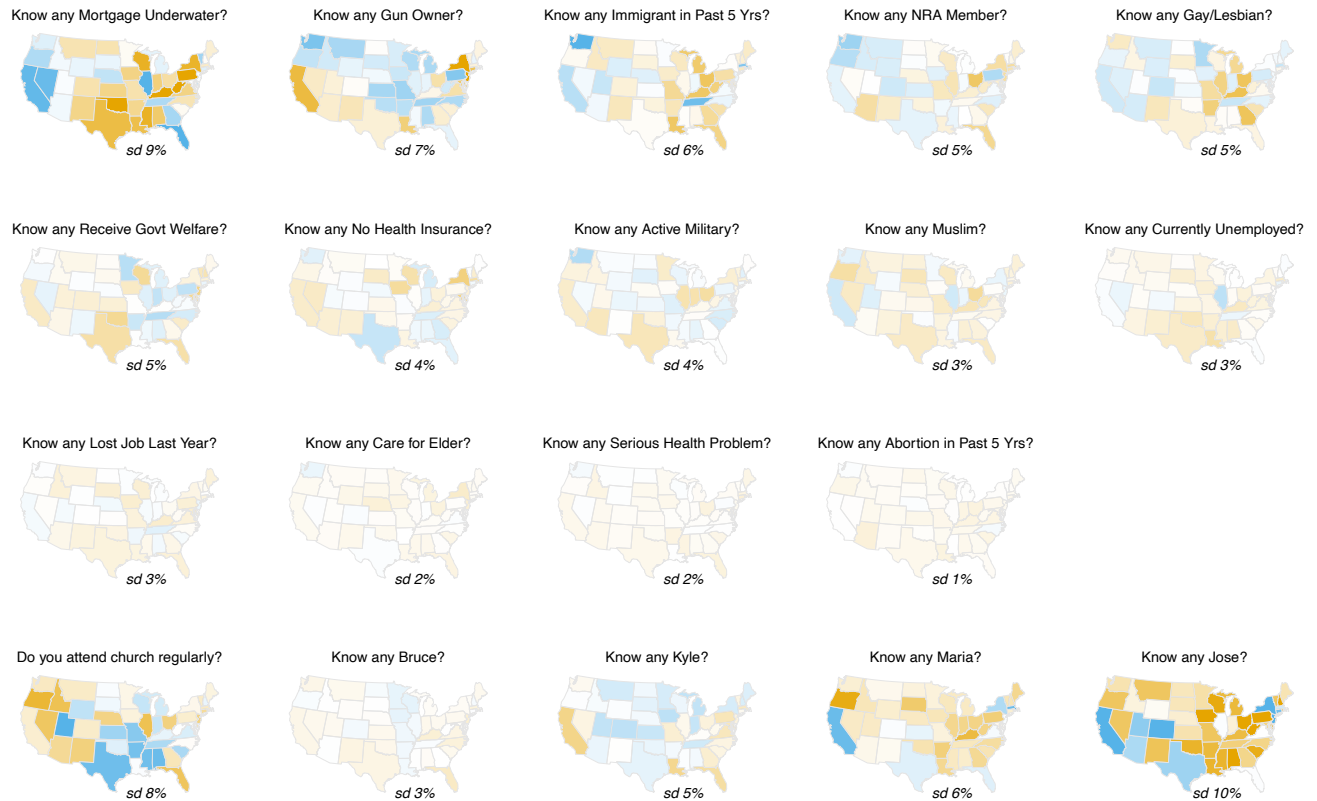


Fig. A.1. Average number known in each group among respondents classified by self-reported income. Wealthier people generally have more acquaintances, with the only exceptions being for poverty-related groups such as welfare recipients or people lacking health insurance.



Shades of blue: People in these states are more likely to know someone of that group
 Shades of tan: Less likely to know someone of that group

Fig. A.2. *Top three rows:* Geographic dispersion of penumbras, as estimated using a simple hierarchical model for each group. Most of the groups' penumbras are roughly evenly distributed across the country. *Bottom row:* Geographic dispersion of several survey responses. These graphs are helpful in calibrating our understanding of the penumbra maps above. Church attenders are more prevalent in the south and less in the west and northeast; Kyles are more common in the middle of the country, and people living in states with more Latinos are, unsurprisingly, more likely to know Marias and Joses.

for Black and Hispanic. It is standard practice to not use weights when the regression adjusts for key variables that can affect nonresponse (see, e.g., Gelman and Carlin, 2001). We performed all computations in R.

