Dynamic Persuasion: Decay and Accumulation of Partisan Media Persuasion

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Abstract

Both academic researchers and political pundits have generally accepted several over-time features of persuasion by partisan media: that the persuasive effects of partisan media might be temporary and decay quickly after a single exposure, and that these effects accumulate from multiple exposures. That effects decay may serve to ameliorate concerns about the broad impact of such media on partisan polarization. Yet the assumption that persuasive effects accumulate may raise larger concerns from real-world repeat exposure. To explore these possibilities, we implement a novel set of multiwave experiments that allow us to examine concerns about media effects over time. We present estimates from three studies which suggest that the persuasive effect of exposure to just a short article or video clip can persist for up to a week. In contrast to this persistence, our results suggest that an experiment adequately powered to detect the accumulative effect from multiple doses of partisan media — let alone one powered to detect accumulative effects among subgroups of the population — would require an unrealistic number of respondents, suggesting that such effects are difficult to test in an experimental setting with limited resources.

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Introduction

Statements by pundits, politicians, and citizens alike lament the rise of political polarization and the role that partisan news media may have played in this process. In particular, this argument articulates a worry that silos of repeated exposure to one-sided media may cause political attitude extremism via accumulated and persistent persuasion (Pariser, 2012; Sunstein, 2001; Tufekci, 2018). Although such echo chambers might only affect a small portion of the population (Allen et al., 2020; Guess, 2021; Prior, 2013; Wittenberg et al., 2023; Wojcieszak et al., 2022, cf. Broockman and Kalla, 2024), if the minority that repeatedly consumes partisan media disproportionately engages in the political system, they might have an outsized effect on policy — especially if these effects accumulate and persist over time. However, observational data rarely allows researchers to examine either the accumulation or persistence of partisan media's effects over time.

In the face of this challenge, political scientists have turned to experimental methods. These studies (e.g. Arceneaux, Johnson and Murphy, 2012; de Benedictis-Kessner et al., 2019; Leeper and Slothuus, 2014) have generally yielded more modest estimates of persuasion effects than observational research designs, leading to ambiguity about the cause of this discrepancy. Indeed, such differences could emerge from a number of limitations such experimental designs face such as their time-limited nature or artificiality of the stimuli. While some studies have avoided the artificiality of media stimuli and the artificiality of the news consumption environment by incorporating more realistic choice settings (e.g. Broockman and Kalla, 2025; Guess et al., 2021; Levy, 2021), these studies often have had to sacrifice some degree of experimental control.

In this paper, we present the results of three experiments that explore the accumulation and persistence of the persuasive effects of partisan media. These multi-wave experiments allow us to examine the way these persuasive effects can dynamically change over time in ways that traditional single-wave experiments must ignore. In particular, we focus on two ways in which temporally limited experiments deviate from real world behavior. First,

such experiments focus on the instantaneous change in respondents' attitudes. However, the persuasive effect of partisan media may quickly decay, limiting its ultimate effect on public opinion and political behavior, or they may persist, leading to longer-term impacts on politics. Second, these experiments typically focus on the consumption of just a single story at a single moment in time. Yet in reality, readers or viewers will repeatedly consume their favorite publications and broadcasts, potentially amplifying their persuasive effects through accumulation. Single-exposure studies with immediate measurement of attitudinal change have little ability to mirror these real-world processes of persistence and accumulation and therefore assess their effects (Slater, 2004).

We address these shortcomings by conducting a series of large-scale multiwave experiments that test for both the accumulation and subsequent decay of media persuasion. Specifically, we report the results of three survey experiments. Experiment 1 focused on policy attitudes about the legalization of marijuana and consisted of three waves. In this experiment, we exposed respondents to a short news article in one or both of the first two waves and measured their policy attitudes in all three waves, allowing us to study the longevity of the effects of news media as well as the accumulative effects of receiving multiple treatments. Based on the results of Experiment 1, we discovered evidence suggesting the persistence of persuasive effects across waves of our survey, but determined that an adequately powered experiment isolating accumulative effects would be virtually infeasible. We then conducted two preregistered experiments (Experiment 2 and Experiment 3) to replicate our tests of the persistence of persuasive effects.[1] Both of these follow-up studies consisted of two waves and focused on the policy issue of the break-up of large technology companies. In both experiments, we only treated respondents once in the first wave but measured their policy attitudes in both waves, allowing us to assess the persistence of the persuasive effects of the initial treatment over the two waves.

