**Article**

# Homophily and acrophily as drivers of political segregation

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Political segregation is an important social problem, increasing p
and impeding effective governance. Previous work has viewed th
driver of segregation to be political homophily, the tendency to a
with others who have similar views. Here we propose that, in add
homophily, people's social tie decisions are driven by political ac
tendency to associate with others who have more extreme politic
(rather than more moderate). We examined this using a paradigr
participants share emotions and attitudes on political policies, o
others' responses and choose which others to affiliate with. In fou
(N = 1,235), both liberal and conservative participants' social tie c
reflected the presence of acrophily. We found that participants w
peers who expressed more extreme views as more prototypical c
political group also tended to engage in greater acrophily. These
identify a previously overlooked tendency in tie formation.

The extreme levels of political segregation evident in the United States today presents a major social challenge[1]. Political segregation reduces interactions between group members, which contributes to polarization and inter-group hostility, and undermines political civility and effective governance[2–4].

Previous work has focused mainly on one key driver of segregation, namely political homophily, defined as the tendency to affiliate with others with similar political views[5–9]. Political homophily is a pervasive and enduring propensity[10] that results in the formation of echo chambers of like-minded people who rarely interact across political lines[11,12]. But does homophily alone drive individuals' decisions about who to affiliate with in political contexts?

In this Article, we propose that, in addition to political homophily, people's tie selection decisions are also driven by political acrophily, which we define as the tendency to prefer to affiliate with others who represent more extreme (as opposed to more moderate) political views in the direction of one's political leaning. Take for example a

of the exact same distance from their view, one who is and the other who is more moderate. The prediction o based on homophily would suggest an equal probabili whereas a prediction based on acrophily would sugge for the more extreme peer. Determining whether poli is evident in addition to homophily is important beca a critical catalyst of political segregation in social ne extension, a driver of attitudinal and affective polariza

Homophily and acrophily are not mutually exclu the documented strength of political homophily, th co-occur. To illustrate how the two may integrate, co who responds with outrage to an incident of police bru encounters others' responses to the same incident. We combinations of the two propensities (Fig. 1): Under h chooser would affiliate with others whose outrage respo to their own (Fig. 1a), regardless of whether these respon or less outrage. Under homophily + acrophily (Fig. 1b
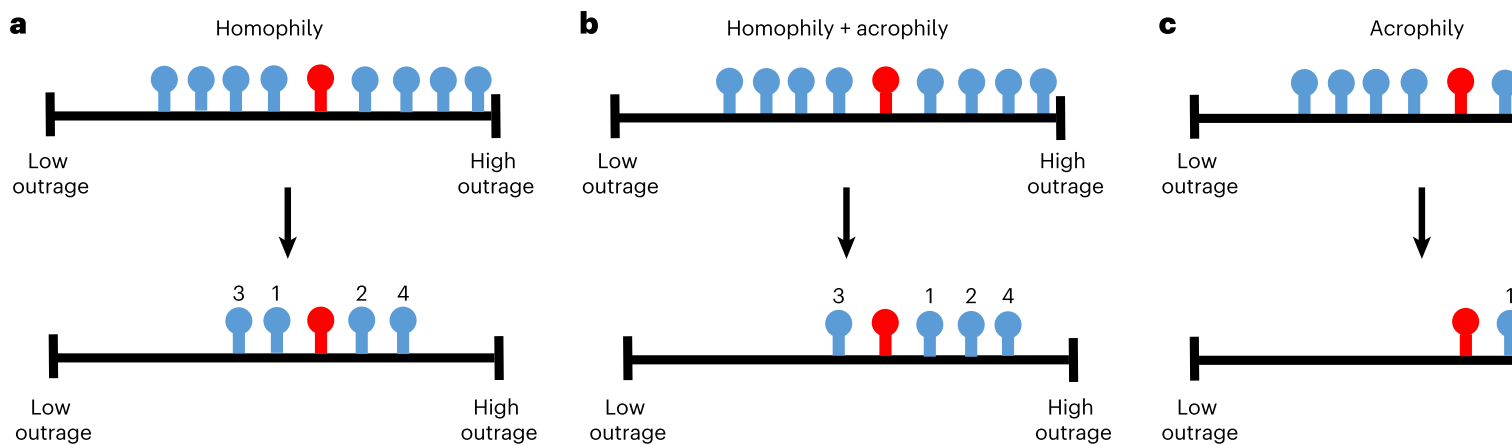
**Fig. 1 | Three hypothetical tie selection strategies.** The red ticker represents a chooser's moral outrage to a certain case of police brutality. The blue tickers represent potential ties' moral outrage, and the numbers represent the order of choosing. **a**, When applying homophily, the chooser elects to keep others whose responses are closest, regardless of whether they are mor **b**, When applying homophily + acrophily, the chooser has a pref outrage responses. **c**, When applying acrophily, the chooser kee who are expressing higher outrage.

is considered a more extreme view related to one's political beliefs, in this context others who express more outrage than they do. However, the chooser would not completely exclude others who expressed less outrage if their responses were similar. Finally, under acrophily, the chooser would elect to affiliate only with others who express more extreme responses than their own, which in this case is people who express more outrage (Fig. 1c). These strategies operate on a continuum, and dividing them into these three categories is done for heuristic purposes. Nevertheless, considering the strength of homophily, our assumption is that participants' choices should be most similar to the homophily + acrophily strategy.

Indirect evidence for its occurrence can be found in existing work. One relevant finding is from research on group deviance, which suggests that people evaluate deviation from group norms towards the extreme more favourably than deviations towards more moderate views[13–16]. A second relevant finding is that people like others who present more coherent political views, a tendency that is often associated with more extreme views[17–19]. Third, acrophily can be extrapolated from the notion of 'directional voting'[20–22], which suggests that people have a clear preference for representatives of their side, even if the distance in attitudes to these representatives is bigger than to representatives on the other side. One corollary of this idea is that people are attracted, to a certain extent, to representatives who are more extreme than them. However, this idea has been the focus of a great debate without clear empirical evidence for its occurrence[23,24]. Furthermore, it is not clear that preference for representatives, on the one hand, and social ties, on the other hand, capture an identical phenomenon. Finally, a fourth indication of a tendency to prefer extreme views comes from the literature on attitude polarization[25–31]. One driver of polarization, among many, is people's tendency to express extreme views to be 'better' than others in their group[32–36]. Interestingly, while the mechanisms that drive such polarization point to an attraction towards extreme views (as in acrophily), the individual-level immediate outcomes are actually opposite in the two cases. When polarizing, people adopt more extreme views, and therefore become more extreme in relation to others. Selecting ties on the basis of acrophily, however, results in individuals becoming less extreme than others in their group because they have selectively affiliated with more extreme others. While acro-