In addition, we fit the overdispersed model for aggregate relational data introduced by Zheng, Salganik, and Gelman (2006) and McCormick and Zheng (2013). In Stan, we fit the model to data y_{ik} , the total number of people in group k known by respondent i , using a logarithmic model for the expected counts: $E(y_{ik}) = e^{\mu + \alpha_i + \beta_k}$, with population models $\alpha_i \sim \text{normal}(0, \sigma_\alpha)$ and $\beta_k \sim \text{normal}(0, \sigma_\beta)$. The parameters α_i represent the relative gregariousness of the survey respondents, β_k represents the relative size of the groups' penumbras, and μ , which is assigned a flat prior, corresponds to an average level. To allow for overdispersion, we modeled the count data y_{ik} using a negative binomial rather than a Poisson, allowing each group k has its own overdispersion parameter ω_k ; that is, we parameterized the negative binomial in terms of its expectation $E(y)$ and overdispersion $\text{var}(y)/E(y)$. Overdispersion $\omega = 1$ corresponds to the Poisson distribution, with higher overdispersions representing clustering in the data that correspond to nonrandomness in the social network. We assign proper but weak unit exponential priors to the scale parameters $\sigma_\alpha, \sigma_\beta$ and the overdispersion parameters ω_k .

Using the Bayesian inference engine Stan, we fit this model to the 1700×22 matrix y corresponding to the survey respondents included in our analysis and all the questions for which we asked how many X's do you know: 8 names and 14 social groups. For the names, all that we had was total known; for the social groups, we constructed a total for each respondent by adding the number known in close family, close friends, and other people. We recognize that responses to the name questions and the group questions are not directly comparable because of recall bias relating to how the questions are asked, but it still should be possible to compare the overdispersions of the different groups. As discussed by Zheng, Salganik, and Gelman (2006), overdispersion in the counts corresponds to clustering in the social network of the penumbra. As with spatial dependence more generally, clustering in the network can arise in (at least) two ways: (a) from an agglomerative process, for example once you know one person in a group, he or she can introduce you to others; and (b) as a reflection of a network-correlated latent variable, if people who are more similar in some social and geographic characteristics are more likely to be in a particular penumbra. Core groups will differ in the extent to which these two processes will arise.

Figure A.3 shows the sizes of the penumbras as measured by the percentage of respondents who report knowing at least one member of the group, the average number known, and the estimated overdispersions (with 50% and 95% posterior intervals) for the 22 penumbras in the study.

Our focus here is on the overdispersions as these give insight into nonrandomness or clustering of the penumbras in the social network. Unsurprisingly, the names show very little overdispersion, with the exception of Jose and, to a lesser extent, Maria. and the other groups vary widely in their overdispersions. The groups with the highest overdispersion (that is, the most clustering in their social penumbras) are National Rifle Association members, gun owners, people without health insurance, welfare recipients, recent immigrants, Muslims, and active military. All this makes sense as these either represent subcultures within the population or marginalized groups. The group, other than names, with the lowest overdispersion is women with abortions, which makes sense too.

How should we think about these summaries? From a political perspective, we assume it would generally be better for a group to have a larger penumbra; conditional on penumbra size, it is not clear to us whether it would be beneficial to have more or less overdispersion. On one hand, low overdispersion represents broad penetration across the population; on the other hand, it is possible that the concentration associated with high overdispersion would motivate more focused political activity. At this point, we can just say that we have measured these properties of penumbras and that they merit future study, both for understanding political groups and in other settings in which there is interest in the representation of groups within social networks.

F. Robustness checks

We perform placebo checks to address four possible threats to identification in the panel study.

Our first concern is that the patterns in Figure 4 could simply be explained as an artifact of measurement error in penumbras. More specifically, the issue would be as follows: in those regressions, we are comparing people who enter the penumbra to those who stay outside. But suppose that reports of number known in a group have some noise. Then, even in the absence of any true effect of entering the penumbra, those people who go from reporting zero to a positive number would know more people in the group, on average, than those who remain at zero. That is, in a hypothetical null world in which underlying penumbra membership is not changing at all but where responses are noisy, a positive reported number known in wave 2 would still be an indication of a higher probability of being in the penumbra.

To address this possibility, we re-fit our model for each group in time-reversed order, predicting change in attitude from waves 2 to 1 from change in penumbra from waves 2 to 1, just considering respondents who reported zero people known at time 2, and adjusting for demographics as before. If the result is a measurement error artifact, we should expect to see basically the same results as before, representing a residual correlation but no change or evidence of causation. If the result is truly a change, we should not expect to see anything in the time-reversed analysis. When we re-fit in this time-reversed order, we see no patterns beyond noise, thus suggesting that the results of Figure 4 of the paper are not explainable simply as a measurement-error artifact.