[1]Pre-registration for Experiment 2 is available at `https://osf.io/gy9q5/?view_only=3462b04bb6934a4a8744a3fe5b8259a3`. The pre-registration for Experiment 3 can be found at `https://osf.io/hefm2/?view_only=cf19e3618c9a4f9e8150c699f43e9b4f`

The results of these three studies lead to two salient conclusions. First, we demonstrate that — in contrast to both longstanding theory and recent work showing "minimal effects" — partisan media can have persistent persuasive effects. Our studies provide evidence that effects of treatment can persist for over a week, with some effects showing significant persistence and others showing suggestive evidence of durability. That even brief exposure to a short news clip or article can lead to lasting changes in attitudes suggests we should broaden our focus beyond partisan media's polarizing effects near elections to consider its substantial influence on political discourse at any point in time.

Second, based on the results of Experiment 1, as well as the magnitude of immediate persuasive effects revealed in Experiments 2 and 3, we show that it would be very difficult to conduct an adequately powered experiment to examine how persuasive effects vary with the treatment received in the previous wave — that is, whether the effects of treatments accumulate over time. Consequently, we believe that our results approach the limit of what can be learned about the accumulative effects of partisan media from design-based analyses such as multiwave experiments. In sum, while exposure to partisan media can lead to *persistent* persuasive effects, studying how these effects might accumulate is unlikely to be achievable with realistic sample sizes without the aid of strong modeling assumptions.

Experimental Designs to Assess Dynamic Persuasion

Research has documented that even short exposure to partisan media can change the opinions of its viewers and readers. These studies are typically single-shot experiments, in which respondents read a short article or watch a short video and then complete a survey (e.g. Arceneaux, Johnson and Murphy, 2012; Leeper and Slothuus, 2014; de Benedictis-Kessner et al., 2019). A few studies have added a second survey wave to measure persistence of the persuasive effects, albeit typically with only a brief period between waves (e.g., 48 hours for Levendusky (2013*b*)). The longer-term durability of any persuasive effects thus remains

unknown. Guess et al. (2021), in turn, find little evidence of durable attitudinal polarization from exposure to MSNBC or Fox, but their reliance on real-world media viewing limits their ability to detect longer-term impacts.

Single-shot experiments are unrealistic in two principal ways. First, the political outcomes we typically care about — such as participation in elections — may occur long after any media exposure. Hence, estimating the influence of partisan media on real-world outcomes requires that we consider whether and to what extent these effects persist over time. Second, typical experiments present participants with a single news story to watch or read. However, consumers of partisan media tend to repeatedly watch or read their favorite shows and publications, resulting in a much larger volume of exposure than typical experiments can reflect. Real-world effects of repeated exposure may thus far exceed those measured in single-shot experiments. We refer to these questions about the durability of effects and repeated exposure as *persistence* and *accumulation* effects, respectively, which we discuss in the remainder of this section.

Persistence and Decay

If persuasive effects of partisan media are short-lived, they may not be as critical a concern as if they are persistent (Gaines, Kuklinski and Quirk, 2007). Identifying the long-term persistence of persuasive effects is thus crucial for understanding the real-world role of the media in politics.

