



Testing the effects of Facebook usage in an ethnically polarized setting

Nejla Asimovic^{a,b,1}, Jonathan Nagler^{a,b}, Richard Bonneau^{b,c,d}, and Joshua A. Tucker^{a,b,e}

^aDepartment of Politics, New York University, New York, NY 10012; ^bCenter for Social Media and Politics, New York University, New York, NY 10012; ^cDepartment of Biology, New York University, New York, NY 10012; ^dCourant Institute of Mathematical Sciences, New York University, New York, NY 10012; and ^eDepartment of Russian and Slavic Studies, New York University, New York, NY 10012

Edited by Christopher Andrew Bail, Duke University, Durham, NC, and accepted by Editorial Board Member Mark Granovetter May 10, 2021 (received for review November 3, 2020)

Despite the belief that social media is altering intergroup dynamics—bringing people closer or further alienating them from one another—the impact of social media on interethnic attitudes has yet to be rigorously evaluated, especially within areas with tenuous interethnic relations. We report results from a randomized controlled trial in Bosnia and Herzegovina (BiH), exploring the effects of exposure to social media during 1 wk around genocide remembrance in July 2019 on a set of interethnic attitudes of Facebook users. We find evidence that, counter to preregistered expectations, people who deactivated their Facebook profiles report lower regard for ethnic outgroups than those who remained active. Moreover, we present additional evidence suggesting that this effect is likely conditional on the level of ethnic heterogeneity of respondents' residence. We also extend the analysis to include measures of subjective well-being and knowledge of news. Here, we find that Facebook deactivation leads to suggestive improvements in subjective wellbeing and a decrease in knowledge of current events, replicating results from recent research in the United States in a very different context, thus increasing our confidence in the generalizability of these effects.

social media | ethnic identity | Bosnia and Herzegovina
| conflict | networks

Does social media usage lead to greater outgroup hostility? This question is being asked with increasing urgency in the context of established democracies, and in particular the United States, with an eye toward establishing whether there is a relationship between social media usage and increasing levels of political polarization (1–3) and, in particular, affective polarization, which is an indicator of partisan animus (4). Although most research on this topic has been conducted in the context of advanced democracies, there is an increasing acknowledgment of the need to understand the role social media plays within different political contexts (1, 5), due to the fact that the use of social media and the internet continues to grow in emerging and developing countries (6). Moreover, we know little about the impact of social media usage on attitudes toward ethnic outgroups, as opposed to supporters of opposing political parties.

Despite great interest in the relationship between social media usage and polarization, to date we are aware of only one prior study, carried out in the context of the United States and focusing on attitudes toward outgroup partisans, that identifies a causal link between social media deactivation and a reduction in political polarization, also finding a negative but statistically insignificant effect on partisan affective polarization (2). While there are a few other randomized impact evaluations of Facebook on users' psychological wellbeing and civic engagement (7–9), none of these have taken place within a postconflict country nor have they focused on attitudes toward ethnic outgroups. Particularly within settings with a more recent experience of war, understanding the dynamics of group processes is of vital importance. Given that the way these processes take place in online

spaces can help or hinder the goal of transforming relations from antagonistic to constructive, social media should be considered and studied as one of the forces influencing the direction of countries' postconflict paths.

Importantly, both ethnicity and partisanship are potential markers of one's identity. Given that partisanship is acquired by choice, however, it is a more informative measure of one's worldview than group membership based on more immutable characteristics such as ethnicity or race (10). As such, some propose that people may assign larger blame and responsibility to others for their partisanship than for their inborn group affiliations (11). The differences between partisan and other social identities have recently been discussed as a potential explanation of why intergroup contact, which tends to be associated with prejudice reduction (12–14), may be less effective at mitigating outgroup hostility in the context of partisanship (15). This, however, remains an open question requiring studies that go beyond partisan affiliation, in particular addressing attitudes toward ethnic outgroups and especially in an online context.

Significance

Amid growing belief that social media exacerbates polarization, little is known about the causal effects of social media on ethnic outgroup attitudes. Through an experiment in Bosnia and Herzegovina where users refrained from Facebook usage during 1 wk of heightened identity salience, we find that—counter expectations—people who deactivated their accounts reported lower outgroup regard than the group that remained active, but this effect was likely conditional on the level of ethnic heterogeneity of respondents' residence. Additionally, we replicate findings from a study on US users: Deactivation led to a decrease in news knowledge and suggestive improvements in subjective wellbeing. Our findings bring nuance to popular beliefs, frequently dichotomous and simplistic, of social media's impact on societal dynamics.

Author contributions: N.A. and J.A.T. designed research; N.A. performed research; N.A., J.N., R.B., and J.A.T. planned the analyses; N.A. analyzed the data; and N.A. wrote the paper with contributions from all authors.

Competing interest statement: J.A.T. received a small fee from Facebook (before any data collection for the current project began) to compensate him for administrative time spent in organizing a 1-d conference for approximately 30 academic researchers and 12 Facebook product managers and data scientists that was held at New York University in the summer of 2017 to discuss research related to civic engagement. He did not provide any consulting services or any advice to Facebook as part of this arrangement.

This article is a PNAS Direct Submission. C.A.B. is a guest editor invited by the Editorial Board.

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¹To whom correspondence may be addressed. Email: nejla.asimovic@nyu.edu.

This article contains supporting information online at <https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.2022819118/-/DCSupplemental>.

Published June 15, 2021.

