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American gun ownership and the ingroup/outgroup divide

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This PDF file includes:

Main Text

Figures 1 to 2

Table 1

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

18
19
20
21
22
23
24
25
26
27
28
29

Abstract

American protective gun ownership privatizes collective behavior, transmuting the role of the state to keep citizens safe into individual actions to protect one’s family and one’s immediate community. In doing so, owners may sharpen the ingroup/outgroup divide into those who need protection and those who need to be protected against. Using nationally-representative individual-level data from the General Social Survey, we find that American gun owners have friendship structures that are more ingroup-focused than non-owners: more cohesive (more of owners’ friends are friends with each other) and less diverse (fewer of owners’ friends are of different races or religions). Using county-aggregated data from over 70 million Facebook users (over 21 billion friendship-ties), we similarly find that US counties with higher rates of gun ownership have friendship structures that are more cohesive and less diverse. This is mirrored in our findings that states and counties with higher rates of firearm ownership have lower rates of social infrastructural sites that bring communities together and lower rates of civic trust. Finally, we show evidence that the presence of guns is a quasi-causal factor in declining social capital - using modern time-series analyses, we show that a state-level increase in gun sales predicts a significant decrease in the next year’s rates of social capital.

Significance Statement

American gun owners often frame their ownership as individually-defending their families and immediate communities against a dangerous world, potentially heightening the divide between ingroups, who should be protected, and outgroups, who should be protected against. We find that the social world of gun owners in America is different than the social world of non-owners. As individuals, American gun owners live in more cohesive, ingroup-focused social networks and have fewer ties to people unlike themselves. American communities with higher rates of gun ownership have similarly-fragmented social structures, have less access to social infrastructure, and accordingly, have lower rates of civic trust. Using longitudinal analyses of American states, we find evidence that suggests guns, specifically, may factor into this fracturing of community.

Main Text

Introduction

Over 40% of American households own at least one gun (1). When asked, gun owners overwhelmingly report that they own guns, at least in part, for self-defense: in a recent nationally-representative survey, 81% of owners indicated that protection was an important part of their reasons for owning (2). This protection is often framed in civic terms: through their ownership of firearms, they are helping to protect not just themselves but those in the community that they care about, directly stepping in where an unwilling or incapable state is unable (3–7). In choosing to protect their communities as individuals, however, these so-called ‘citizen-protectors’ or ‘sheepdogs’ may neglect approaches that might extend their assistance beyond their local networks. In this paper, we investigate the ways in which American gun ownership predicts changes in the ways that people form social ties, form community infrastructure, and engage in civic life.

Gun ownership is often linked in America with ‘rugged individualism’ - an ideology which prioritizes self-reliance and freedom from constraint by others (8, 9), and which holds itself in opposition to more systemic or structural accounts for inequities (10). In contemporary American life, gun owners often reject or deride collective action (11, 12).

By choosing to prioritize the individualistic protection of just those in one’s inner circle (household, family, neighborhood) instead of working to keep one’s entire community safe through collective action, citizen-protectors may be reinforcing the boundaries between ingroups (who can and should be protected) and outgroups (who need to fend for themselves), dividing society into friends, who are deserving of protection, and strangers, who are not. This may, then, be reflected in different preferences for social ties. A more ingroup-focused social-life (characterized by bonding social capital, the degree to which one is connected with people like oneself; see 13, 14) is one in which individuals have small, tightly-knit friendship circles, where friends are friends with each other, and where people are able to rely on their friends for support (e.g., 15). These social networks are also frequently hermetic with sharp boundaries between ingroups and outgroups (16, 17): if one is closely-bonded to one’s group and unable to socially-survive among strangers, then one needs to be very careful not to upset group harmony and to make sure that the group as a whole is able to continue to survive (18, 19). Faced with a hostile world, in which one’s success is tied to the success of the group, a person needs to avoid spending too much time with outsiders, whose goals may not be aligned with the goals of one’s core group and who therefore may imperil group functioning (20–22). This ingroup-focused life tends to promote a more parochial prosociality, in which people come together to improve their local communities in ad-hoc ways, often characterized by helping friends and family (23, 24) instead of the community as a whole. By contrast, a more broadly-held social life (characterized by bridging social capital, the degree to which one is connected to people unlike oneself; see 25, 26) is one in which there is a greater amount of trust in strangers and a less-stark distinction between one’s ingroup and one’s outgroup. In such a social world, it is more beneficial to have many different sorts of ties to many different people: since relational ties, based more on personal preference than mutual interdependence are easier to break, it is therefore more optimal to have many weak ties that are more robust to disruption (27). This bridged openness to those unlike oneself is also associated with a greater sense of political power, less cynicism, and less fear of strangers (28); and, perhaps in turn, higher rates of collective political action, such as boycotts, signing petitions, and attending demonstrations (29).