Previous work on informational framing in news articles indicates that experimental estimates of persuasion may be quite persistent.[2] For instance, some research suggests that the polarization effects of partisan media may persist for at least two days (Levendusky, 2013*a*, p. 85-86), while decaying by approximately half over ten days and remaining at that

[2]One related theory in research on media effects that we do not discuss at length here argues that the persuasive impact of political communication will not manifest immediately, but will have a delayed "sleeper effect" (e.g. Hovland, Lumsdaine and Sheffield, 1949; Hovland and Weiss, 1951). More recent work, however, has failed to find evidence of a sleeper effect, except in limited circumstances (Capon and Hulbert, 1973; Coppock, 2022; Gillig and Greenwald, 1974; Jensen et al., 2011).

level for up to a month (Coppock et al., 2018). Additional research suggests that persuasive effects may decay, but only in certain segments of the population — such as those who are high in "need for cognition" (Chong and Druckman, 2010), or moderately politically knowledgeable (Baden and Lecheler, 2012).

It remains possible that persistence of persuasive effects might vary depending on the type of treatment (e.g., text vs. video). For instance, while there is little evidence to date on the question of whether text or video treatments produce more persistent persuasive effects, some media effects research suggests a mechanism by which persuasive effects of video might be more persistent because, more than text, video can "attract and hold attention and... excite the imagination" (Nisbett and Ross, 1980, 45). Yet recent research (Wittenberg et al., 2021) finds little evidence of a difference in persuasiveness between text and video, calling this argument into some question. In sum, previous research on partisan media and informational treatments more generally suggest that persuasion effects are likely to be persistent to at least some extent and that there is no clear ex ante reason to anticipate that such persistence will vary substantially depending on the type of treatment. We summarize these previous studies on persistence in Table A1 in Appendix A.

On the other hand, research in other domains — e.g., campaign advertising and highly polarizing political issues (Hill et al., 2013), policy preferences (Dowling, Henderson and Miller, 2019), information about climate change (Nyhan, Porter and Wood, 2022), crime (Carey et al., 2022; Larsen and Olsen, 2020) and evaluations of government (Kalmoe et al., 2019) — finds evidence of fairly rapid decay in persuasive effects and only residual persistence.

Thus for some policy attitudes, attitudinal persuasion may be short-lived, especially when people are likely to confront additional relevant information in their everyday lives that can potentially conflict with the initially persuasive information.

Accumulation of Partisan Media's Effects

Most people who watch or read partisan media do so repeatedly. Over time, this can lead to both attitudinal change and shifts in electoral choices, as shown in aggregate observational data (Ash et al., 2021; Hopkins and Ladd, 2014; Martin and Yurukoglu, 2017). These patterns are difficult to square with the findings of typical single-exposure experimental studies that tend to find minimal effects. Yet observational studies are often unable to distinguish between cumulative attitudinal changes resulting from repeated, over-time self-selection into consumption of these media outlets because observed attitudes result from both processes.

A few studies, however, have used experimental designs incorporating multiple exposures to partisan news and assessed whether repetition of arguments produces a cumulative effect. This research has found limited evidence that persuasive effects accumulate after repeated exposure to media, depending on the content, circumstances, and individuals receiving information.

Levendusky (2013*a*), for instance, shows survey respondents either like-minded partisan news editorials or apolitical articles in a two-wave experiment. He finds that multiple exposures to like-minded partisan media polarizes attitudes more than a single exposure, though the additional effect of the second exposure is smaller than the effect of initial exposure. Thus, we might expect that persuasive effects compound, to some extent, after multiple exposures. That said, additional research finds limits to this accumulation, and suggests that repeated exposure may have no effect beyond that of a single exposure (Lecheler and de Vreese, 2013). This latter finding is consistent with communication theory predicting that repeated framing of information may be redundant (Baden and Lecheler, 2012; Guess et al., 2021).

Characteristics of both individuals and the information they consume may contribute to the observed limitations in accumulation of persuasive effects. For instance, "pretreatment" effects from the initial exposure to partisan media may limit the degree of attitude change

resulting from subsequent exposure (Druckman and Leeper, 2012). Similarly, repeated exposure to contradictory or offsettinng arguments may undermine any impact on attitudes or beliefs (Chong and Druckman, 2010). Thus, prior exposure may moderate any accumulation of persuasive effects (de Benedictis-Kessner et al., 2019; Huber and Arceneaux, 2007; Zaller, 1992). This would lead us to anticipate relatively large initial effects and relatively large effects among those with limited previous exposure to partisan media, but little additional impact from repeated exposure.