To address the gaps in the literature pertaining to the causal link between time spent on social media and attitudes toward outgroups based on more immutable identity categories such as race and ethnicity, as well as the lack of research on social media's impact in postconflict societies, we conduct a preregistered experimental field study, set in Bosnia and Herzegovina (BiH), of the effects of exposure to social media on ethnic outgroup attitudes. More specifically, we randomly subset users to deactivate Facebook accounts during 1 wk around the Srebrenica genocide commemoration—a period of heightened attention to past conflict—and assess interethnic regard as the primary outcome of interest. We find, contrary to our preregistered hypotheses based on the existing literature, that decreased use of Facebook led to more negative attitudes about ethnic outgroups. Moreover, a series of supplementary analyses—not preregistered, but undertaken in an attempt to better understand our surprising finding—suggest that these effects are concentrated predominantly among those who live in ethnically homogeneous environments, i.e., people whose offline networks are likely to be ethnically homogeneous (see Fig. 3 and *SI Appendix, Tables S10–S12*). We also extend our analysis to include assessment of the impact of social media usage on knowledge of the news and subjective wellbeing, in an effort to examine the robustness of prior findings from the United States (2). In line with our preregistered hypotheses based on the prior findings from the United States (2), we find that decreased Facebook usage improves subjective wellbeing but decreases knowledge of current events, thus advancing our confidence in the generalizability of our findings as well as the validity of our experimental setup.

Our research is motivated by the debates around the challenges and opportunities for intergroup contact brought forth by the proliferation of social media. As social media usage has spread across the globe, there has been a great deal of optimism about the potential for social media usage to encourage the sharing of information among different groups (16–18), to serve as a tool for promoting intercommunity relations, and to shift perceptions and behaviors by increasing mutual understanding between antagonistic groups through a platform on which people can engage in discussions even across identity lines (19–21). Social identities can be activated on social media in a myriad of ways: The overall context of the social media environment, nonverbal and visual cues by users, and even linguistic cues that denote group identity are only a few of the possible options (22, 23). By its nature, social media allows for direct access to individual voices that can be voices of either ethnic hatred or ethnic solidarity. As the communication moves from a “one-to-many” to a “many-to-many” structure (1), individual users become creators of content with the opportunity to share their own messages with the wider public, a feature that used to be reserved only for elites and traditional media. Allowing for the individual outgroup voices to be heard can also have a personalizing effect, especially within contexts such as the one we study in which much of the official discourse categorizes and draws boundaries between groups of people based on their ethnic membership. Even when users do not reveal their political thoughts online, they will be exposed to the posts friends (and often friends of friends) share, comments their friends write, and discussions in which they engage, all of which may be of a different nature than the official rhetoric to which they would otherwise be exposed. Compared to the offline world, social media platforms facilitate more connections with “weak ties,” defined as acquaintances that link more distant clusters of people while introducing novel information and more diverse views into the conversation (24). Having weak ties across social cleavages forms the basis for growing what in the literature is referred to as “bridging social capital,” which is hypothesized to facilitate cross-ethnic cooperative relationships (25, 26). While previous research shows a positive association between Facebook usage and bridging social capital (27, 28), it

also reveals a positive association with bonding social capital, which refers to resource sharing with strong ties and homogeneous social networks (i.e., fellow in-group members, family, and friends). Strong levels of bonding social capital, while important for social support, may provide increased opportunities for ethnic entrepreneurs (29), thus endangering democracy in ethnically diverse societies (30). Scholars are also increasingly raising concerns that bridging social capital is endangered in online social networks by platforms' algorithms (31, 32). There is growing evidence suggesting that the way in which platforms' algorithms deliver content may be inducing echo chambers, online incivility, and hate speech, all of which in turn contributes to polarization and further exacerbates societal problems (33–35), which can be particularly problematic within politically fragile or ethnically polarized societies.

One of the enduring features of postconflict settings is the lack of exposure to the outgroup and segregation, which is associated with a plethora of discriminatory behaviors and attitudes. To alleviate those negative effects, scholars propose and show that contact with individual outgroup members can translate into lower prejudice levels toward the entire group (13), with positive association between contact and prejudice reduction supported in the seminal meta-analysis of 515 intergroup contact studies (12). Unique characteristics of online communication—the ability to transcend physical distance, lower the cost of contact, more easily create perception of equal status, and reduce anxiety around interethnic interactions—may be particularly valuable in providing an opportunity for intergroup contact within otherwise segregated areas (36). Sharing the same online space with outgroup members, however, does not necessarily satisfy the facilitating factors under which contact experiences are more likely to reduce prejudice: equal status, intergroup cooperation, common goals, and support by social and institutional authorities (37). Although electronic interaction more frequently provides the perception of equal status due to status differentials being less observable than within face-to-face contact (36), other conditions are less frequently satisfied as part of one's online experience.* Unlike e-contact interventions that are designed with optimal conditions of contact in mind and engage participants to work together on a task with a chat moderator or other source of authority support, average social media interactions are far less structured. Even beyond optimal conditions of contact, the literature is inconclusive when it comes to the effectiveness of virtual contact in shaping intergroup attitudes and behavior. Although the virtual sphere may provide a less threatening environment for group interactions to unfold, these interactions also lack physical touch and features of nonverbal communication, such as mirroring gestures or tone of voice, that can be powerful in cultivating closeness and trust (38, 39). Moreover, in unstructured and naturalistic settings, episodic interethnic interactions may also be negative, causing higher category salience and exacerbating rather than ameliorating group conflict (40).

We considered these competing arguments and preregistered the following hypotheses:

H1: Users Who Are Not Active on Facebook during the Week of Genocide Commemoration Will Display More Amicable Interethnic Attitudes Compared to Their Counterparts Who Remain Active.