American protective gun ownership may additionally tip owners towards a more ingroup-focused social approach and away from a more outgroup-focused approach by making the world seem to be a more dangerous place and society to be less able or willing to step in (3, 30–32). Gun ownership is associated with belief in supernatural evil (33) and enhanced attention to the prevention of harms (34). If the world seems generally hostile and people seem likely to want to take advantage of you as a gun owner (6, 35, 36), then it makes sense to hunker down into the communities that you know that you can trust. Alternatively, it may be the case that living in a

neighborhood where one feels less of a sense of control or efficacy leads to people withdrawing from broader social life (37, 38). Indeed, prior work has shown that states that have higher levels of gun ownership also have lower rates of social capital, lower beliefs in the honesty of their neighbors, and stronger beliefs that others would take advantage of them if they had the chance (39, but see 40).

By influencing the worldview of individuals, American protective gun ownership should additionally influence the nature of the broader communities in which these owners are embedded. If there is an increased proportion of community members who withdraw from the broader collective, or who express mistrust of other community members, then it should be harder for communities as a whole to support the complex interdependence required for broader civic action (e.g., 41).

In the present article, we empirically test whether gun ownership is associated with differing social-network strategies and means of coming together in community. We use both individual-level friendship data and county-level aggregations of Facebook friendships to establish that ownership is related to a greater ingroup-focused friendship approach (one in which more of a person's friends are friends with each other) and a lesser outgroup-focused friendship approach (one in which a person's friendship group has more members different than oneself). We then show that this difference in friendship strategy is reflected in the social infrastructure of communities: where there are more guns, there are fewer places where one can come together and meet strangers, and this difference in social ecology helps to statistically-explain some of the relationship between gun ownership and outgroup-focused social life. Following research on guns and social capital (39, 42), we find that counties with higher rates of gun ownership have lower rates of political participation and civic trust. Finally, we use time-series analysis to begin to understand the causal direction within the correlation between guns and civic life: we investigate whether changes in gun sales predict changes in social capital, or whether changes in social capital predict changes in gun sales - over a 19-year span, we find that state-level gun sales predict future-year declines in social capital above-and-beyond prior-year social capital.

Results

Individual-Level Effects

We begin by documenting an individual-level relationship between gun-ownership and friendship strategies. Data come from the General Social Survey (GSS), a long-running nationally-representative sampling of American adults. The GSS has regularly asked about whether respondents own a firearm, and in several years, it has also asked about the friends that a participant has.

Friendship Cohesion

To capture the degree to which a person has cohesive friendships, we use data from the 1985 and 2004 waves of the GSS, where participants were asked to list their friends and to then report, dyad-by-dyad whether their friends were friends with each other (on a three-point scale, where 1 indicated that the two specific friends were strangers to each other and 3 indicated that the two specific friends were very close to each other). We averaged these closeness ratings across all dyads within a person to create a friendship-cohesion score, with higher scores indicating more cohesive friendships. Using data from 1,154 adults (511 of whom reported owning a firearm), we find, controlling for respondent age, race, gender, income, political affiliation, and the urbanicity of their residential area, that gun owners have more cohesive friendship groups than non-gun-owners, $d = 0.13$ [0.02, 0.25], $p = .023$. In supplemental models, we additionally controlled for the presence of racial outgroup members in neighborhoods to address potential differences in

opportunities for cross-group interaction more directly (over and above other controls, including urbanicity). Our conclusions are unchanged, $p = .045$.

Friendship Diversity

To capture the degree to which a person has diverse friendships, we use data from the relevant GSS waves where participants were asked to list their friends and to then report their friends' age (in 1985), gender (in 1985), race (in 1985, and 1998), religion (in 1985, 1988, and 1998) and political ideology (in 1987). Again, controlling for age, race, gender, income, political affiliation, and urbanicity, as well as including a random-intercept for the wave of the survey, we find that gun owners are less likely to have cross-race or cross-religious friendships: cross-race, $n = 2,258$ (919 gun owners), $d = 0.22$ [0.13, 0.30], $p < .001$; cross-religion, $n = 2,861$ (1,168 owners), $d = 0.21$ [0.13, 0.28], $p < .001$. We find no evidence for differences in friendship-diversity between owners and non-owners across gender or age lines (perhaps unsurprisingly, as gender and age are less-frequently used to define ingroups and outgroups in the United States than race and religion, 43, 44, see also 45), and no evidence for difference across political lines, which may reflect the relatively-lower degrees of affective partisanship present at the time of the survey (46). Our conclusions are unchanged when using models without controls or models that additionally control for the presence of racial outgroup members in neighborhoods when predicting cross-race friendships - see the Online Supplement for all model coefficients, descriptives, and correlation-tables.