Identifying the conditions under which the persuasive effects of partisan media decay or accumulate is essential for understanding the real-world effect of partisan media on policy and public opinion. To address these questions, we constructed several experiments to test whether the persuasive effects of short exposure to a short partisan media article or video clip can persist over days and weeks, and whether their effects accumulate.

Experimental Design

Our three experiments employ multiple media formats (text and video) to examine the temporal dynamics of partisan media exposure's effects on public opinion on two distinct policy issues. The first study (Experiment 1) used a three-wave design involving text treatments to assess both persistence and accumulation.[3] The second and third experiments focused on the persistence of persuasive effects in two-wave experiments with both text (Experiment 2) and video (Experiment 3) treatments.[4] For all three experiments, we exposed respondents to media about (and asked respondents for their attitudes about) policy issues that have support (and opposition) on both sides of the partisan aisle among elites. This means that these issues are ones on which we might reasonably expect there to be persuasion rather

[3]While the analyses for Experiment 1 were not pre-registered, we used the results of Experiment 1 to guide a pre-analysis plan (PAP) for the later experiments, which we pre-registered prior to data collection. Our PAPs for these experiments are available at `https://osf.io/gy9q5/?view_only=3462b04bb6934a4a8744a3fe5b8259a3` and `https://osf.io/hefm2/?view_only=cf19e3618c9a4f9e8150c699f43e9b4f`.

[4]Recent studies have found that the persuasive effects of video treatments can be marginally larger than text treatments, though this gap is relatively small.

than issues about which people might have calcified opinions immune to opinion change.