In addition to testing our expectations around the effect of social media on outgroup regard, our research design also allows us to test the robustness of two key findings—that Facebook

*A meta-analysis of 515 studies of intergroup contact concludes, however, that these conditions increase the chance but are not necessary for contact to produce a positive effect (12).

deactivation improved subjective wellbeing and decreased knowledge of current events (hereafter “news knowledge”)—from a recent Facebook deactivation study, which, as noted previously, was not conducted in a postconflict society but rather in the United States (2). We consider these two outcomes as separate from one another and, as such, we derive our expectations of the effect of deactivation for each of the outcomes independently.

While there is research suggesting that social media can reduce users’ levels of psychological distress by enabling them to stay in contact with their extended families, receive more social support, or access health information (41), a growing literature reports the negative psychological impact of the time spent on social media platforms. Such negative impact is attributed to the features of social media platforms that can encourage social comparisons, induce addictive behavior, or enable cyberbullying (42, 43). In preregistering our own hypothesis, we drew most heavily from the largest-scale causal evidence to date, which found that a month-long Facebook deactivation led to small but significant improvements in wellbeing among the US users (2). We did not expect that the postconflict nature of the context would lead to a different direction for the effect of Facebook deactivation, although it seemed plausible that the effect size, especially as it relates to anxiety levels, would be stronger given the emotionally charged nature of the commemorative period in which we conducted the study:

H2: Users Who Are Not Active on Facebook during the Week of Genocide Commemoration Will Display Higher Levels of Subjective Wellbeing Compared to Their Counterparts Who Remain Active.

In addition to subjective wellbeing, we test the effect of Facebook deactivation on news knowledge. In the previously referenced Facebook deprivation study that took place in the United States (2), the authors found that deactivation reduced participants’ news knowledge index by 0.19 SD and speculated that the magnitude of the effect might differ, depending on the duration of the time spent deactivated from Facebook. We saw no reason why we would expect this dynamic to play out differently within a postconflict society. In an attempt to evaluate the external validity of that finding, we therefore test the following hypothesis:

H3: Users Who Are Not Active on Facebook during the Week of Genocide Commemoration Will Display a Lower Level of News Knowledge Compared to Their Counterparts Who Remain Active.

We also preregistered a test of the impact of deactivation on a measure of political disaffection. We find suggestive evidence that the treatment of deactivation led to an increase in the level of political disaffection, i.e., negative affinity toward politics, which we operationalize as a composite index capturing levels of apathy, skepticism, and cynicism. This is yet another area in which exposure to social media may be affecting users and have important sociopolitical implications. We do not, however, focus on this outcome in the main text due to our lower confidence in the measurement of some of the indicators, but provide full results, as well as an explanation for our lower levels of confidence in this measure, within *SI Appendix, section 14*.

Research Design

Our study focuses on Bosnia and Herzegovina, the most ethnically diverse of the former Yugoslav republics, and a site of a devastating war during the period from 1991 to 1995. Following the signing of the Dayton Peace Agreement, the country was divided into two entities, with about 51% of the territory granted

to the Federation of BiH (predominantly Bosniak and Croat) and 49% to Republika Srpska (predominantly Serb). The Agreement also enforced a complex power-sharing system between the three ethnic groups, including a tripartite Presidency. More than two decades later, ethnonationalism continues to dominate the political arena. According to the latest 2013 census, Bosniaks make up 50.11% of the population, followed by Serbs at 30.78% and Croats at 15.43%, and finally 2.73% categorized as others.

Our treatment of Facebook deactivation took place from 7 July until 14 July 2019, encompassing the week around the Remembrance Day (11 July) of the genocide in Srebrenica. The genocide in Srebrenica is central and deeply intertwined with the memory of the Bosnian war as the worst atrocity in Europe after World War II. Online and offline discussions related to the war are held to a certain extent throughout the year, but significantly intensify during this period. The central event includes a mass funeral in Srebrenica for the victims’ remnants identified over the previous 12 mo, but there has also been an effort to provide digital content in the form of archives, museums, data collection, and journalistic accounts aimed at preservation of collective memories (44). These efforts are particularly valuable as a means of confronting a growing trend of genocide denialism. Despite the fact that the International Criminal Court of Justice (ICC), among other institutions, ruled that the acts against the Bosniak Muslims committed in Srebrenica were acts of genocide under the international law (45), significant numbers of Republika Srpska officials and ethnic entrepreneurs continue to reject such rulings. The commemoration period serves as a natural prime of ethnic identities and, more generally, a proxy for periods during which identities (in this case, ethnic) are made salient and more fervently discussed.

Participants were recruited through Facebook advertisements, which we ran across BiH (*SI Appendix, Fig. S1B*) in both Cyrillic and Latin alphabets. Importantly, there is no language comprehension barrier between the members of three main ethnic groups in BiH. Prior to initiating this research, we obtained the approval of the New York University Institutional Review Board (protocol IRB-FY2019-3042). Participants were provided with a consent language as part of the email confirming their participation and were asked to respond to the email stating clearly that they agreed to it and chose to take part in the study. Out of the individuals who successfully completed the baseline survey, we selected only those who reported following at least one BiH news or political page on Facebook and reported being never or almost never on Twitter nor Reddit. We chose these criteria to increase the likelihood of our sample being exposed to political or intergroup content, as well as to reduce the extent to which the discussions on other social media platforms (Twitter or Reddit) might be influencing our outcomes of interest. Regarding the former, it should be noted that Facebook is by far the largest social media platform in BiH, encompassing 99.02% of social media market share, compared to Twitter and Reddit with 0.37% and 0.01% of the market share, respectively (46). Hence, active Twitter or Reddit users tend to be a more distinctive group and, by excluding them, we focus our attention on an average Facebook user responding to our advertisement.[†] We block randomized the 556 resulting individuals into treatment and control, blocking on the variable from the baseline survey that measures the importance of ethnic identity to one’s self-identification. A total of 258 of individuals assigned to the control group and 263 of those assigned to the treatment group were successfully emailed.