Community-Level Effects

Looking beyond the individuals surveyed by the GSS, we investigated the difference in friendship structures in areas that contain more or less gun owners. As the United States does not track individual-level gun ownership, we use a well-validated proxy, the percentage of deaths by suicide carried out with a firearm (see 47, 48) to estimate county-level firearm ownership. County-level friendship data comes from a dataset created by (49) based on friendship graphs from 72.2 million American Facebook users, aged 25-44, containing over 21 billion friendship ties. Aggregated at the county level, this dataset provides estimates of both friendship cohesion and friendship diversity. Cohesion is measured through the proportion of a person's friends that are friends with each other. Diversity is operationalized as the proportion of a person's friends that are of a different social class. Social class is imputed from a range of features, including the device used by the recipient to access Facebook; see (49) for more details.

Using data from 2,953 American counties, and controlling for county-level population density (log-transformed), poverty rate, household income per capita, economic inequality, fraction of Black residents, racial segregation, total crime rate, unemployment rate, and the proportion of registered Republicans, we find that counties with higher rates of gun ownership also have higher rates of cohesive friendships, $\beta = 0.09$ [0.05, 0.12], $p < .001$. Using the same controls and same counties, we also find that counties with higher rates of gun ownership also have lower rates of cross-SES diverse friendships, $\beta = -0.08$ [-0.11, -0.05], $p < .001$. See Figure 1.

Our conclusions are unchanged when using models without controls. Additionally, when using spatial regression models to correct for spatial autocorrelation (i.e., spatial dependence) in the data, our conclusions remain consistent - see the Online Supplement for all model coefficients, descriptives, and correlation tables.

Social Amenities

Across both individual-level and area-aggregated data, looking both at self-reported friendships and actual friendship connections on Facebook, we find evidence that gun ownership is associated with a more ingroup-focused social life, one in which social networks are tighter. Social life does not happen in a vacuum - it is something that can be fostered or hindered by the proper physical environments (see 50 for a discussion). For people to meet and befriend people unlike themselves, they need to find the right spaces (51, 52). Where there are fewer places to run into strangers or casual acquaintances, it may be harder to initiate and maintain these broader, shallower, friendship ties. Closer, deeper ties, by contrast, may not need specialized physical space

- one can always invite one's close personal friends to one's home or other private space (e.g., 53, 54). We therefore would expect that an increased availability of Third Places would predict an increase in bridging-type ties, but would not necessarily predict a change in bonding-type ties.

We therefore set out to characterize the social infrastructure available in areas with higher or lower rates of gun ownership. To aid in this characterization, we use data from the National Neighborhood Data Archive (NaNDA), which provides detailed information about the geographic distribution of infrastructure of all sorts. We specifically set out to examine the presence of so-called Third Places (55), places that are not a person's home, nor a person's workplace, but are instead places where people can see each other in public and where people can assemble - places in which people can build social connection (see 52 for a review).

NaNDA provides higher-level aggregations of place types; in our analyses we conducted an initial factor analysis form a typology, using the following labels to capture the diversity of Third Places: arts (galleries, museums, etc.), eating & drinking (restaurants, bars, etc.), personal care (salons, laundromats, etc.), grocery stores (grocers, butchers, etc.), retailers (various non-food shops), religious organizations (churches, mosques, etc.), civic/social organizations (fraternal societies, unions, etc.), and social service organizations (childcare, senior centers, etc.).

Regardless of the type of place, using data from 2,953 counties and controlling for county-level population density (log-transformed), poverty rate, household income per capita, economic inequality, fraction of Black residents, racial segregation, total crime rate, unemployment rate, and the proportion of registered Republicans, we find that counties with higher rates of gun ownership have lower rates of Third Places, β 's -0.17 - -0.11, p 's < .001. See Figure 2. Our conclusions are unchanged when using models without controls and models that correct for spatial autocorrelation - see the Online Supplement for all model coefficients, descriptives, and correlation tables.

As expected, we find that the presence of Third Places helps to mediate the relationship between county-level rates of firearm ownership and bridging-type cross-SES diversity of friendships. Across all eight types of Third Place, we find significant evidence of mediation, whereby counties with higher rates of gun ownership have fewer Third Places, and counties with fewer Third Places have a lower proportion of diverse friendships ($n = 2,883$ counties, all controls as above), proportion mediated 0.136 - 0.377, p 's < .001. We do not find the same pattern of results for the mediating effect of Third Places on bonding-type friendship cohesion, where we find that only the presence of religious organizations and social service organizations help to significantly explain the relationship between county-level gun-ownership and increased friendship cohesion (see 54 for a similar finding). See Table 1 for all proportions mediated, and see the Online Supplement for full model details, as well as alternate mediational pathways.