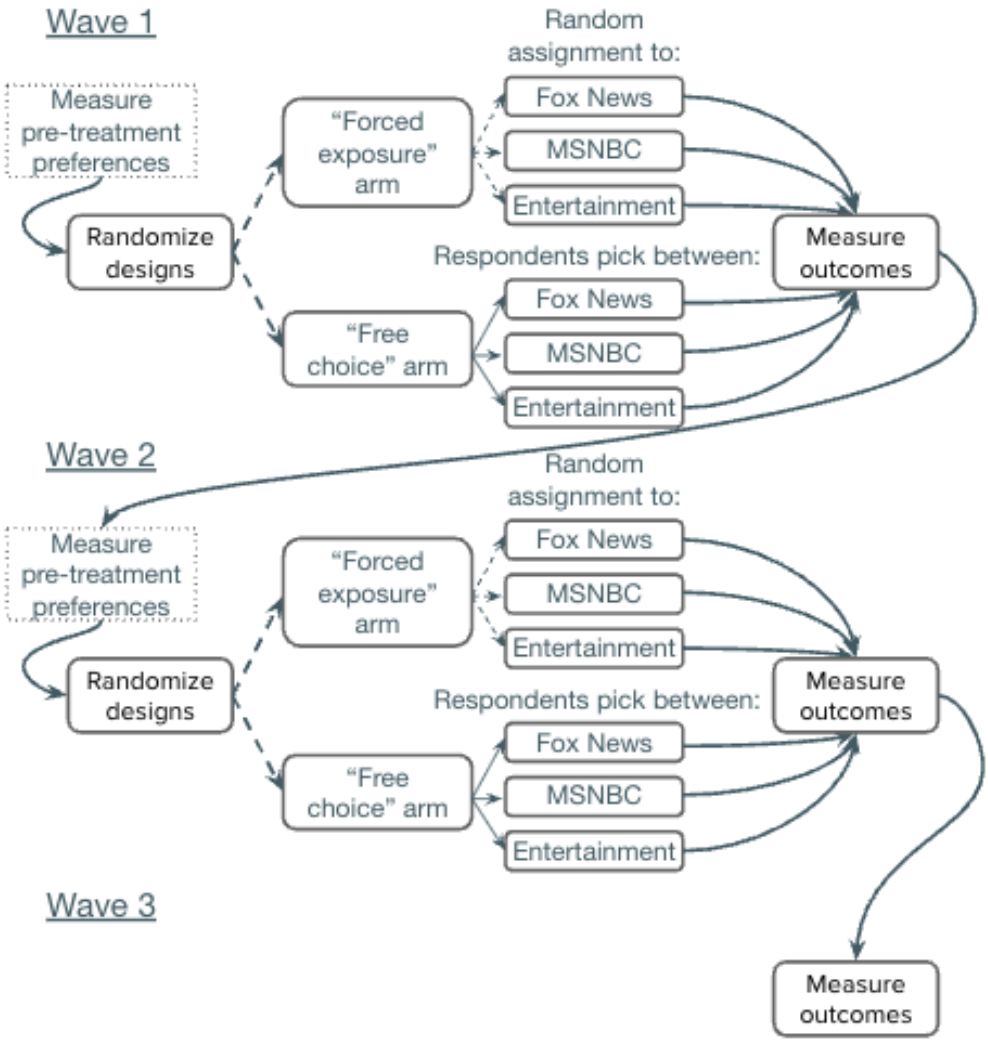
Experiment 1

We embedded Experiment 1 within a three-wave panel survey, which we depict visually in Figure 1. In the first two waves, respondents provided their stated media preference before reading an article supportive of marijuana legalization (MSNBC), opposed to marijuana legalization (Fox News), or about grocery shopping (the entertainment, or placebo condition). In both waves, we randomly assigned half the respondents to a "free choice" condition, which tasked respondents with reading an article of their choice — again, either a pro- or anti-legalization story on MSNBC or Fox News, respectively, or an entertainment story — and half to a "forced exposure" condition, which randomly assigned respondents to read one of the three articles.[5] We focus on the respondents who were in the forced-choice arm of the first wave of the experiment and in the free-choice arm of the second wave in order to assess the persistence of the effects of randomly-assigned treatments on their opinions while incorporating realistic post-treatment interference from respondents consuming other (non-random) media in realistic media environments.

We measured our outcomes at the end of the first wave, the end of the second wave, and in the third wave survey. Since we were interested in opinion change on underlying latent attitudes about marijuana policy, we focused on one summary measure of opinions rather than focusing on individual policy opinions in the domain of marijuana policy that would be subject to measurement error (e.g. Ansolabehere, Rodden and Snyder Jr, 2008). Our outcome measure for this experiment was the first principal component of a wide-ranging series of questions on marijuana policy, which we asked following treatment in the first and second waves of the experiment. We provide additional details on the experimental design and the full text of these questions in Section G of the supplementary information (SI). The third wave included the same outcome battery, but did not include a treatment.

[5]Note this distinction between the free choice and forced exposure groups represents an adaptation of a PICA design (de Benedictis-Kessner et al., 2019; Knox et al., 2019) to the multiwave setting.

Figure 1: Experimental Design, Experiment 1



We administered this experiment via an online survey to a national sample of respondents recruited through Dynata in November 2017.[6] Our sample consisted of 7,393 survey respondents in the first wave, 4,926 in the second wave, and 4,526 in the third wave. We invited respondents to the first two waves to participate in the next wave one week after they had completed the previous survey wave. This yielded a final retention rate in the third wave of 61.2%. Section E of the SI provides a detailed discussion of survey attrition patterns,