[†]For comparison, the data for the United States over the same period suggest that the social media market share of Facebook, Twitter, and Reddit is 50.93%, 18.17%, and 0.55%, respectively.

After we informed them of their assigned treatment, 92 from the treatment group and 64 from the control group either never responded or responded too late to be included as participants. Of those who did confirm their participation after receiving their group assignment, 31 participants (15 from the treatment group and 16 from the control group) failed to complete the study. Since attrition may introduce bias if it is systematically related to the outcomes of interest, we analyze the wide range of baseline characteristics of users who did not finish the final survey. We do so by first using the sample of all users included in randomization, where we detected significantly higher attrition in the treatment group. We also present an attrition analysis with the subsample of users who attrited after initially providing an affirmative response to our invitation to participate in the study (*SI Appendix, section C*). In both cases, the characteristics of those who attrited after being assigned to deactivate versus those who attrited after being assigned to remain active are largely balanced. We also estimate the probability of attrition for each user and show that our findings are robust to the inclusion of this control in our key models. This strengthens our belief that, although more people attrit within the treatment group, they do so for reasons largely unrelated to our outcomes of interest, which limits the potential of attrition biasing the internal validity of our results. We cannot, however, eliminate the possibility that those who have not finished the endline survey systematically differ on an unobservable characteristic related to our outcome and thus caution readers to interpret the results with this caveat in mind.

We received endline surveys from 159 participants in the treatment group and 194 participants in the control group, with their observable characteristics balanced between the treatment and the control group (*SI Appendix, Table S3*). The only imbalance detected is on the self-reported weekly frequency of accessing Facebook, with participants in the control group reporting somewhat higher values in the baseline survey compared to the treated group. We control for this covariate in the main results (model 2), which does not substantially change the estimated treatment effects. The final sample, with descriptive statistics reported in *SI Appendix, Tables S1–S3*, consists primarily of participants who identified themselves as Bosniaks (58.92%), followed by those identifying as Serbs (15.71%) and Croats (6.52%). Finally, 13.03% of respondents chose to identify as Bosnians and 4.82% chose to not report their ethnic identification. Ethnic and religious identities largely overlap within the context of the three communities in BiH.

The deactivation was monitored via a Python script that automatically checked Facebook URLs twice a day and sent a report to researchers with the IDs of participants who remained active. In addition, we manually checked the URLs at random times throughout the day. All of the initial URLs were also transformed into numeric IDs, so that we would be able to detect activity from the profile even if a user changed the way the username is shown to the general public. Once deactivated, the group complied with deactivation at a rate that exceeded 98%. Those who did not abide by the treatment and activated their profile at some point during those 7 d were contacted to describe their reason for activation and provided with a final warning (email and text); if they did not deactivate within 1 h after the email was sent to them, they were excluded from the study. The control group was asked to continue using Facebook as they regularly would, while also sharing the information on the exact daily amount of time they spent online by sending screenshots of the report that Facebook creates for each user.[‡]

Participants took a comprehensive survey at the end of the experiment, and we focus on questions within three families of outcomes: outgroup regard, subjective wellbeing, and news knowledge (full list of questions in *SI Appendix, Table S4*). All of the questions were preregistered; following our preanalysis plan, we present results both for the composite indexes and for each of their corresponding indicators.[§] With the following regression, we estimate the intent-to-treat effect of Facebook deactivation on our outcomes of interest:

$$Y_i = \alpha + \beta T_i + \theta X_i + \epsilon_i, \quad [1]$$

where Y_i is an outcome, $T = \{0, 1\}$ an indicator of treatment assignment, and X_i a vector of covariates for the individual. Full covariate specification includes the following controls captured in the pretreatment survey: gender, age, employment status, ethnicity, weekly frequency of Facebook usage, and the perceived importance of country and ethnic membership to one's identity. When incorporating covariates and in an effort to improve consistency of the estimated effect, we include mean-centered covariates and interact them with the treatment indicator (47, 48).

Results

We first present our results on the impact of Facebook deactivation on subjective wellbeing and news knowledge, after which we present the effect that deactivation had on users' interethnic attitudes.

Main Effects on Subjective Wellbeing and News Knowledge. We test our news knowledge variable by creating an eight-item knowledge quiz with news headlines, some of which truly appeared over the 7 d of the treatment and some of which were written by our research team to provide a combination of true and false news. Participants were asked to indicate, without checking the information on the internet, whether the headline was true or false or whether they were unsure. The news knowledge index was created as a count of correctly assessed statements minus the number of statements for which the respondents gave the wrong response. What we find is that Facebook deactivation significantly reduced news knowledge, with treatment leading to a reduction of news knowledge by 0.27 SD (SE = 0.106; $P < 0.05$) (Fig. 1A). This effect is 0.08 SD larger than the effect detected in the study on the US sample. As the authors of the US study discuss (2), a longer period without Facebook is likely to have a lesser impact on news knowledge as users find alternative sources of information, which could be one of the reasons explaining why the magnitude of the effect they detect after 1 mo of deactivation is somewhat lower than the magnitude we find with a shorter treatment. They furthermore propose that one way in which Facebook deactivation might be reducing news knowledge is by making the treatment group participants more likely to answer "unsure" (2). We find a similar pattern within our sample, with the treatment group answering an average of 3.62 of 8 questions with unsure, compared to an average of 3.29 within the group that remained active on Facebook.