political group to be more extreme than they actually a more attracted to extreme compared with moderate they think that these views are more prototypical repr their political group.
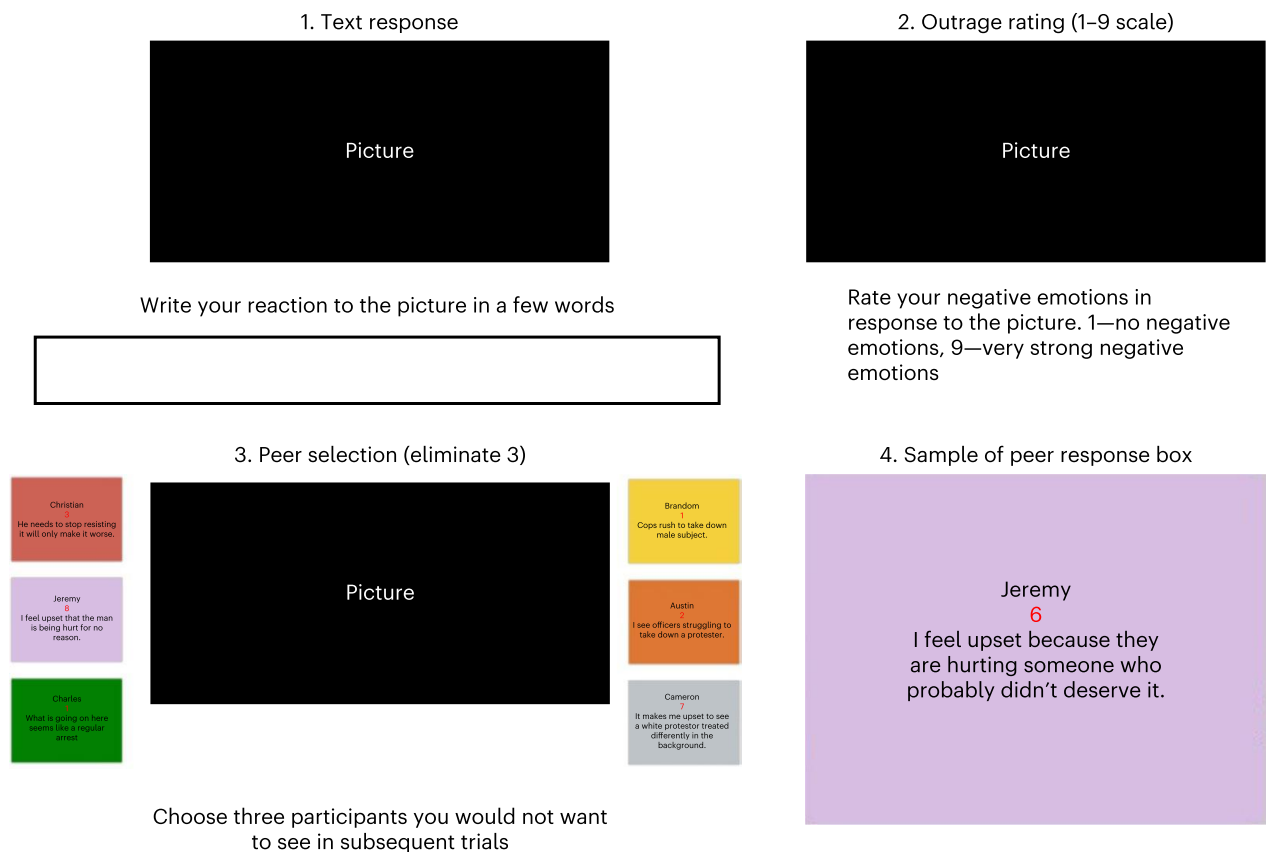
We conducted four studies with the goal of exami rence of acrophily. In studies 1–3 we examined particip tion strategies as they choose other participants on the responses of moral outrage to cases of police brutalit show that one mechanism for acrophily is the perce prototypical view of the group is more extreme. Study to examine the occurrence of acrophily in a differen emotions to police brutality, providing evidence of its selecting social ties on the basis of support for politica

## Results

Analyses for all studies were conducted in R using mix repeated measures. Assumptions of normality (Kolmog test) and equal variance (Levene test) were done for all ma full report, see sections on formal tests of assumptions tary Information). When these assumptions were violate a robust estimation of mixed effects using the packag finding similar results in all cases (Supplementary Info

**Acrophily based on moral outrage to police bruta**
The goal of studies 1–3 was to examine participants strategies when evaluating responses of moral outrag police brutality against Black demonstrators. We ch expressions of outrage—defined as a negative emoti primarily consisting of anger, towards a transgressor wrongdoing[43]—because it has been shown to be espec in social signalling[44,45] and in driving affiliation decision to specifically focus on responses to police brutality it is a highly salient issue and because responses to p vary greatly by political affiliation in the United States examined liberals' tie selection decisions when choos work of liberals and conservatives. In study 2 we tra online design that allowed us to increase the sample both liberals and conservatives. In study 3 we replica

### 1. Text response



Write your reaction to the picture in a few words

### 2. Outrage rating (1–9 scale)



Rate your negative emotions in response to the picture. 1—no negative emotions, 9—very strong negative emotions

### 3. Peer selection (eliminate 3)



Choose three participants you would not want to see in subsequent trials

### 4. Sample of peer response box



Jeremy
6
I feel upset because they are hurting someone who probably didn't deserve it.

**Fig. 2 | An outline of a trial in the choice condition.** After being presented with a picture of police brutality against a Black demonstrator, participants were asked to: (1) provide a text response to the picture; (2) rate their negative emotions from 1 (no emotion) to 9 (a lot of emotion); and (3) view six peer responses to the same picture (each response in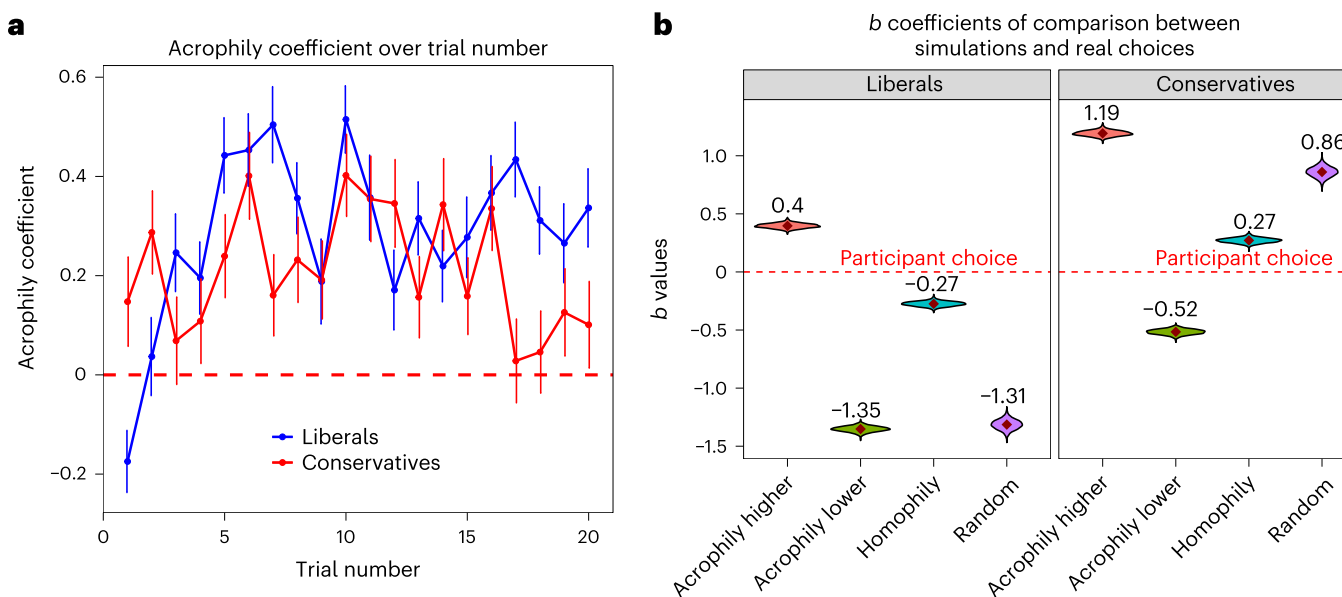cludes a name, a rating and a text response) and choose three peers they do not wish to see in subsequent trials. The thre participants chose to keep stay for the next trial and participant their responses to the following image. An enlarged version of a peer response is shown in panel 4.

represented a more extreme view based on their political view. In the case of outrage to police brutality, acrophily for liberals meant preferring peers who expressed stronger outrage and acrophily for conservatives meant preferring peers who expressed weaker outrage.