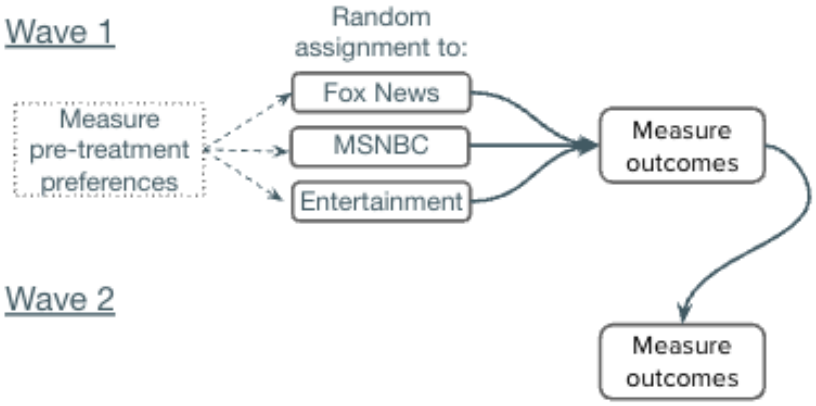
[6]Dynata recruits participants through various online communities, social networks, and website ads. When deploying a particular survey, Dynata randomly selects participants for survey invitations. We asked Dynata to recruit a target population that matched the (18 and over) census population on education, gender, age, geography, and income. The result is a diverse national sample, albeit not a probability sample.

and Section D of the SI presents balance tables summarizing the demographic composition of our panel across treatment groups.

Experiments 2 and 3

We designed Experiments 2 and 3 to replicate the findings of persistent persuasive effects found in Experiment 1 using a second policy issue: the breakup of big technology companies. Specifically, we preregistered both experiments to focus on the persistence of persuasive effects between survey waves. Both experiments included two waves, which we depict visually in Figure 2. In Experiment 2, we randomly assigned respondents into one of three treatment conditions: a pro-breakup condition where respondents read two articles with MSNBC formatting supporting the breakup of tech companies, an anti-breakup condition where respondents read two articles with Fox News formatting opposing the breakup of tech companies, or an entertainment condition where respondents read two articles about grocery shopping, presented with the Food Network logo. In both the MSNBC and Fox conditions, one article always focused on monopolization and market power while the other focused on the spread of misinformation online. Experiment 3 employed a video treatment and randomly assigned respondents to watch either a pro-breakup video clip from MSNBC, an anti-breakup clip from Fox News, or a non-political clip from the Food Network about how to make a fried chicken sandwich.

Figure 2: Experimental Design, Experiments 2 and 3



Both experiments employed two primary outcome measures which we measured both at the end of the first wave and in the second-wave survey. The first, the "number of companies broken up," is a count variable based on respondents' selections from a list of nine companies they believe should be broken up by federal regulators. The second measure is the first principal component extracted from a battery of survey questions that capture respondents' underlying attitudes toward large tech companies and related policies. This component serves as a summary indicator similar to the measure used in Experiment 1.[7] In both Experiments 2 and 3, Wave 2 included no treatment, and instead just repeated the outcome measures, allowing us to assess the persistence of the treatment effects between waves.

We administered these experiments via an online survey to a national sample of respondents recruited through Dynata in July 2021. Experiment 2 included 3,816 respondents in its first wave, all of whom were invited to participate in the second wave a week later, of which 1,487 (38%) completed Wave 2. Experiment 3 included 3,367 in the first wave, and retained 1,830 (54%) in the second wave. Section E of the SI examines the attrition patterns in all experiments, showing that dropout was not systematically related to treatment assignment and did not substantially alter the demographics of the sample.

Results

Persistence

Experiment 1

Figure 3 presents results regarding the magnitude and persistence of the persuasive effects of partisan media over the course of the three survey waves in Experiment 1, using the

[7] See Section G of the SI for more details on these experiments, including the complete text of the survey questions used.

first principal component as the outcome measure.[8] The vertical axis plots the difference in the outcome between those respondents receiving a partisan news treatment and those respondents receiving the entertainment media treatment. Positive effects indicate that the treatment resulted in more conservative attitudes while negative effects suggest that treatment led to more liberal ones. The estimates presented here use respondents that were randomly assigned a treatment in wave 1, but were in the free-choice group in the second wave.