Social Capital & Civic Engagement

Prior work (39, 42) has found that gun ownership, at the state level, is associated with lower rates of mutual trust, civic engagement, and general social capital. We build upon that work by examining the relationship at a smaller level of aggregation - instead of looking at states, we look at county-level relationships between guns, social capital, and civic engagement, and by breaking social capital out into both its bonding and its bridging forms. The distinction between bonding and bridging social capital is especially-relevant here, given our findings above about the friendship strategies associated with firearm ownership.

To measure social capital at the county level, we use data from three datasets. One, from (56), created a set of indices based on demographic features from the 2010 U.S. Census and data from the Environmental System Research Institute (ESRI). In addition to calculating an overall social-capital index for each county, they calculated sub-indices for both bonding and bridging social capital. Their bonding index captures community-level homogeneity, with indicators such as race similarity, and educational and economic equality; while their index of bridging social capital was defined by metrics such as the percentage of the residents' membership in religious, civic, and charitable organizations, fraternal orders, and unions.

Controlling for county-level population density (log-transformed), poverty rate, household income per capita, economic inequality, fraction of Black residents, racial segregation, total crime rate, unemployment rate, and the proportion of registered Republicans, we find that in counties with

more firearms there is evidence for higher rates of bonded social capital, $\beta = 0.14$ [0.11, 0.17], $se = 0.02$, $t(2,942) = 8.53$, $p < .001$; and directionally-lower, but not statistically significant, rates of bridged social capital, $\beta = -0.03$ [-0.07, 0.01], $se = 0.02$, $t(2,942) = -1.38$, $p = .169$.

Social capital has frequently been suggested to support civic life more generally (e.g., 14, 24, 25, 29, 57). We therefore looked at a measure of county-level political action created by (56), determined by the percentage of residents who attended political rallies, speeches, and organized protests. We find that higher rates of gun ownership in a county, using the same controls as above, predicts lower rates of political action, $\beta = -0.06$ [-0.11, -0.02], $se = 0.02$, $t(2,942) = -2.46$, $p = .008$ (though, see 58 who finds that gun owners tend to vote at higher rates than non-owners).

As a robustness check against any particular operationalization of social capital, we also analyzed data from the US Senate Republicans' Joint Economic Committee (JEC) Social Capital Project (59), released in 2018; and 2014 data from the Northeast Regional Center for Rural Development at Penn State (NERCD, 60). Even though their construction of bridging and bonding social capital indices include different ingredients, our results are largely the same: when using the same controls as above, we find that higher rates of gun ownership in a county directionally predict lower rates of bridging social capital, although this association is not consistently statistically significant across measures (JEC index of informal civic society and associations, $\beta = -0.03$, $p = .115$; NERCD rates of non-profits per-capita, $\beta = -0.08$; $p < .001$; NERCD rates of associations per-capita, $\beta = -0.02$, $p = .335$); and significantly predict lower rates of civic trust and political participation in the county (JEC index of institutional trust and political engagement in the 2012-2016 elections, $\beta = -0.07$, $p < .001$; NERCD index of Census response rates, $\beta = -0.06$, $p = .001$; NERCD rates of voting in the 2012 election, $\beta = -0.03$, $p = .103$, not statistically significant). See the online supplement for all models, including models without controls, models accounting for spatial autocorrelation, and for correlations between all measures.

Directionality

It is possible both that gun ownership leads to degraded social infrastructure and that, where the infrastructure of society has been hollowed out, people may need to rely more on their ingroups (e.g., 61, 62). In places where community life has frayed, gun ownership may appear an appropriate reaction to the ensuing sense that one is on one's own (e.g. 3, 4, 7). Indeed, when we reverse our models, using our gun-ownership proxy as a DV and our various measures of friendship strategy and social capital as IVs, we find significant relationships, albeit ones where the overall fit of the models is slightly-worse than the models presented in-text. See the Online Supplement for more details.

To disentangle the potentially-bidirectional relationship between community-level gun ownership and social capital, we turned to a multilevel vector autoregressive (mlVAR) model approach (63). These models can take multiple time-series and decompose their reciprocating relationships into contemporaneous (within-timepoint) and temporal (lagged) components while also separately estimating autoregressive components and random intercepts for each time series - vital aspects to avoid confounding the interpretation of coefficients in any cross-lagged time-series model (64-66). mlVAR can additionally model the nonindependences that come from grouping variables within a dataset, such as states or counties, which allows us to compare states against themselves across time, thereby controlling for any time-invariant differences across states. Using this approach, then, we can simultaneously test whether changes in firearms ownership predict lagged changes in social capital and, at the same time, whether changes in social capital predict lagged changes in firearms ownership.