A second possibility is that changes in the attitudes could reflect nothing more than general liberal-conservative ideology, for example, that entering the gay penumbra is correlated with having more liberal attitudes more generally which would then show up as increased support for same-sex marriage, without being specific to the gay penumbra. To check this hypothesis, we perform 14×12 regressions, predicting change in each of 12 attitude questions given entrance to each of 14 penumbras.

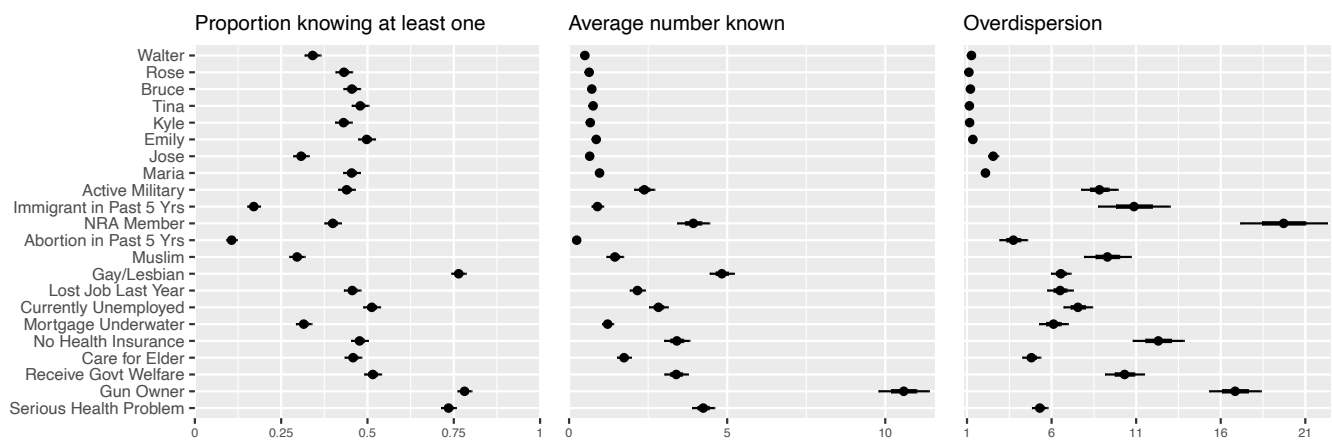


Fig. A.3. For each of 8 names and 14 groups, the proportion of survey respondents knowing at least one person in the group, the average number known in the group, and the estimated overdispersion, where 1 corresponds to no overdispersion (that is, a group whose contacts are randomly distributed within the social network) and higher values correspond to clustering of the penumbra within the social network.

Table A.2. Coefficients of regressions of change in issue attitudes, given entrance into different penumbras. The numbers in bold font correspond to the estimates in Figure 4. The distribution of other elements of this matrix, not in bold, is not statistically distinguishable from noise.

	Wars	Imm+	Illeg	Muslm	Guns	Abort	GayM	Unemp	Mortg	Hlth	Care	Welf
Military	-.04	-.04	.03	-.03	.03	-.06	.01	.03	-.01	-.02	.01	-.06
Immigrant	-.01	.00	.03	.04	-.01	-.01	.01	.07	-.05	.06	.11	.00
NRA	.01	.01	-.08	-.04	.14	-.04	-.03	.04	-.09	-.14	.10	-.10
Abortion	.04	.10	.04	-.05	-.09	.04	-.06	-.01	.03	.04	.08	.00
Muslim	.02	.12	.00	.04	.06	.02	.08	.00	.05	.05	.16	.04
Gay	.01	.12	.02	-.02	.00	.07	.02	-.01	-.04	.00	.04	.02
Lost Job	.05	.07	.01	-.05	-.06	-.02	.07	.09	.04	.05	.13	.06
Unemployed	.01	.05	-.04	.05	-.02	.01	.02	.11	.05	.01	.03	.04
Mortgage	-.01	.04	-.02	-.03	.00	-.02	.07	.00	-.04	-.02	.02	.06
No Insurance	.02	.04	-.08	.05	.01	-.04	.10	.02	.00	-.04	.06	.04
Care Elder	.06	.08	-.05	.00	.08	.03	-.02	.02	-.01	-.04	.12	.04
Welfare	-.01	-.03	.02	-.03	-.07	-.03	.04	-.04	.00	.02	.08	.04
Gun Owner	.05	-.06	-.07	-.14	.00	.04	.03	.03	.02	.00	.08	.01
Health	.06	.01	.06	.03	.05	.04	.01	-.03	-.06	-.10	-.02	-.16

Of the 168 regressions, 18 correspond to issue attitudes and group membership that we predicted ahead of time and 150 are cross-correlations for which we had no expectation of finding effects. The estimated coefficients are shown in Table A.2. The 150 cross-correlations show no apparent patterns beyond what might be expected by noise, a pattern we also confirm in a formal check. For each of these groups of coefficients, we compute the sum of squares of the t -scores (estimate divided by its standard error) of the coefficients. For the group of 18, this sum of squares is 35, much higher than would be expected from the χ^2_{18} distribution that would occur due to chance alone. In contrast, for the group of 150, the sum of squares of t -scores is 158, completely consistent with the χ^2_{150} noise distribution. This does not mean that there is nothing going on in these 150 regressions, merely that whatever is happening is overwhelmed by noise. This finding serves as a useful placebo check that allows us to reject the hypothesis that the positive coefficients in Figure 4 are nothing but a manifestation of a general correlation with liberal-conservative political attitudes.