With regard to subjective wellbeing (Fig 1A and *SI Appendix, Table S5*), we detect statistically significant effects on levels of anxiety (intention to treat [ITT]: $\beta = -0.37$ SD, SE = 0.108, $P < 0.01$) and loneliness (ITT: $\beta = -0.20$ SD, SE = 0.107, $P < 0.10$). Anxiety was also identified as one of the variables with the

[‡]In November of 2018, Facebook rolled out a new feature called "Your Time on Facebook," which tracks the amount of time a user spends on the Facebook mobile app. Instructions on how to access this feature were sent to all participants in the control group, yet depending on the device used, not all users were able to access or send the

updated reports and thus self-reported the time instead. We do not use this information in the analysis.

[§]Deviations from the preanalysis plan (in terms of final survey measures) are explained and documented in *SI Appendix, section S4.B*.

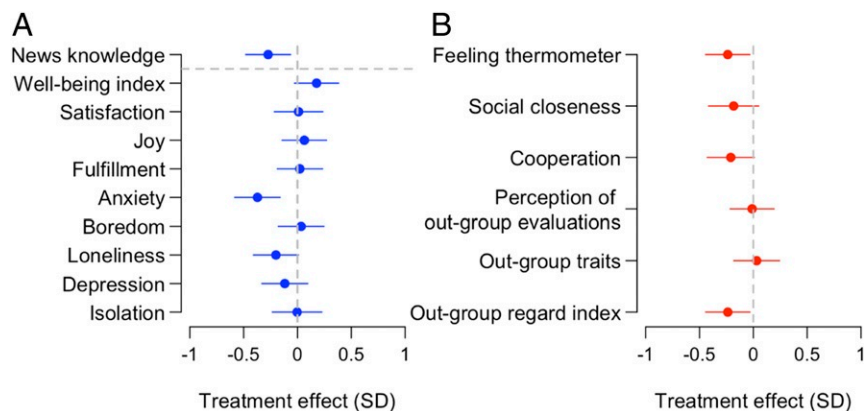


Fig. 1. (A and B) Intent-to-treat treatment effects of Facebook deactivation estimated on subjective wellbeing (A), news knowledge (A), and interethnic attitudes (B), with a full set of controls: gender, age, employment status, ethnicity, weekly frequency of Facebook usage, and the perceived importance of country and ethnic membership to one's identity. Each coefficient is reported with its corresponding 95% confidence intervals based on robust standard errors and is standardized relative to the SD of the control group ($n = 353$). In the creation of the wellbeing index (additive index of z scores), depression, loneliness, anxiety, boredom, and isolation were reverse coded so that higher values indicate more positive attribution.

largest and most significant effects (0.10 SD) in the US deprivation study (2). The reason why the decrease in anxiety level that we detect is much larger could be related to the period in which we conduct the analysis—the week around Srebrenica genocide commemoration—during which the content to which users are exposed online is likely to be particularly emotional and distressing. The effect estimate on the index of subjective wellbeing, created as a sum of z scores, yields a marginally significant effect size of 0.18 SD ($SE = 0.105$, $P < 0.10$, as shown in *SI Appendix, Table S5*). It should be noted that a one-sided test of the unadjusted difference in means of the composite wellbeing index, consistent with the direction of our hypothesis and excluding the box-plot outliers, yields a P value of 0.03.[†] In *SI Appendix*, we present regression results incorporating different sets of controls (*SI Appendix, Table S5*) and the effects remain stable across specifications. When we adjust the P value for false discovery rate (49) (*SI Appendix, Table S7*), the coefficient on anxiety remains statistically significant, but not the coefficients for loneliness and the aggregated index of wellbeing. Taken together, we conclude that deactivation of Facebook led to a significant decrease in users' anxiety levels, with positive improvements suggested in other components of users' subjective wellbeing.

Main Effects on Interethnic Regard. Analyzing the impact of the treatment on interethnic attitudes, we find that deactivation from Facebook led to more negative rather than positive outgroup attitudes, the opposite of what we initially hypothesized. The two outcomes for which we see very little movement include perception of outgroup traits (asking subjects to evaluate traits of the outgroup members) and perception of outgroup evaluations (asking subjects to evaluate how they think their in-group members are perceived by the members of other ethnic groups). However, we find that deactivation reduced the reported willingness to cooperate with the outgroup by 0.21 SD ($SE = 0.112$, $P < 0.10$), while significantly reducing the feeling thermometer score by 0.24 SD ($SE = 0.105$, $P < 0.05$), controlling for randomization block and a rich set of baseline covariates. We consider measured indicators to be different ways of capturing a latent variable of outgroup regard and, informed by factor loadings, create our main index of outgroup regard as a principal component score of the five indicators (feeling

thermometer, social distance, willingness to cooperate, outgroup trait ratings, and perception of outgroup evaluations, as described in *SI Appendix, Table S4*). With a principal component index of outgroup regard, we find that deactivation significantly reduced reported levels of outgroup regard by 0.24 SD ($SE = 0.105$, $P < 0.05$). We also tested—and show in *SI Appendix, section 6*—that our results are largely robust to outliers. To understand the magnitude of the effects, it is useful to contextualize the results by putting them within a comparative context. Although there are still no published and comprehensive evaluations of long-term trends in partisan affective polarization across the developing world, it is informative to note that a recent US study (50) shows an increase of 0.72 SD in partisan affective polarization by 2016, measured with feeling thermometer results and taking 1978 as the baseline. An effect size of 0.24 SD is one-third of that increase and is, as such, of considerable importance.

The finding that Facebook deactivation had a negative impact on users' outgroup attitudes goes against the theoretical insights on which we based our hypothesis, suggesting the need for theory refinement and further exploration of our findings.