Data for this analysis comes from two different sources. Historical social capital data comes from (67), which uses data from the marketing firm MRI's Survey of the American Consumer, an annual survey of over 20,000 Americans, to measure community organizational life, engagement in public affairs, and community volunteerism. The measure was designed to match Putnam's overall social-capital measure - a measure aligned with bridging social capital (14, the same measure that was used to find evidence for a state-level relationship between gun ownership and social capital in ref. 39), and has been shown to correlate highly with the Putnam measure across time when aggregated within year across states, r 's = .62-.82, $p < .001$, depending on the year;

and across space when aggregated within states across years, $r = .80$, $p < .001$. Data for the social capital index is available for the years 1986-2006.

In our preferred time-series specification, we use not the gun-ownership proxy modeled above, but instead, a model of state-level gun-sales. The gun-ownership proxy (validated at the state-level by ref. 48) captures existing ownership patterns, but it does not set out to model increases or decreases in gun sales over time. To give a sense of the stability of the gun-proxy measure, for the years 1984-2006 (the years that can be modeled in our analyses), the average state-level standard-deviation in ownership is just 0.05 (with an SD of 0.02). Given that the state-level mean value of the ownership proxy is 0.58 (SD = 0.13), it is clear that states do not vary much in their ownership patterns over the duration of our analyzable timeseries: mean/standard-deviation ratio for the firearm-ownership proxy = 13.57 (SD = 4.57), with an ICC of .87 [.82, .91]; and therefore that there is little variation to leverage. Across this timeperiod, in other words, there does not appear to be meaningful changes in the number of owners within a given state. We therefore model data on the yearly state-level sales of firearms, as indexed by the number of gun-sales background checks carried out by the FBI using the National Instant Criminal Background Check System (NICS). Using this dataset, for the years 1998-2006 (the years that can be modeled in our analyses) the average within-state-level mean/standard-deviation ratio for the gun-sales measure is 2.80 (SD = 0.37) with an ICC = .76 [.67, .83], implying far more variability to make use of in time-series prediction.

Analyzing gun-sales, using data from 48 states, covering the years 1998-2006, we find that an increase in gun sales predicts a decrease in the next year's bridging-type social capital, $\beta = -0.159$ [-0.26, -0.059], $se = 0.051$, $p = .002$. We find no evidence for the reciprocal pattern: changes in social capital do not significantly-predict changes in gun sales, $\beta = 0.0087$ [-0.091, 0.11], $se = 0.051$, $p = .87$. In line with prior state-level social-capital findings (e.g., 42; 39), we find that, across the time-series, states that generally have higher levels of gun-sales also have generally lower levels of social capital, $r = -.38$, $p < .001$. See the Online Supplement for the full parameters of this model, as well as the parameters that instead come from using the gun-ownership proxy.

Discussion

Using individual-level self-report, aggregations of large-scale friendship data, well-annotated place data, and multiple measures of both social capital and civic trust, we find that gun ownership is associated with a greater emphasis on ingroup ties and a weaker emphasis on outgroup ties. This ingroup/outgroup divide is echoed in the differential availability of the sort of places where people can socialize: in counties with higher rates of gun ownership, there are fewer Third Places - the sorts of environments (not one's home, not one's workplace) where people are able to see strangers and make broader friendship ties. The relationship holds across a whole diversity of Third Places: restaurants, bars, museums, and fraternal societies, but also salons, grocery stores, churches, and social service organizations. We find that, across the board, the decreased presence of these Third Places helps to statistically explain why counties with higher rates of gun ownership have fewer outgroup friendship ties. This ingroup/outgroup divide is also echoed in the finding that counties with higher rates of gun ownership are also those with lower rates of civic trust or political action. We find evidence that increases in gun ownership is a quasi-causal factor for this decrease in social capital, as state-level increases in gun sales predicts year-lagged state-level decreases in social capital, while finding no evidence for a pathway from changes in social capital to changes in gun sales.