In the first wave, the estimated average treatment effect for the Fox News treatment relative to entertainment (red points and line) is 0.139 [0.004, 0.274], indicating that respondents who consumed conservative media rather than entertainment media reported more conservative opinions. In contrast, the estimated effect of the MSNBC treatment (blue points and line) is -0.068 [-0.206, 0.069]. Although in the expected direction, the effect for MSNBC is smaller than that observed for Fox News and statistically insignificant.[9]

In the second wave, the point estimate for the persuasive effect of Fox News remains essentially unchanged, while the effect of MSNBC is near zero and statistically insignificant. The persuasive effect of treatment with Fox News rather than entertainment is even stronger in Wave 3 and is again statistically significant (0.217 [0.07, 0.365]). Conversely, the effect of treatment with MSNBC rather than entertainment remains null. Overall, these results suggest that partisan news can have a persistent persuasive effect, even when treatment involves reading just a short news article.

[8] We present results for the individual questions in SI H.1. We use our main principal component outcome here, which is both more reliable from a measurement validity perspective and enables us to avoid floor and ceiling effects that might constrain our ability to detect treatment effects. While some individual survey items showed clustering at scale extremes, our use of principal component analysis mitigates this by aggregating across multiple items. Similarly, the "number of companies broken up" outcome in the entertainment condition had sufficient range to detect treatment-induced changes in either direction despite some clustering at zero.

[9] These effects also appeared in the individual questions that formed the principal component outcome. For example, 63% of respondents at least somewhat agreed with the statement that "Marijuana should be legal for recreational use" after receiving the MSNBC treatment while only 52% did after receiving the Fox News treatment. Similarly, respondents were 6.7 percentage points more likely to indicate that legalizing marijuana would make the economy at least somewhat better after receiving the MSNBC treatment than after receiving the Fox News treatment.

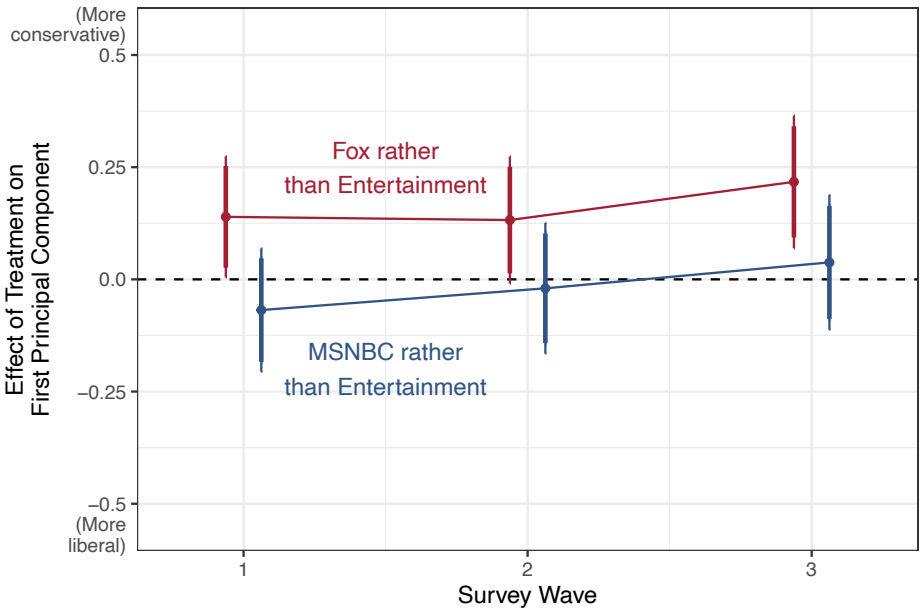


Figure 3: Effect of Treatment on First Principal Component in Experiment 1. Points represent the effect of being treated with partisan media instead of entertainment on the outcome measured in the wave identified on the x-axis, with 95% (thin lines) and 90% (thick lines) confidence intervals. Red shading identifies the effect of being treated with Fox News while blue shading identifies the effect of being treated with MSNBC.