Discussion

In this section, we move beyond our original preregistered study in an effort to shed some light on our unexpected findings: Why might it be the case that moving off of Facebook at the time of a genocide commemoration led to higher levels of outgroup animosity? While a full consideration of this topic would require new preregistered studies to address this research question specifically, for now we use data from our original experiment—as well as some additional data we collected expressly for this purpose—to provide an exploration of the impact of one potential explanation: differences in the composition of one's offline and online networks, especially as it relates to the degree of exposure to the outgroup.

As our starting point, we acknowledge that, in interpreting the role of any media on shaping social dynamics, focusing solely on direct media exposure is insufficient without taking into account the alternative activities that such exposure is crowding out (i.e., direct versus substitution effects) (51, 52). When asked how they spent their newly freed-up time, the treated group (deactivated from Facebook) reported spending more time than usual with friends and family as the most frequent response (Fig. 2); further

[†]Outliers here are defined as observations standing above and below the $1.5 \times IQ$.

analysis revealed that the treatment of Facebook deactivation increased the amount of time users spent with friends and family, as well as the amount of time spent reading the news on other online sources, at $P < 0.06$ significance level (*SI Appendix, Fig. S3*).

Given the commemorative period during which this study was conducted, it is important to note that people exhibit a tendency to share emotional experiences (53) and discuss contentious events, such as wartime-related topics and politics, with those with whom they feel closest. Scholars of social psychology explain how experiences of collective trauma and suffering feed back into the present, with narratives of family members often cited as the most powerful influences in transmitting and forming awareness of group victimization (54). Moreover, some scholars (55, 56) have suggested that vulnerability to echo chambers may be greatest in offline social networks and point out that we have lost sight of the fact that offline social networks are oftentimes even more homogeneous than the online networks. Previous research conducted in the context of a violent conflict also illustrates that in-person social interactions within homogeneous areas may in fact increase discriminatory outgroup behavior (57).

Even those who experience no direct contact with the outgroup may benefit from living within a diverse setting with ingroup members who do partake in such contact. This contextual effect can translate to online platforms as well, given that social media provides easier access to the extended networks of users' online connections. Indeed, affordances of Facebook, particularly in settings with no language barrier, are conducive to extended (58) and vicarious contact (59, 60), where the former includes observing intergroup interactions and the latter knowing that an ingroup member befriended an outgroup member. Several studies find the positive effect of such contact on intergroup relations, although many of these studies are cross-sectional and warrant stronger empirical evidence. Our treatment of social media deactivation that reduced, if not entirely eliminated, participants' contact with the outgroup may have made some users more dependent on offline echo chambers and moved them further away from the opportunity to engage with individual voices, as opposed to solely having the effect of reducing exposure to online divisive rhetoric. Drawing on insights from contact theory, we could therefore expect that the treatment of deactivation might have a more negative effect on outgroup regard on those who have no contact with the outgroup as part of their offline experiences either.

To explore whether this implication holds in the context of our study, we performed a series of analyses that were not explicitly part of our original preregistration and thus should

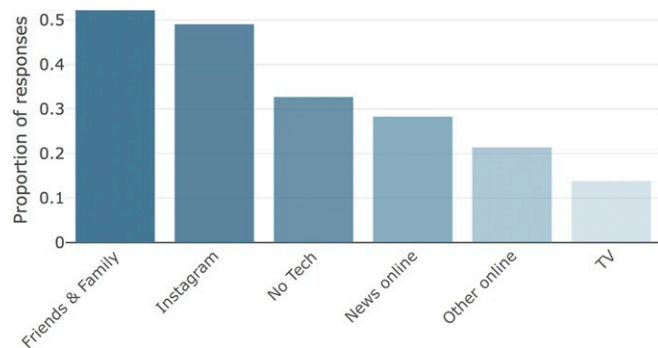


Fig. 2. Histogram of the treated group's responses ($n = 159$) to the final survey question (multiple responses permitted): "In the last week, relative to what is typical for you, would you say you spent more or less of your free time..."

be interpreted with that caveat in mind.[#] To proxy for users' offline networks, we use the latest Bosnia and Herzegovina census data (2013) on ethnic heterogeneities of BiH localities. We believe this proxy is reasonable as prior research has shown that county-level political and racial heterogeneity can help predict individual-level heterogeneity of political discussions, which we posit could hold for ethnic heterogeneity as well (61). Our conceptualization of offline networks goes beyond friends and family of users to include the composition of individuals with whom users might come into contact, both in the workplace and in daily activities. Measuring diversity is complex, with a variety of indexes employed, depending on the theoretical questions of interest. We test and check the robustness of our insights using three indexes with which ethnic heterogeneity can be quantified: an index of ethnolinguistic fractionalization, calculated using the Herfindahl concentration index, which is a widely employed measure of ethnic diversity; the share of the majority group, a measure that takes into account the size of the largest ethnic group in a particular town following the information from the latest census; and the Shannon diversity index, a mathematical measure most frequently used to characterize species diversity within a community (formulas and detailed descriptions of the indexes can be found in *SI Appendix, section 10*). For each of these three diversity indexes, we follow the same procedure. We first calculate the heterogeneity index of users' networks and then subset the data into below and equal to or above the median of the index value, thus categorizing towns into a dichotomous more and less heterogeneous subcategory. We then rerun our original analysis within the two subsamples and evaluate whether the effect of deactivation on outgroup regard is more negative for users who live in more homogeneous communities. Indeed, this is exactly what we find using all three indexes of ethnic diversity (Fig. 3): Within the subsample of more homogeneous towns, the effect of deactivation on the composite index of outgroup regard is negative and highly statistically significant (*SI Appendix, Tables S10–S12*); on the contrary, for people living in more heterogeneous offline environments, there is no effect of deactivation on outgroup attitudes.