**Task.** The task was similar in studies 1–3, with small variations described in each study (Fig. 2). In each trial, participants saw pictures of police brutality against Black demonstrators intended to elicit negative emotions. For each picture, participants were first asked to provide their emotional response to the picture in a few words and then to rate their emotions in response to the picture on a scale of 1 (no negative emotion) to 9 (a lot of negative emotion). After rating and responding to the picture, participants then saw six boxes with unique colours, each containing a peer response to the same picture that they just rated. Each box included a name that was congruent with the participant's gender, a peer rating and their text response to the same picture. Peer ratings and responses were collected in a pre-test and included real ratings by real participants. After observing the responses for five seconds, participants' choices were different in the choice versus no choice conditions. In the choice condition, participants were asked to select three peers they would not want to see in a subsequent trial by clicking on the boxes they wished to eliminate. In the no choice condition, participants were asked to eliminate a random subset of three names coloured in red. In both conditions, participants were told that the eliminated peers would be eliminated completely from the entire

**Studies 1 and 2.** Participants in study 1 were self-ide who completed the task in the lab. Participants in stu liberals and conservatives who completed the study effort to increase the sample size and diversity in poli (compared with what could be found around Stanford ies, participants were randomly divided into the choic conditions. This was mainly designed to provide ev occurrence of homophily that was found in both studi at changes in ratings as a function of condition, which (analysis of participants' emotions in Supplementary Inf main analysis of acrophily focuses on results from the ch

To examine the occurrence of acrophily, we condu both focusing on the choice condition. Our first test o done by creating an acrophily coefficient for each part trial and testing whether these coefficients were simi from zero, and whether they changed over time. Our a ficient was designed to estimate the difference betwee actual choices and what would have been a symmetri choice. Recall that, in each trial, participants were p ratings of six peers, and were asked to eliminate three p

three peers). Participants therefore had $\binom{6}{3} = 20$ po

of sets of peers to keep in each trial. Of these 20 ave tions, one combination (or more) reflected the most

**a**

Acrophily coefficient over trial number

**b**

$b$ coefficients of comparison between simulations and real choices



**Fig. 3 | Results from study 2 ($n$ = 213, experimental condition). a**, The acrophily coefficient (reverse scaled for conservatives for ease of comparison) over trial number, where positive values represent a tendency for acrophily. Error bars represent 95% confidence intervals. **b**, Summary of comparisons between the average kept ratings and the four simulations (acrophily higher, acrophily lower, homophily and random). Each simulation was repeated 1,000 times and

was compared with the actual average kept ratings. The zero line the average of participants' kept rating. Each red dot represents coefficient for the simulation and its distribution. Participants' a ratings are located in between a pure homophily tie selection str acrophily strategy, higher for liberals and lower for conservative

coefficient by dividing it by the standard deviation (s.d.) of all possible choices of sets of peers.

In both studies 1 and 2, we calculated an acrophily coefficient for each participant in each trial in the choice condition and created a mixed-model analysis predicting the acrophily coefficient from trial number. We standardized trial number to be able to evaluate the average coefficient using the intercept of the model. In addition, and similar to the previous analysis, we used a random intercept of participants' ID. Furthermore, in study 2 we added an interaction term with political affiliation to evaluate differences in acrophily between the political groups. We report results by political affiliation although no significant differences were found between political groups (acrophily and political affiliation in Supplementary Information). Notice that coefficients for all of our analysis are in standardized values and can be compared across studies.

For our liberal participants, results suggested that the acrophily coefficient was significantly positive (study 1: $b = 0.33$, $t(30) = 2.51$, $P = 0.01$, $R^2 = 0.23$, 95% confidence interval [0.07, 0.60]; study 2: $b = 0.29$, $t(195) = 3.56$, $P < 0.001$, $R^2 = 0.32$, 95% confidence interval [0.11, 0.44]), pointing to an acrophily. Furthermore, results of study 2 (same direction to study 1 with less power) suggested that liberal tendency for acrophily increased over time (study 1: $b = 0.08$, $t(588) = 1.49$, $P = 0.13$, $R^2 = 0.23$, 95% confidence interval [−0.02, 0.19]; study 2: $b = 0.05$ [0.001, 0.11], $t(3,760) = 1.98$, $P = 0.04$, $R^2 = 0.32$, confidence interval [0.02, 0.05]; Fig. 2a).

We then examined the same effects with our conservative participants in study 2. Looking first at the intercept of the model, results suggested that the acrophily coefficient was negative and significantly different from zero ($b = −0.21$, $t(196) = −2.53$, $P = 0.01$, $R^2 = 0.32$, 95% confidence interval [−0.40, −0.06]) pointing to an acrophily tie selec

limitation by comparing participants' actual tie selec the choice condition with what they would have chos four different tie selection strategies: a no choice st phily (without any acrophily) and two complete ac gies (one towards more emotional ratings, and on emotional ratings). Simulating participants' tie selec these strategies was done by using participants' ac the pictures they saw, but instead of making the actu choices that they made, our simulation executed one selection strategies mentioned above. Notice that tr are dependent, such that the peers whom participant trial were dependent on their choices in previous tri our simulation was designed to replicate the task stru first trial and allow the simulation choices in each tri peers in the following trial.

In the random selection strategy, agents in our sim peers randomly. In the homophily strategy, agents in c chose in each trial the three peers closest to partici regardless of whether they were more moderate or m both of our acrophily simulations (more outrage and agents in our simulations chose the peers closest to th but only on one side of the scale, either more outrage c Only if there were no available peers in designated sid depending on the simulation) did agents choose the cl the other side.