Third, we perform basic robustness checks by repeating our analysis using different specifications, considering other measures of penumbra membership (change in penumbra size or change in square root of penumbra size, instead of a binary in/out measure), excluding respondents over the age of 65 or over the age of 40 (to search for the possibility that effects could be larger among young people whose attitudes are more malleable), including an interaction of treatment effects with age, and adjusting for total network size (as estimated by the sum of responses to the first names questions). The results for those alternative analyses are broadly similar to those shown in Figure 4: the rankings of the different estimates change, but the average effect estimate remained positive.

Fourth, we test for a “demand effect,” whereby individuals who report in the second survey knowing someone from the core group (entering its penumbra) perceive the socially desirable thing to do is to report a policy attitude more favorable to the group. If this is so, the change we observe in attitudes does not reflect a true shift in attitudes but instead is an artifact of the survey design. To address this possibility, we estimate the same models as before, but replacing the outcome variable of actual observed change in position on a given policy question with respondents’ *self-perceived* change in position on that same question. We measure this perception based on respondents’ answer to the the following question in the phase 2 survey: “On each of these items, please try to think how your current view compares to the one you held 12 months ago.” Respondents were then provided with options from which to describe the change in position (“I became more in favor,” “My opinion hasn’t changed,” or “I became more opposed”). Due to space constraints in the survey, this question was asked for only six of the policy items.

By using respondents’ responses as the outcome, we can compare the effect of entering a penumbra on actual versus perceived change in views. When estimating the model using perceived changes, the estimated effects of penumbra entry on perceived change in policy views are all close to zero and indistinguishable from noise; see Figure A.4. This supports the idea that the actual change in policy views we saw in Figure 4 arose from entering the penumbra rather than simply reflecting concerns about social desirability. Having said that, even a change in responses after penumbra entry due to a shift in one’s sense of what is socially acceptable could in itself also represent a meaningful behavioral change, even if not one that represents a full underlying opinion shift.

Figure A.4 shows the results of the regressions we performed, for each penumbra predicting *remembered* changes in policy attitude given entrance into the penumbra. Compared to the results on actual changes, shown in Figure 4, we see no strong patterns. The only coefficient that stands out is that for the unemployment penumbra. The overall lack of pattern in Figure A.4 serves as a robustness check: the contrast to Figure 4 suggests that the overall positive finding in that earlier figure cannot simply be explained by a demand effect.

Table A.2 shows the coefficients estimated from separate regressions predicting change in policy views given penumbra entry, also adjusting for demographics. Of these $14 \times 12 = 168$ regressions, 18 correspond to issue attitudes and group membership that we predicted ahead of time and 150 are cross-correlations for which we had no expectation of finding effects. The 150 cross-correlations show no apparent patterns beyond what might be expected by noise, a pattern we also confirm in a formal check.

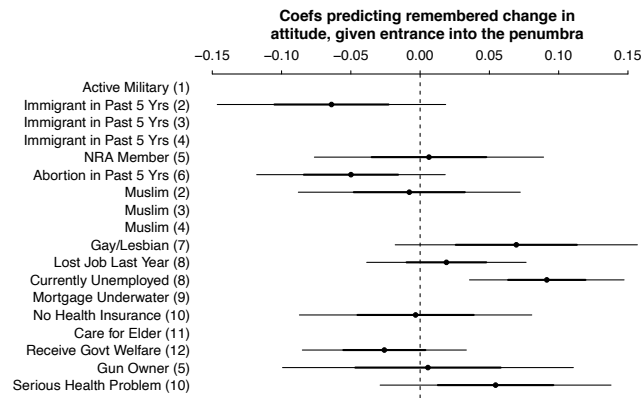


Fig. A.4. Estimated effects of penumbra entry on *remembered* change in policy views. The null effects are consistent with the idea that the effects on actual changes shown in Figure 4 arose from entering the penumbra rather than simply reflecting concerns about social desirability. The numbers on the issue questions correspond to the list in SI Appendix, section A.2, and the blank rows correspond to questions that were not included in the recall followup survey.