Hence, it appears that the negative effect of Facebook deactivation on outgroup regard is almost entirely driven by users within the communities in which the opportunities for offline intergroup contact are limited (and in some cases possibly nonexistent), and they therefore may be living within offline echo chambers that are stronger than the ones users find online. Although smaller sample size can lead to overestimating the magnitude of subgroup effects (62), we find consistent conclusions across different ways of measuring the effect. While the subgroup results in Fig. 3 rely on a binary indicator, the moderation analysis is robust to using a continuous measure of town heterogeneity (*SI Appendix, Tables S16 and 17*). Across all three methods of measuring diversity, the estimate on outgroup regard passes the Benjamini–Hochberg multiple-comparisons correction at the 0.05 level (*SI Appendix, Tables S13–15*).

For the heterogeneity of online networks, we invited interested participants to download and share with us the list of friends with whom they are connected on Facebook. We gathered this information from 134 participants, which constitutes 38% of our initial sample.^{||} We simultaneously created a

[#]We did, however, preregister that we would map the level of ethnic heterogeneity within users' online networks from their list of Facebook friends (presented later in the section) and that we would examine how the level of segregation affects ethnic divisions, so these new analyses are very much in the spirit of that original plan.

^{||}It was a pleasant surprise that this many people elected to share their list of friends with us, especially given the effort involved in downloading these data from Facebook, but also of course far short of full compliance. Therefore, results from analyzing

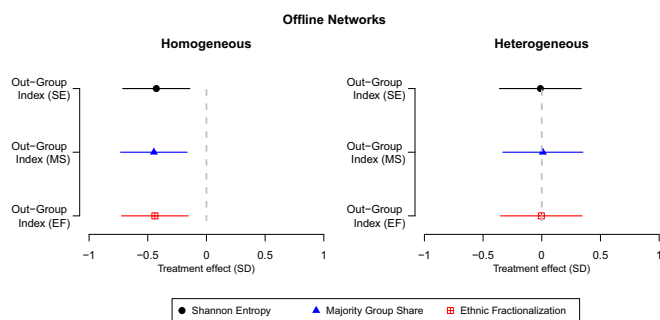


Fig. 3. Subgroup analysis: Treatment effect (full covariate adjustment) of Facebook deactivation on the composite index of outgroup attitudes for users with offline networks equal to or above, and below the median value of heterogeneity as measured by the three indexes of ethnic diversity ($n = 172$, $n = 179$, $n = 176$, for Shannon entropy, majority group share, and ethnic fractionalization measures, respectively).

comprehensive database of names categorized by likely ethnicity, which enabled us to obtain percentages of Bosniak, Serb, and Croat names in the networks of each of our users, as identified from the three categories of names in our database. On average, we were able to estimate the ethnicity of 74.9% of the names within the online network of each user. Manual inspection of the other names suggests that most unmatched names mainly belong to one of the three categories: non-Bosnian names (possibly friends from other countries), nicknames (unique combinations of letters), and nonhuman accounts (coffee shops, artists, and locations.) Following the same steps as for the analysis of offline networks, the direction of the estimates suggests that the effect of deactivation on outgroup regard (*SI Appendix, Tables S19 and S20*) is more negative for users with more heterogeneous online networks (which, as expected, contrasts with the effect becoming more negative for users with more homogeneous offline networks, as previously described). Although the estimated interaction effect between the heterogeneity of one's online network and the deactivation treatment is in the expected direction, the standard errors are too large to draw firm conclusions. It should be noted that this measure captures only users' direct outgroup friends and is likely an underestimation of the total exposure to the outgroup as it overlooks exposure through one's extended networks (friends of friends). Indeed, there is some evidence suggesting that such exposure may be substantial within the Balkan region. In 2016, Facebook introduced the first comprehensive measure of social connectedness across the world, constructing a dataset of aggregated information of friendship links between all Facebook users (63). Researchers have found that the level of connectedness is higher between regions who formed part of the same country in the past and highlight some regions in the former Yugoslavia as being several times more connected compared to similar pairs of other European regions (63).

We also use the available data to test whether those users whose online networks are more diverse than their offline networks are more negatively affected by the treatment of deactivation. Again, this analysis should be considered exploratory in light of the fact that it was not preregistered, yet we believe it suggests an important difference in the way Facebook deactivation affects people whose online and offline network diversity metrics differ. Using the same measures—ethnic fractionaliza-

tion, Shannon entropy, and majority group share—we estimate the diversity of users' online networks and create a binary variable that indicates users whose online networks are more diverse than their offline ones.** The interaction term between the treatment and this indicator reaches statistical significance with outgroup regard formed as a sum score and diversity measured with any of the three indexes (*SI Appendix, Fig. S6 and Tables S21 and S22*), while confidence intervals are wider when the index of outgroup regard is created as a principal component score. Across the two operationalizations, however, the direction of the estimates suggests that deactivating from social media had a comparatively more negative effect on outgroup attitudes for users whose online networks are more diverse than their offline ones. It is important to note that our results are aligned with two possibilities: that those who stayed active on Facebook experienced an improvement of outgroup attitudes because of their online contact and discussions engendered by the remembrance period or, alternatively, that those who deactivated their Facebook accounts experienced worsening of their outgroup attitudes because they were primarily exposed to discussions within homogeneous offline networks or the official discourse.