We ran 1,000 iterations of each of the four simula selection, homophily, acrophily higher and acrophily l each simulation generated an average of rating of the ke trial. We then ran 1,000 models in which we compare actual average kept ratings (the peers whom particip

Looking first at the liberal participants, results suggested that the average rating of the actually kept peers was significantly higher than the homophily simulation (study 1: $b = -0.646$, $t = -3.58$, 95% confidence interval $[-0.650, -0.643]$, $P < 0.001$; study 2: $b = -0.27$, $t = -2.60$, 95% confidence interval $[-0.275, -0.273]$, $P = 0.010$ $[0.010, 0.11]$), and significantly lower from the more outrage acrophily strategy in study 2 but not in study 1 (Study 1: $b = 0.327$, $t = 1.82$, 95% confidence interval $[0.323, 0.330]$, $P = 0.088$ $[0.084, 0.92]$; study 2: $b = 0.396$, $t = 3.75$, 95% confidence interval $[0.395, 0.397]$, $P < 0.001$), indicating that participants' tie selection strategy was between homophily and acrophily in study 2 and marginally significantly different from acrophily in study 1. Coefficient sizes indicate that differences from acrophily high was ~50% smaller in study 1 and 44% bigger in study 2 than the distance to homophily. These findings suggest that, despite the fact that participants' choices in both studies fell between homophily and acrophily, there was quite a lot of variance in whether participants behaviour was closer to homophily or acrophily. Finally, as expected, the average kept ratings in participants' actual choice was also significantly higher than a random selection (study 1: $b = -1.111$, $t = -6.15$, 95% confidence interval $[-1.117, -1.106]$, $P < 0.001$; study 2: $b = -1.313$, $t = -12.44$, 95% confidence interval $[-1.316, -1.311]$, $P < 0.001$) and the acrophily lower strategy (Study 1: $b = -1.911$, $t = -10.58$, 95% confidence interval $[-1.915, -1.907]$, $P < 0.001$; study 2: $b = -1.351$, $t = -12.80$, 95% confidence interval $[-1.353, -1.350]$, $P < 0.001$). Results from our comparisons in the choice condition provided further evidence that participants' tie selection choice included a combination of homophily + acrophily towards more emotional responses.

Looking next at the conservative participants in study 2, as expected, results suggested the exact opposite: conservatives' peer choices were lower than what they would have chosen with just homophily ($b = 0.271$, $t = 2.02$, 95% confidence interval $[0.269, 0.272]$, $P = 0.04$ $[0.044, 0.45]$) and higher than the acrophily lower simulation ($b = 0.515$, $t = -3.85$, 95% confidence interval $[-0.517, -0.514]$, $P < 0.001$), suggesting that choices were between homophily and acrophily lower (but 88% closer to homophily in this case), which represented a more extreme conservative view. As expected, the average rating of the actually kept peers was significantly lower than a random selection ($b = 0.860$, $t = 6.43$, 95% confidence interval $[0.857, 0.862]$, $P < 0.001$) and also significantly lower than the acrophily higher simulation ($b = 1.192$, $t = 8.91$, 95% confidence interval $[1.190, 1.194]$, $P < 0.001$). Results from our comparisons in the choice condition provide further evidence that participants' tie selection choices involved a combination of homophily and acrophily, but in this case towards less intense ratings.

**Study 3.** The goal of study 3 was to replicate findings of study 2 and further test a potential mechanism driving acrophily. We hypothesized that participants were selecting ties who are more extreme because they evaluated these extreme responses as more prototypical of their groups' responses. To evaluate this hypothesis, participants first completed a task that was similar to that of studies 1 and 2 (with some minor differences; Methods). At a second stage, participants were then shown six of the trials they completed again (with the exact same peer responses) and were asked to rank the three responses that represented the most prototypical response of their own political group. We did not provide participants further details regarding the meaning of that term but assumed that participants understood it to be related to the political spectrum.

1 and 2, the acrophily coefficient became stronger wit for liberal participants ($b = 0.04$, $t(7,161) = 2.46$, $P =$ 95% confidence interval $[0.01, 0.08]$). For the conser pants, results suggested that the acrophily coefficien significantly different from zero, and slightly smaller ($b = -0.15$, $t(374) = -3.06$, $P = 0.001$, $R^2 = 0.28$, 95% conf $[-0.25, -0.05]$), pointing to an acrophily tie selection str ingly, results suggested that the acrophily shown in ou participants decreased with trial number ($b = 0.06$, $P < 0.001$, $R^2 = 0.28$, 95% confidence interval $[0.03, 0.10$ why acrophily decreased for conservatives and increas This could be caused by the salience of strong emotional reduce the strength of acrophily over time, or by some i ences in the way acrophily operates between liberals and

We then turned to our second method of evaluatir comparing it with simulated data of various strategies results of study 2. Looking first at liberals, results sug average rating of the actually kept peers was significan just homophily ($b = -4.87$, $t = -5.06$, 95% confidence i $-4.89$, $P < 0.001$), and significantly lower compared with higher simulation ($b = 5.88$, $t = 6.11$, 95% confidence inte $P < 0.001$), revealing again a mix of homophily and acro tant from acrophily ~20% bigger. Finally, as expected, th rating in participants' actual selection was significantl random selection ($b = -15.22$, $t = -15.81$, 95% confidence i $-15.20$, $P < .001$), and also significantly higher than the a simulation ($b = -19.26$, $t = -20.00$, 95% confidence ir $-19.25$, $P < 0.001$), suggesting that average kept ratin homophily and acrophily. Findings of the conservativ were as expected, the exact opposite. The average rat servative tie selection was lower than just homophily ($b$ 95% confidence interval $[2.27, 2.29]$, $P < 0.001$), and h acrophily lower simulation ($b = -7.24$, $t = -7.25$, 95% conf $[-7.25, 7.23]$, $P < 0.001$). In this case, however, conser were much closer to homophily that previously seen significant on average). Finally, as expected, the averag participants' actual choices was also significantly lower selection ($b = 21.26$, $t = 21.29$, 95% confidence interva $P < 0.001$) and significantly lower than the acrophily hig ($b = 18.47$, $t = 18.49$, 95% confidence interval $[18.46, 18.4$