A conceptual limitation in this work comes from our use of proxy variables. By operationalizing geographic gun ownership with an indirect measure, and by measuring social capital largely through administrative data, we are able to capture the shadow of our psychological model, but we are unable to directly capture the way that gun ownership changes how people see the social world in the moment. This concern is especially present in our analyses of social capital, where the precise operationalization of bridging and bonding social capital shifts depending on the source. Substituting the presence or absence of associations for

the concept of mutual trust, shared identity, and community goodwill has been criticized as being overbroad or potentially-incoherent (e.g., 68–72), and deciding which types of associational memberships should be included in an index of social capital (and whether they should be considered as bridging or bonding) is itself non-obvious (see e.g., 57, 73, 74). Conceptually-speaking, one definition of the distinction between bridging and bonding social capital (28, 75) hinges not on the type of association but on their makeup - a church, for example, that is demographically-homogeneous would provide bonding social capital, while a church that is demographically-heterogeneous would provide bridging social capital. On this account, simply adding up the number of churches or unions or civic associations in an area may be a misleading indication of the true nature of the connections between people. Our friendship data addresses this concern - by directly measuring the ties between people, we show that gun owners and counties higher in gun ownership have the more homogeneous networks characteristic of greater degrees of bonded social capital, with less of the heterogeneous networks characteristic of bridged social capital, but future work that can more precisely characterize areas in terms of their social-capital characteristics would be welcome.

While our individual-level analyses help us to address worries about the ecological fallacy (the statistical error of assuming that what happens at the aggregate level also happens at the disaggregate level), we are still limited in our ability to show that gun ownership causally changes the ways that people understand their individual social worlds. Much of our work is correlational, and it is possible that additional third variables help to explain both gun ownership and the structuring of the social world. While our time-series analyses suggest at least a quasi-causal role for gun sales, it is by no means definitive. Threats to one's place in society, for example, may both increase the American desire for firearms and also decrease trust in broader society (e.g., 3, 76, 77). Future work that directly manipulates gun ownership or that makes guns more or less psychologically-accessible (see e.g., 31) will be important for further understanding this worldview.

Our proxy measure also has the downside of homogenizing an incredibly-diverse range of Americans. By treating all gun ownership the same, the use of proxy measures blurs together hunters, protective owners, sport shooters, collectors, people who use a gun for their jobs, and all the other ways that Americans relate to their guns. As a gun is simply a physical object, how a person treats it is a key factor in what it helps a person to do or to be, and how they choose to live in the world. As it is estimated that there are over 100 million Americans living in a house with a gun (2), there clearly isn't just one way of being a gun owner (by comparison, only 56 million Americans were estimated to ride a bike in 2024, 78); future work that examines how different psychological constructions of gun ownership promote or hinder the construction of social worlds will be a necessary step - there is no reason to think that those who own guns primarily to hunt or sport-shoot should be psychologically-constructing their guns in the same way that those who have guns primarily to protect their families do (see e.g., 79, 80).

Nevertheless, in sum, we find that gun ownership in the United States is associated with a more ingroup-bonded social life, with greater neighborhood homogeneity, with fewer places to see and interact with strangers, and with lower rates of civic/institutional trust and engagement. This pattern, historically, has been shown to facilitate the rise of authoritarianism and ethnic violence (e.g. 81–84). By acting as independent sheepdogs, contemporary American protective gun owners may be, in the long run, making themselves more vulnerable to wolves.

Materials and Methods

Data Availability

Data for the Individual-Level analyses come from the General Social Survey, which can be accessed at <https://gssdataexplorer.norc.og/>. For the Community-Level Effects analyses, data on friendships come from (49), and can be found at <https://www.socialcapital.org/>; county-level controls come from (85), and can be found at https://opportunityinsights.org/wp-content/uploads/2018/04/online_table4-2.pdf; except for data on county-level Republican voter registration, which is tabulated by the Redistricting Data Hub

and can be found at <https://redistrictingdatahub.org/data/about-our-data/voter-file/>. Data on county-level firearm suicides come from the restricted-use CDC All-County Mortality Files (see https://www.cdc.gov/nchs/data_access/cmf.htm for access).

For the Social Amenities analyses, additional data come from the National Neighborhood Data Archive, and can be found at <https://nanda.isr.umich.edu/data/>.

For the Social Capital and Civic Engagement analyses, additional county-level social capital data come from (56) (available at <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/IUNNZM>), from the Joint Economic Committee Republicans, United States Congress (available at <https://www.jec.senate.gov/public/index.cfm/republicans/socialcapitalproject>) and from the Northeast Regional Center for Rural Development at Penn State University (available at <https://nercd.psu.edu/data-resources/county-level-measure-of-social-capital/>).

For the analyses of Directionality, additional state-level social capital data come from (67) (available at <https://web.archive.org/web/20160120101301/http://perg-tamu.com/data-reports>); gun sales data comes from the FBI's National Instant Background Check database (available at https://www.fbi.gov/file-repository/cjis/nics_firearm_checks_-_year_by_state_type.pdf/view); and state-level gun ownership data comes from (48) (available at <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/QVYDUD>).