Theoretically, there is a potential, alternative, nonnetwork-based, explanation for our findings: that Facebook content about the commemoration promoted reconciliation, in which case the results we observe could be a product of the positive skew in the news content on the platform, irrespective of the homogeneity of either one's offline or one's online networks. To gauge the type of political content that was circulated during this period, we conduct a qualitative content analysis of the top five Facebook news pages in terms of the number of followers and—when these two categories do not overlap—Facebook pages of the top five news outlets in terms of the average number of website visitors per month. We find little to no evidence of unifying campaigns or promoted content and, in fact, find the contrary to be the case in our sample: Most articles are emphasizing group divisions (for more, see *SI Appendix, section 1*). The same, if not more, is true in the case of print media and public broadcasters, where, despite the existence of multiple media sources, pluralistic views remain rare (64). Of course, it is possible that those in the deactivated treatment group could have accessed different media articles about the commemoration through means other than Facebook. This, however, does not explain the observed heterogeneity in the effects depending on the composition of users' networks. Moreover, media outlets increasingly rely on mobile resources to share the news and distribute information through social networks, with Facebook being the most frequent option (64). As such, many news outlets tend to promote their content through both their official websites and Facebook. Since a user could presumably access similar, if not the same, news in print, through a website or distributed via social media, we argue that it is the experience of engaging with such content that makes social media uniquely different, given the opportunity to participate in discussions, as well as to observe one's social network and larger community engage with the online content.

Conclusion

Restoring social capital after conflict in societies with tenuous interethnic relations, as well as maintaining constructive interethnic relationships within a multiethnic society, is a complex and ever-evolving process. The rise of digital technologies and the increase in social media penetration across the world have for many changed the environment within which group processes unfold, yet we still lack rigorous evidence about the

these data should be considered especially exploratory. We compare baseline characteristics of those who shared versus those who chose not to share their online data in *SI Appendix, section 13*, and find no significant imbalances. It is plausible, of course, that the groups differ on an unobservable characteristic—e.g., trust of researchers—that our baseline survey measure does not capture.

**We conduct the same test with a continuous variable—*SI Appendix, Table S21*—and the insight continues to hold.

consequences of these developments. Going beyond the US context and partisan attitudes, we provide causal evidence of deactivation from Facebook leading to an unexpected decrease in users' regard toward ethnic outgroups. In addition, we find preliminary evidence suggesting that such impact is conditional on the degree of ethnic homogeneity of one's local community. We also find that recent findings from the United States (2) of a positive effect of social media deprivation on subjective wellbeing and a negative effect on levels of news knowledge generalize beyond US Facebook users. The uniqueness of the context in which our study was conducted, in terms of BiH's history and intergroup relations, makes it an important test case for assessing the effect of social media usage on intergroup relations, but also requires that the findings be interpreted with the characteristics of the environment in mind. For now, our findings should be interpreted as being limited to a postconflict area that is characterized by varying levels of spatial group segregation and no language comprehension barrier between the members of main ethnic groups, as well as during an emotionally and politically charged period. Moreover, those actively using Facebook to propagate hatred and extremist views, of whom there are many, would possibly not show interest in participating in a study led by a US-based university and may thus not be fully captured within our sample. As such, our results do not speak to all of the possible effects that Facebook could have even in BiH and certainly not to all postconflict and ethnically polarized societies. Isolating the ways in which the features of our research design shaped the direction of our main effect would be a valuable next step in advancing understanding of social media's impact on outgroup attitudes.

Our study is, of course, not without limitations. Studies with a smaller sample size, like ours, may overestimate the magnitude of the true effect (62). Given the lack of social media deprivation studies that—like ours—focus on interethnic regard, we hope to see larger-scale replications in the future to reach a more precise estimate of the true effect size. Such replications could also allow for a more robust exploration of heterogeneous treatment effects for which this study is underpowered. We also encourage future research to compare the diversity of online versus offline networks, which would better shed light on the mechanisms underlying the relationship between the time spent on social media and group attitudes. In particular, additional measures of

networks that go beyond the experiences of direct contact would allow for a finer-grained analysis of the differences in outcomes depending on the composition of one's network (although for now such studies on Facebook would likely require the cooperation of the company due to data access limitations for those outside of Facebook). Finally, as we deliberately set our study during a period around the Srebrenica genocide commemoration in which we expected emotions to be heightened and political discussions intensified, it remains to be seen how robust the effects we observed will be in a less emotionally charged period. Nevertheless, insufficient attention has been given to exploring the role that social media plays in enabling individuals to negotiate identity, preserve history, and cope with grief and societal trauma, a question to which we hope to contribute to answering in our future work.

Within the growing disappointments and valid concerns about the role of social media—many of which extend far beyond the scope of our paper—our findings do suggest that simply deactivating from social media is not a panacea to ethnic polarization, especially if the offline environment provides few to no opportunities for positive intergroup contact. Indeed, to answer the question of how time spent on social media affects users, scholars would do well to move away from social media determinism by paying attention to the contextual factors, alternative activities, and intergroup contact opportunities available to the individuals within the particular research context. How to continue doing so in a manner that can ultimately create a road map for strengthening of social capital through the tools of digital networks remains a crucial question in pushing this ever-important research agenda forward.

Data Availability. Anonymized survey dataset and replication files have been deposited on GitHub (https://github.com/SMAPPNYU/facebookdeprivation_bh).

ACKNOWLEDGMENTS. We are grateful to all members of the New York University (NYU) Center for Social Media and Politics and participants of the NYU Comparative Politics Workshop and Center for Social Media and Politics Election Seminar Series for excellent comments and suggestions. We thank Cyrus Samii, Gwyneth McClendon, Chris Daves, Matthew Gentzkow, Andrew Guess, Kevin Munger, Riada Asimovic Akyol, Mikdat Yildirim, and Rajeshwari Majumdar for providing helpful feedback; Megan Brown for excellent technical support; and Edima Zejnilovic for invaluable expertise and assistance on the ground.

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