After establishing the existence of acrophily, we examine one possible mechanism for acrophily. As a completing the first phase of the task, participants v previous trials that were identical to those they just saw to rank the most prototypical response of their group six peers, from 1 to 3. To analyse this phase of the task, w ference score between participants' ratings and the pee marked as prototypical, such that a positive number inc chosen prototypical person that was chosen by our pa the pictures more strongly than the participant and th a negative number. As participants chose prototypica $(1-3)$, we did this for each of the three peers chosen b We then conducted an interaction between the rank o peer $(1-3)$ and participants' political affiliation in pre ference score between participants and the prototyp outcome could tell us whether the first selected prototy higher or lower than participant's rating (the intercep
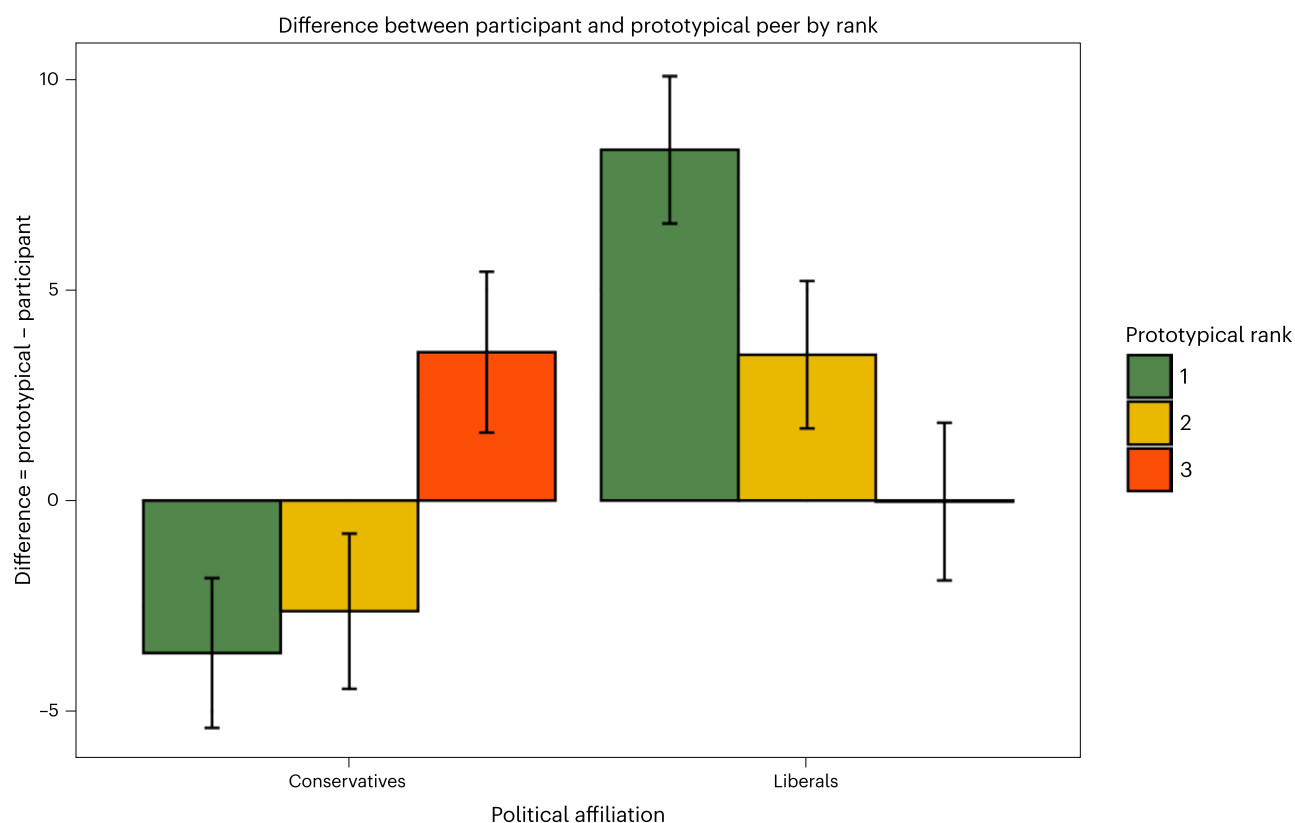
**Fig. 4 | Results from study 3.** The difference between participants' ratings and the peers they chose as most prototypical of their political camp in a rank order of 1 to 3 ($N = 387$). Liberals evaluated the first most prototypical peer as well as the second most prototypical peer to be expressing stronger emotions than their own emotions. The third peer seems to be equal to participants' emotions, but this is caused by the fact that there were not available peers who were expressing stronger emotions after the first two. Conservatives show the same patter but in the opposite direction. Conservatives evaluated the first mos[t] peer as well as the second most prototypical peer to be expressi[ng] emotions compared with their own emotion. The third most pro[totypical] seems to be expressing stronger emotions, but this is caused by [the fact that] there were not available peers who were expressing weaker emo[tions after the] first two. Error bars represent 95% confidence intervals.

participants was estimated to express more negative emotions compared to participants' own ratings by 8.07 points on the 1–100 scale ($b = 8.07$, $t(545) = 6.02$, $P < 0.001$, $R^2 = 0.30$, 95% confidence interval [5.45, 10.70]). As expected, going down the prototypicality rank led to reduced difference between participants and the prototypical peer ($b = -4.15$, $t(545) = -7.50$, $P < 0.001$, $R^2 = 0.30$, 95% confidence interval [−5.25, −3.07]), as fewer peers who expressed stronger emotions were available (Fig. 4). We then centred the model on the conservative participants. The intercept of the model was significantly negative, suggesting that the most prototypical peer designated by the conservative participants was estimated to express less negative emotions compared with participants' own ratings by 4.47 points ($b = -4.47$, $t(545) = -3.23$, $P < 0.001$, $R^2 = 0.30$, 95% confidence interval [−7.17, −1.76]). As expected, going down the prototypicality rank led to reduced difference between participants and the prototypical peer ($b = 0.56$, $t(545) = 6.23$, $P < 0.001$, $R^2 = 0.30$, 95% confidence interval [2.44, 4.68]). Notice that conservatives' third choice was on average higher in rating than participants' own ratings. This is probably caused by the fact that on average there were not enough conservatives who were more extreme than participants by the third choice. Results also revealed a stronger difference for liberals, such that liberals assumed prototypical members to be more extreme compared with the assumption made by conservative (for further information, see prototypicality and political affiliation in Supplementary Information).

participants' acrophily and participants' choice of th[e prototypical] members of their political group ($b = 0.30$, $t(375) = 6[...]$, $R^2 = 0.09$, 95% confidence interval [0.34, 0.44]), supp[orting] that participants choice of prototypicality was associ[ated with] degree of acrophily.
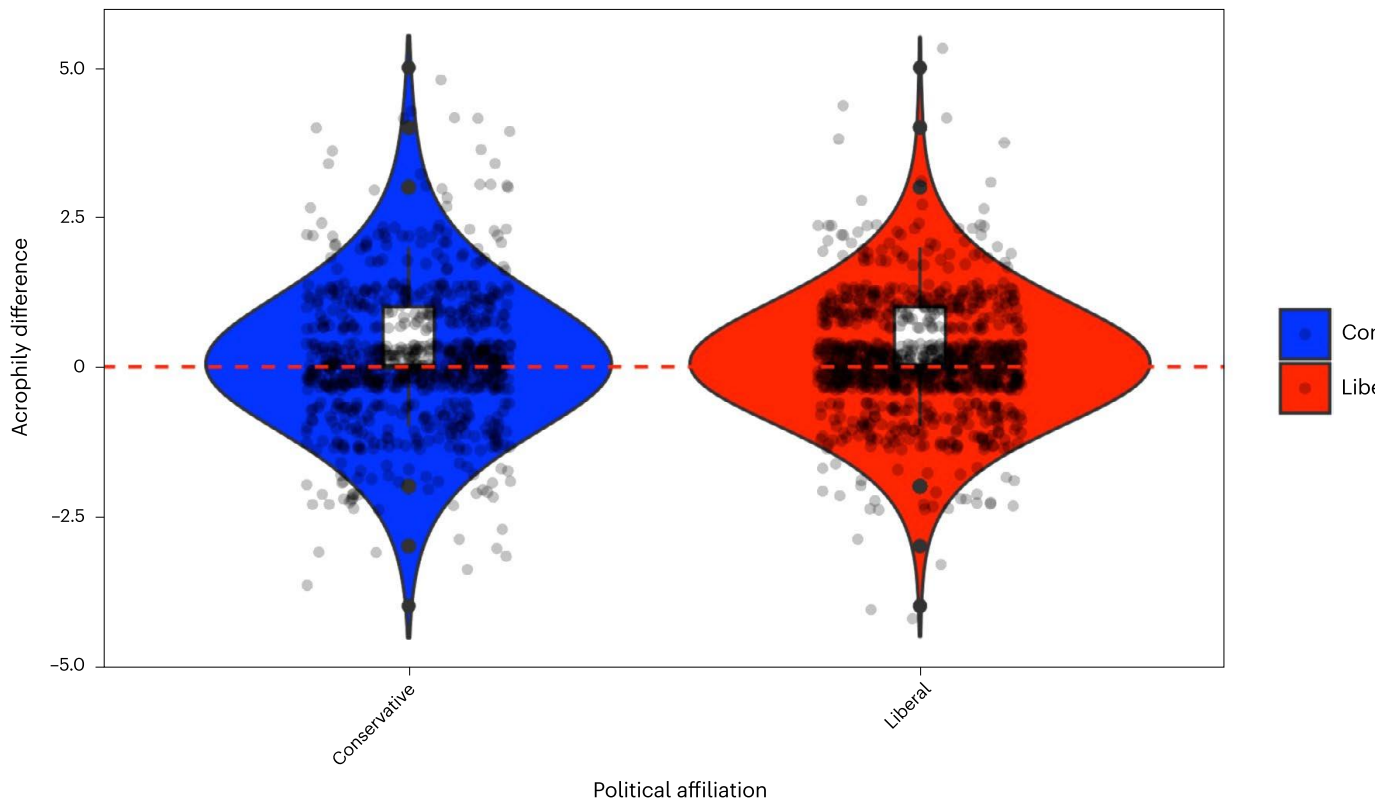
## Study 4