As all data reported here are secondary, no IRB approval was required for this work.

Statistical Analyses

For analyses of individuals, we calculated friendship cohesion and diversity scores using data from the GSS. To create a friendship-cohesion score, we use data from the 1985 and 2004 waves of the GSS, where participants were asked to list their friends and to then report, dyad-by-dyad whether their friends were friends with each other (on a three-point scale, where 1 indicated that the two specific friends were very close to each other and 3 indicated that the two specific friends were strangers). We averaged these closeness ratings across all dyads within a person to create a friendship-cohesion score and reversed them, with higher scores indicating more cohesive friendships.

To create a friendship-diversity scores, we use data from the relevant GSS waves where participants were asked to list their friends and to then report their friends' age (in 1985), gender (in 1985), race (in 1985, and 1998), religion (in 1985, 1988, and 1998) and political ideology (in 1987). We coded each item as 0 when participants and their friends shared the same age bracket, gender, race, religion, or political ideology, and as 1 when they differed on these characteristics. We then calculated the proportion of friends who differed from the participant on each characteristic, with higher scores indicating greater diversity, following the methodology of (49). These proportions were used as indicators of friendship diversity across the five demographic dimensions.

We used the `lm` function in R to test whether individuals' gun ownership status (non-owner vs. gun owner) predicts their friendship cohesion and diversity in individual-level analyses, controlling for respondent age, race, gender, income, political affiliation, and the urbanicity of their residential area. For the friendship cohesion analysis, we additionally controlled for the number of friends participants reported. For the friendship cohesion and cross-race friendship analyses, we additionally controlled for the presence of racial outgroup members in the neighborhood ("Are there any ["whites" for black respondents, "blacks" for non-black respondents] living in this neighborhood now?") to address potential differences in opportunities for cross-group interaction more directly. We also included a random-intercept for the wave of the survey when friendship measures were available in more than one year (i.e., cross-race and cross-religious friendship), using the `lmer` function in R.

For the community-level analyses, we used county-level measures of clustering and economic connectedness from (49), based on Facebook network data. Clustering captures how often a person's friends are also friends with each other, while economic connectedness reflects the extent to which individuals with low and high socioeconomic status are connected. See (49)

for more details about the measures. In our study, these correspond to friendship cohesion and friendship diversity, respectively. Using Redistricting Data Hub (RDH) L2 voter-file aggregates, we calculated the county-level proportion of registered Republicans as Republican-labeled registered voters divided by the total registered voters. RDH notes that in states without party registration (e.g., North Dakota), these party labels are modeled by L2 based on public/private data (e.g., exit polls, census, and polling) using Bayesian analysis and other statistical techniques.

We used Third Place data from the NaNDA dataset, which provides aggregated tract-level densities of Third Places based on North American Industry Classification System (NAICS) codes of the National Establishment Time-Series (NETS) database (2003–2015, 2017). To assess the availability of Third Places, we used the number of amenities per square mile, which reflects whether social infrastructure is geographically available in the local environment in ways that facilitate incidental contact and social connection among strangers or casual acquaintances. This density-based operationalization is common in prior research on social infrastructure and local social environments, and it aligns with our proposed physical environment mechanism more directly than per-capita measures for accessibility (e.g., 86, 87). The dataset originally provides values at the census tract level, which we aggregated to the county level by computing average values across tracts within each county. We grouped Third Places into eight broader categories using factor and reliability analyses (see the Online Supplement for more details), and used these scores to represent the county-level availability of Third Places.

To measure social capital at the county level, we use data from three datasets. The first is from (56), with further details provided in the Social Capital & Civic Engagement section. The second dataset comes from the JEC Social Capital Project (59), which provides two composite indices at the county level: one measuring informal civic society and associations (community health in the JEC dataset) and another reflecting institutional trust and political engagement (institutional health in the JEC dataset). The index for informal civic society and associations includes county-level indicators such as the number of non-religious nonprofit organizations per 1,000 residents (based on IRS Business Master File, 12/2015), the number of religious congregations per 1,000 residents (from the 2010 U.S. Religion Census), and an Informal Civic Engagement Subindex, derived from state-level survey data and downscaled to counties, covering behaviors like volunteering and attending public meetings (based on the 2013 and 2015 Volunteer Supplements and the 2008 Civic Engagement Supplement of the Current Population Survey). The index for institutional trust and political engagement includes the presidential election voting rate (2012 & 2016), the mail-back census response rate, and a Confidence in Institutions Subindex, derived from state-level survey data and measuring confidence in public institutions such as corporations, media, and public schools. These indicators come from multiple sources, including the Election Administration and Voting Survey, the Census Bureau, and the Volunteer Supplement to the 2013 Current Population Survey.