The goal of study 4 was to address key limitations of stu[dies 1–3. First,] we wanted to examine whether acrophily can be seen [when it is] based on other types of responses than emotions, aski[ng participants] to rate and choose ties on the basis of support for four [politi]cal policies associated with four highly contentious top[ics: climate] action, gun control, hunting and military budget. Seco[nd, we wanted] to see whether acrophily is evident when participants [choose] rather than eliminate peers. Third, we wanted to simp[lify the task to] allow acrophily to be detected without using simulation[s. In order to] achieve these goals, study 4 has quite a different design [from the previ]ous studies. However, we believe that by addressing th[e limitations of] studies 1–3, we were able expand the notion of acrophi[ly in important] ways. In the revised task, participants provided text [and then a] rating of support (1–7 scale) for four political policie[s. Then, for] each policy, participants saw seven peers who provide[d actual] responses to the policy on a 1–7 scale. Then, participa[nts were asked] [to choose one peer whose response they would like to ...]

**a**



Kelsey
3
Military budget should stay the same

Catherine
1
The US already spends too much. We
dont't need this

Jacqueline
2
I feel that this is not a valuable
proposition

Bailey
4
I'm not sure how I feel about this.

Gradually
increasing
military budget

Jor
7
We need a strong
safe from tyrants ir

Stephanie
5
The military budget should increase
over time like all budgets

Ash
6
The world is gettin
dangerous: we ne
be as strong

**b**



**Fig. 5 | Task and results of study 4. a**, Representative peer rating window from which participants were asked to choose one peer they would like to keep. **b**, Acrophily difference between participants and the peer they chose to keep in response to each concept (*N* = 386). Positive values represent acrophily, and

results suggest acrophily in both the liberal and conservative use The boxes represent the interquartile range (IQR). The lines repr the first quartile − 1.5 IQR and the third quartile + 1.5 IQR.

participants' ID and one of policy type. Looking first at the intercept of the model, which was our liberal participants, results suggested that our liberal participants chose to keep peers whose rating represented

more common than initially thought and can occur v ties on the basis of a variety of response types. Second, acrophily can occur when people choose new ties, rather

acrophily. Removing such ratings (which represent 31.3% of all ratings) doubles the effect (study 4 analysis in Supplementary Information). Albeit small, these results are especially striking given the structure of the task and the fact that participants just rated their response to the stimuli and then immediately chose users whose ratings are more extreme than their own.

## General discussion

The goal of the current project was to introduce the concept of acrophily—the tendency to prefer to affiliate with others with more extreme (as opposed to more moderate) political views—and to assess whether acrophily is evident in tie selection decisions as an additional driving force of political segregation and polarization. In four studies, we showed that participants tended to keep ties whose ratings reflected a preference towards more extreme (versus more moderate) views. Importantly, we found strong evidence for homophily as well, and participants' tie selection strategy seemed to reflect a mix of homophily and acrophily.

Our findings have important implications for understanding political segregation. If people's tie selection is affected by acrophily in addition to homophily, we should assume that segregation occurs at a faster rate and leads to more extreme outcomes than would otherwise be expected. To evaluate this possibility, we created an agent-based model (section on agent-based model of network segregation in Supplementary Information) that randomly populated a network of both liberals and conservatives and examined the rate and degree of network segregation as a result of homophily alone, acrophily alone or a combination of homophily and acrophily similar to that found in our studies. As expected, our simulation suggested stronger segregation in either version featuring acrophily, relative to homophily alone.

Research on acrophily is especially important in the current digital era, in which people make many tie selection decisions every day. Social media algorithms are often designed to increase or decrease strength in ties on the basis of users' activity. Liking a certain post on social media is likely to lead to an increase in tie strength with the person who produced the post, and ignoring a post is likely to contribute to weakening of a social tie. Therefore, in the many hours that people spend on social media every day, they make many tie selection decisions. Further specifying tie selection strategies and the psychological processes that give rise to them is of utmost importance in light of their daily prevalence and their impact on social segregation.

In addition to providing evidence for the existence of acrophily, results of study 3 also provided an indication of why acrophily may be occurring, suggesting that one reason for the preference for more extreme views is that participants see the prototypical group member as more extreme than they actually are, and may want to have ties to these prototypical ingroup members. Further analysis supporting this idea revealed that individual-level tendencies to evaluate prototypical peers as extremes were associated with increased tendencies for acrophily. One limitation of the current measure is that participants were asked to indicated a prototypical member of their group, without specifically indicating a political group. Future work should re-examine this evaluation with a more specific indication of political group.

Despite this encouraging evidence, it is likely that other mechanisms also contribute to acrophily. One such mechanism is the relative salience of extreme views. Such salience may be caused by increased

Our experiments leave open several questions acrophily is translated to emotions, attitudes and beh the lab. One limitation relates to the fact that in each stu chose ties on the basis of peers' responses to a single in the real world multiple issues drive processes of tie chose to minimize the complexity of information al whom participants saw in order to reveal the occurren However, it is likely that tie selection decisions that ar basis of responses to a single issue are more susceptib than more complex tie selection decisions, in which balance multiple issues[51]. Future studies should examin of acrophily in natural social settings, for example, on s in closed organizations such as companies and schools should also examine whether acrophily occurs in top political in nature.

A second limitation relates to the goals that parti keeping certain peers. In the current study, the goal wa than in many interactions in real life: to keep seeing th a subsequent trial. In many situations outside the lab, ties to achieve various affiliative and strategic needs. should modify the goals for participants' interaction how they affect the occurrence of acrophily.

A third limitation of the current work is that we f viding evidence for acrophily rather than thinking ab mitigate the effects of acrophily. Future work shoul possibility of mitigating participants' tendency tow by either making them aware of such tendency, or by information of the true prototypical ratings of their gr

Finally, our findings raise interesting questions abo recent changes in political segregation. Given that we s levels of segregation and polarization in the United Sta societies around the globe now than ever before, one in tion is what has changed. A related question is what t given the tendency of acrophily. It is possible that acr cies would taper off when segregation reaches an ext whether and when this would happen is not clear. We b demonstration of the presence of both homophily a political tie selection decisions can inform investigation and we see great potential in not only further investiga but also perhaps finding ways to reduce acrophily an

## Methods

This research was approved by Stanford University (st and Harvard University (studies 2 and 3: IRB19-1409; 0698). All participants provided informed consent an sated for their time.

### Studies 1–3
**Participants.** In study 1, we used data from a task that task used in the present research to be able to estima sample size. Our estimated sample size for study 1 was b evidence for homophily. Results suggested that using 3 completing 20 trials in our experimental condition wou obtain almost 100% power for the study (for power esti on each sample size, see Supplementary Information included both choice and no choice conditions, the study 1 included 70 participants (males: 26, females: 4

2 and 3 when transitioning the task to online studies. No participants who completed the study were removed from the analysis.

Study 2 was designed with the goal to recruit a larger and more diverse participant sample. For this reason, we converted our lab task into an online task and increased the target sample size to 400 participants (200 in the choice condition), with the hope of recruiting 200 liberals and 200 conservatives and increasing the power to almost 100% (power analysis in Supplementary Information). Participants were recruited using the online platform Prolific in exchange for $2.50 (~20 min). Out of the 400 participants who completed our task, we removed 8 participants for providing nonsensical text responses or not providing their demographics. Our final sample therefore included 392 participants (males: 228, females: 160, other: 4; age: mean 37.15 years, s.d. 13.49 years), who were randomly divided into no choice and choice conditions. All participants were American citizens. We were aiming to get an equal number of participants in each political side. Accordingly, in terms of their political affiliation, 184 participants identified as liberals, 180 identified as conservatives and 28 identified as located in the middle. We removed middle participants from the main analysis.

In study 3, as in study 2, we recruited 400 participants with the hope of recruiting 200 liberals and 200 conservatives. Participants were recruited using the online platform Prolific in exchange for $3.5 (~30 min). Out of the 400 participants who completed our task, we removed 13 participants for providing nonsensical text responses or not providing their demographics. Our final sample therefore included 387 participants (males: 236, females: 149, other: 2; age: mean 43.25 years, s.d. 13.14 years). All participants were American citizens. In terms of their political affiliation, 194 participants identified as liberals, 183 identified as conservatives and 10 identified as located in the middle. Similar to study 2, we removed middle participants from the main analysis.

**Tie selection task.** The structure of the tie selection task was the same in all studies with a few modifications that will be described below. Participants were told that they were taking part in a study with the goal of understanding how people respond emotionally to political situations, as well as how they make decisions about what responses they would like to see. The task included 3 practice (in which participants saw anger-inducing pictures relating to driving) and 20 actual trials. In the actual trials, participants saw pictures of police brutality against Black demonstrators. Pictures were pre-tested to elicit negative emotions, primarily anger (full description in the image pool below). For each picture, participants were first asked to provide their emotional response to the picture in a few words (Fig. 2). After providing their response, participants were asked to rate their emotions in response to the picture on a scale of 1 (no negative emotion) to 9 (a lot of negative emotion). We chose to use a neutral to negative emotion scale rather than a positive to negative scale for two reasons. First, measuring tie decisions on the basis of a neutral to negative scale allowed us to test in study 2 whether acrophily is caused by just attraction to more emotion, or rather to extreme views expressed by either no emotion or a lot of emotion, depending on one's political beliefs. Second, we specifically selected pictures that were evaluated as eliciting negative emotions by more than 90% of the participants including conservatives (see description below), which means that positive raters would be outliers and would change the focus of the task.

After rating and responding to the picture, participants then saw

(for further details, see image and peer pool). Participa to look at the six responses for 5 s before making any of 5 s, participants' choices were different depending on were assigned to the choice versus no choice condition condition, participants were asked to select three peers want to see in a subsequent trial by clicking on the box to eliminate. Clicking on each box eliminated it from chose to instruct participants to eliminate those they see rather than selecting those they did want to see in o size the fact that eliminated participants are never show no choice condition, a random subset of three names red. Participants were asked to click on the boxes with In both conditions, participants were told that the eli would be eliminated completely from the entire task a and responses would not be seen again, while the ke would be seen in the subsequent trial.

After eliminating three peers in each trial, parti tioned to the next trial, in which they were again as a text response and rate their emotional response to of police brutality. Participants were then shown six responses to the new picture. In every trial except for of the six boxes were of peers who were kept from the These boxes retained the same location, colour and previous trial, and the peer ratings and responses we the same original person who participants kept from trial. The other three boxes were randomly generated pool and included new names, ratings and responses. ing 20 trials in which they provided their responses t and chose to eliminate three new peers, participant short survey described below.

**Image and peer pool.** We conducted a pilot study to cr pool for the study, testing 40 candidate pictures of p against Black citizens. One hundred and four particip sented with each picture and were asked to first provide to the picture. Participants were then asked to rate t response to the picture using the same scale that was u Finally, participants were asked to select whether observ elicited a negative emotion, positive emotion or no emo question did not appear in the actual task and was used pictures would be used. Two criteria were used to sele First, all of the selected pictures were rated by less than pants as positive. Second, we excluded pictures whose was higher than 7 or lower than 3 (to allow variance in p As expected, our pictures were rated as eliciting sign negative emotion by liberals compared with conserva mentary Fig. 1).

Out of the 104 participants who completed the chose 63 participants to be part of our peer pool to allo nation of three peers in each trial in addition to six pe trial (19 × 3 + 6). Our first criterion in choosing peers w that our peer pool was heterogeneous in terms of p tion. We chose 30 conservative, 30 liberals and 3 pa self-identified as middle. Our second criterion for choo was participants' text. We chose participants who m more than one-word responses to all of the pictures, a

Study 3 was based on study 2's procedure with four meaningful changes. First, participants were only assigned to the select condition, as the goal was to get a better sense of the mechanism for acrophily. Second, we recreated our peer pool from that of study 2, by employing a new set of peers who provided new responses to the pictures of police brutality in the task. The reason for this change is that the social movement related to the death of George Floyd occurred between studies 2 and 3 and we suspected that such a large-scale movement may have changed people's attitudes towards police brutality. We therefore ran an additional pilot in which we created a new peer pool to the same pictures of studies 1 and 2 (Supplementary Information). Third, we changed the scale participants used to rate their emotions from 1–9 to 0–100, 0 indicating no outrage and 100 very strong outrage. This was done to increase the variance in participants' responses. The fourth and most important change to the task was our measurements of the prototypicality of response. After completing the task in a similar way to studies 1 and 2, participants then completed six additional trials in which they saw a copy of a previous trial (trials 3, 6, 9, 12, 15 and 18) and were asked to rank the responses that represented the top three most prototypical responses of their political group using this question: 'Choose the three peers that represent the most prototypical response of your political group.' After completing these six trials, participants were forwarded to a survey that included a few final questions described below.