The last is from the NERCRD (60). The rates of non-profits per-capita capture the number of registered nonprofit organizations per county (excluding those with an international mission), sourced from the National Center for Charitable Statistics (<http://www.nccs.urban.org/>). The rates of associations per-capita reflect the density of local civic, religious, and professional associations. It was constructed by aggregating the number of establishments in religious organizations, civic and social associations, business associations, political organizations, professional and labor organizations, as well as sports and recreational facilities (e.g., bowling centers, fitness and recreational sports centers, golf courses, country clubs, and sports teams/clubs). These data are sourced from the County Business Patterns (<https://www.census.gov/programs-surveys/cbp.html>) and classified using NAICS codes. To capture civic engagement, we used two indicators: the voter turnout rate in the 2012 presidential election, based on data from Dave Leip's Atlas of U.S. Presidential Elections (<https://uselectionatlas.org/>); and the Census self-response rate from the 2010 U.S. Census (<https://www.census.gov/cgi-bin/census2010/staterates.cgi>).

To measure social capital at the state-level, we use a measures from (67) that aggregates whether a participant in the MRI Survey of the American Consumer belongs to

various civic organizations (i.e., fraternal orders, civic/religious clubs, or local government); engagement in politics (i.e., voting, contacting representatives, writing letters to newspapers); community volunteering; donations to public television; and measures of community nonprofits based on data from the IRS and National Center for Charitable Statistics.

For robustness in county-level models, we additionally used spatial lag regression models in all community-level regressions to estimate spatial dependencies in these community-level processes. This approach accounts for both direct effects of gun ownership on friendship cohesion within a given county and indirect spillover effects from neighboring counties, helping to isolate unique local effects while accounting for spatial autocorrelation in the dependent variable. Spatial lag regressions were run using the `spatialreg` and `spdep` packages in R. For the mediation analyses, we used the mediation package in R.

For analyses of directionality, we used multilevel vector autoregressive models (63). These models estimate temporal (t+1 lagged) and contemporaneous network relationships across time-series (a within-series analysis), as well as estimating the covariance structure across the stationary means of each time series (i.e., a between-series analysis). All analyses were carried out in the `mlVAR` package in R, using package-default settings (a sequential univariate multi-level estimator, `lmer`, for lagged and contemporaneous networks, allowing random effects to correlate; with an alpha of .05).

All analysis code can be found at

https://osf.io/yhfum/?view_only=99c2e59f668c46af99a718bfaa51a3c5

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Figures and Tables

Figure 1. Relationship between county-level gun ownership proxy and both friendship cohesion (Panel A) and rates of cross-class friendships (Panel B), controlling for county-level population density (log-transformed), poverty rate, household income per capita, economic inequality, fraction of Black residents, racial segregation, total crime rate, unemployment rate, and the proportion of registered Republicans. Each dot represents one county; the envelope around the regression line indicates the 95% confidence interval.

Figure 2. Relationship between county-level gun ownership proxy and rates of categories of Third Places, controlling for county-level population density (log-transformed), poverty rate, household income per capita, economic inequality, fraction of Black residents, racial segregation, total crime rate, unemployment rate, and the proportion of registered Republicans. Whiskers represent 95% confidence intervals. All p 's < .001.

Table 1. The proportion mediated from mediation models in which county-level gun ownership proxy predicts county-level friendship measures through rates of categories of Third Places, controlling for county-level population density (log-transformed), poverty rate, household income per capita, economic inequality, fraction of Black residents, racial segregation, total crime rate, unemployment rate, and the proportion of registered Republicans. Bracketed values indicate 95% confidence intervals for the proportion mediated. ***p < .001; **p < .01; *p < .05.

	Criterion (DV)	
	Friendship Cohesion	Friendship Diversity
Art Places	0.023 [-0.026, 0.404]	0.146 [0.086, 0.853]***
Eating and Drinking Places	0.041 [-0.018, 0.343]	0.204 [0.114, 0.739]***
Personal Care Services and Laundromats	0.094 [0.009, 0.357]*	0.256 [0.146, 0.622]***
Grocery Stores	0.043 [-0.022, 0.191]	0.189 [0.100, 0.432]***
Retail Establishments	0.031 [-0.023, 0.427]	0.136 [0.077, 0.740]***
Religious Organizations	0.150 [0.054, 0.371]***	0.305 [0.185, 0.596]***
Civic and Social Organizations	0.014 [-0.033, 0.257]	0.184 [0.104, 0.806]***
Social Services	0.137 [0.026, 0.483]**	0.377 [0.217, 0.928]***