**Measures.** While completing the task, we collected participants' ratings and text in response to each picture. We also recorded which peers they chose to keep versus eliminate. In study 1, after completing the task, participants completed a survey that included two questions relating to their motivation to keep certain peers based on similarity and difference. In the similarity question, participants were asked: 'To what extent did you choose people who felt similar emotions to you in response to the pictures?' In the difference question, participants were asked the same question, but using the words 'different emotions' instead. Participants rated their response using a scale from 1 (not at all) to 6 (very much so). Participants also completed a few scales including a group identification scale[52], a heterogeneity test in which participants were asked to estimate what portion of their social environment has different race, socio-economic status, a political affiliation measure, a need-to-belong scale[53] and a personality scale[54]. These scales were measured with the intention of testing them as potential mechanisms for acrophily (for full description and analysis of the connection between these scales and acrophily, see Supplementary Tables 1, 5, 6, 10 and 11). In study 2 we removed the need to belong scales from our survey and added a few new scales in which we examined potential motivations for acrophily (choosing people because they are more creative, provided new interpretations, made the participants feel good, and so on), feeling thermometers for various groups[55], and participants' political identification (for further analysis, see Supplementary Information). In study 3, after participants completed the task, we measured participants' ranking of peers' prototypicality using the task described above. Finally, participants answered a few survey questions that were similar to study 2 (Supplementary Information).

**Study 4**
We recruited 400 participants after processing results from study 3

169 identified as conservatives. We had no participan middle in this study as participants had to make a bina beginning of the task.

**Tie selection task.** The structure of the task was based in studies 1–3 with a few important modifications. Th one practice trial and four actual trials. Participants sa ing a political policy (see description below). For each pants were first asked to provide their text response to few words. After providing their response, participant rate their support for the policy on a scale of 1 (comple 7 (completely support).

After rating and responding to the policies, pa saw seven boxes, each containing a peer response to t that they just rated. While the type of content in the bo to studies 1–3 and included a name, a rating and a tex few important differences in this stage compared wit in studies 1–3. First, we made sure that all seven opti were present at each trial, covering the whole scale from designed to allow participants in each trial to choose t that they wanted and not be limited by what was ava random draw. We decided to use this structure to simpli of acrophily. The order of ratings was randomized to participants looked at the whole screen. Here again, par watch all the boxes for 5 s before making their pick. Sec choosing to eliminate peers, participants chose the peer keep. This was to make sure that acrophily can be detec sions to keep and to eliminate. Third, participants were just one peer of the seven on the screen. This was mo there was always one peer per rating. Fourth, peers wh certain trial were not necessarily carried forward to the to the structure of the task. Unlike previous tasks, partic told explicitly that choosing to keep certain people w participants would see them in subsequent trials.

**Policy and peer pool.** We conducted a pilot study to cr pool for the study, testing multiple six candidate policie and six participants were presented with each policy to first provide a text response to the picture. Particip asked to rate their support for the policy using the sam was used in the task. We selected the four policies tha least polarized ratings (to allow for the possibility of a the intention of selecting two eliciting more support an tives and two among liberals: ('Gradually increasing m 'Reducing the power of the federal government over sta affirmative action to minorities' and 'Increasing restri ing'). As expected, our policies were rated differently b and liberals (Supplementary Fig. 3).

For each policy and for each rating (from 1 to 7), responses based on coherence and fit between the text (Supplementary Table 15). In the cases in which it was p to get two responses by a liberal and two responses by for each rating. In the few cases in which such response able, we used responses from the other political group. participants in our task saw responses that were most people who identified with their own political group, that these included all ratings from 1 to 7 in response t

scale and participants' political identification (for further analysis, see Supplementary Tables 16 and 17).

**Reporting summary**

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

## Data availability

Data for study 1 are available here: https://osf.io/nz4dk/. Data for studies 2–4 are available here: https://osf.io/649fq/. Data for the agent-based model are available here: https://osf.io/ad7vh/.

## Code availability

Code for study 1 is available here: https://osf.io/nz4dk/. Code for studies 2–4 is available here: https://osf.io/649fq/. Code for the agent-based model is available here: https://osf.io/ad7vh/.

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## Competing interests

The authors declare no competing interests.

## Additional information

**Supplementary information** The online version contains supplementary material available at https://doi.org/10.1038/s41562-022-01474-9.

**Correspondence and requests for materials** should be Amit Goldenberg.

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| ☐ | ☒ | A description of all covariates tested |
| ☐ | ☒ | A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
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| ☐ | ☒ | Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated |

*Our web collection on statistics for biologists contains articles on many of the points above.*

## Software and code

Policy information about availability of computer code

| Data collection | Data collection was done using a task that was built in jspsych. |
|---|---|
| Data analysis | Data analysis was done with R and Python |

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio guidelines for submitting code & software for further information.

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# Behavioural & social sciences study design

All studies must disclose on these points even when the disclosure is negative.

| | |
|---|---|
| Study description | Studies are mostly repeated-measure within participant tasks evaluated quantitatively. |
| Research sample | All participants were recruited from prolific/mturk. Data is not representative in terms of population. Specific details:<br>Study 1: N=70; men: 26, women: 42; age: M= 21.30, SD = 9.20,<br>Study 2: N= 392 men: 228, women: 160, Other: 4; age: M= 37.15, SD = 13.49<br>Study 3: N= 387; men: 236, women:149, other: 2, Age: M = 43.25, SD = 13.14<br>Study 4: N = 386; men: 199, women:183, other: 4, Age: M = 39.88, SD = 12.04 |
| Sampling strategy | Sampling for Study 1 was done through the Stanford participant pool. Sampling for Study 2 was done through prolific and<br>3 and 4 through mturk (using the platform mturk prime). Sample sized were determined by power analyses that were co<br>either as a result of previous findings (Study 1), or based on results from the previous studies in the study sequences. |
| Data collection | All of our data were collected online with a jspsych task that was designed by the research team. Participants were sent t<br>and followed the instructions. Once they completed the task, they were sent to a Qualtrics survey and answered a few qu<br>cases in which some variables were manipulated, for example when manipulating whether participants were assigned to<br>or no choice conditions, participants were not informed of such manipulations due to the fear that it would affect their p<br>in the task. |
| Timing | Start - Feb 2018<br>End - May 2022. |
| Data exclusions | Our exclusion criteria for studies 1-4 was for participants who provided nonsensical text responses to the pictures  (that v<br>related at all to the stimuli at hand).<br>Study 1: N=70; excluded  - 0<br>Study 2: N= 392; excluded - 8<br>Study 3: N= 384; excluded - 13<br>Study 4: N = 386; excluded - 14 |
| Non-participation | *State how many participants dropped out/declined participation and the reason(s) given OR provide response rate OR sta*<br>*participants dropped out/declined participation.* |
| Randomization | In studies in which was done (Studies 1, 2) this was done randomly. |

# Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether e
system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting

## Materials & experimental systems

| n/a | Involved in the study |
|---|---|
| ☒ | ☐ Antibodies |
| ☒ | ☐ Eukaryotic cell lines |
| ☒ | ☐ Palaeontology and archaeology |
| ☒ | ☐ Animals and other organisms |

## Methods

| n/a | Involved in the study |
|---|---|
| ☒ | ☐ ChIP-seq |
| ☒ | ☐ Flow cytometry |
| ☒ | ☐ MRI-based neuroimaging |

# Human research participants

Policy information about [studies involving human research participants](#)

| | |
|---|---|
| Population characteristics | See above |
| Recruitment | Participants were recruited through the Stanford participant pool, prolific and mturk. |
| Ethics oversight | Stanford University (Study 1) Harvard University (Studies 2-4) |

Note that full information on the approval of the study protocol must also be provided in the manuscript.