One complicating factor in interpreting the results of Experiment 1 is the role of the free-choice condition in wave 2. Specifically, our design allows respondents to consume a follow-up dose of partisan media of their choice, to some extent simulating the real world process by which respondents will self-select into additional doses of partisan media. Although more realistic, because this design allows for the possibility that respondents might consume reinforcing, offsetting, or unrelated stories across the two exposures — that is pro- vs. anti-marijuana legalization, and/or a story about groceries — it might lead us to over- or under-state the persistence of the effects of partisan media relative to a design with no treatment in the second wave. That said, our analysis in Appendix F of the SI reveals that Wave 1 treatment assignment did not significantly influence Wave 2 media choices, with only about one-third of respondents choosing the same media outlet in both waves. Unlike Experiment 1, Experiments 2 and 3 did not include a second treatment in Wave 2, and so allow us to more directly identify the persistence of the persuasive effect of a single dose of partisan

media.

Experiments 2 and 3

We next present the estimates for the persuasive effect of partisan media in the full sample for both our "number of companies broken up" outcome (Figure 4) and first principal component outcome (Figure 5) in Experiments 2 and 3.[10] The "number of companies broken up" measure directly captures respondents' support for regulatory intervention by counting the companies they favor breaking up, while the first principal component aggregates responses from several related questions to provide a broader summary of their underlying tech policy attitudes. Note that a positive effect for the "number of companies broken up" measure indicates a shift toward increased support for regulation (i.e., a more liberal stance), whereas a positive effect for the principal component indicates a shift toward more conservative attitudes.

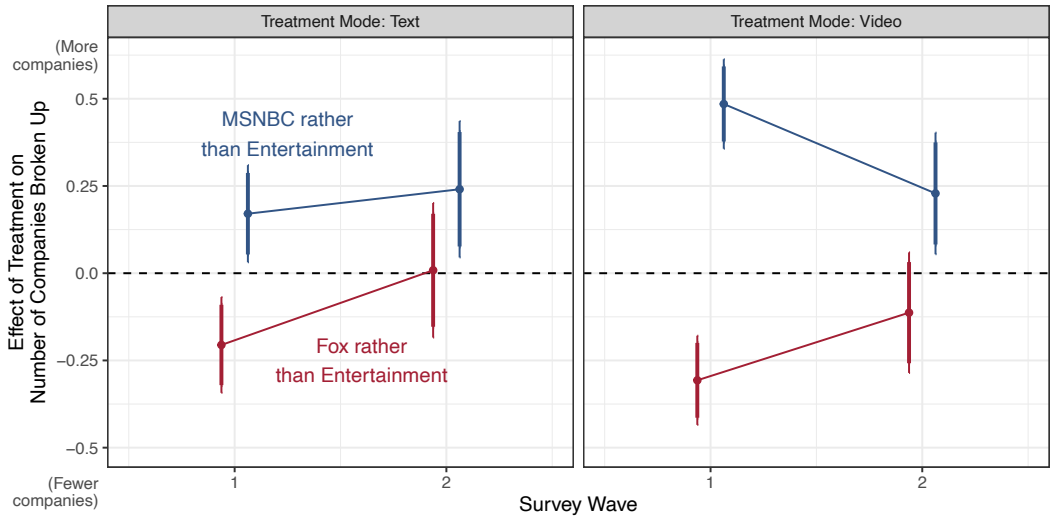


Figure 4: Effect of Treatment on Number of Companies Broken Up in Experiments 2 and 3. Points represent the effect of being treated with partisan media instead of entertainment on the outcome measured in the wave identified on the x-axis, with 95% (thin lines) and 90% (thick lines) confidence intervals. Red shading identifies the effect of being treated with Fox News while blue shading identifies the effect of being treated with MSNBC. The left panel shows effects in Experiment 2 (text stimuli) and the right panel shows effects in Experiment 3 (video stimuli).

[10]We present results for the individual questions in Sections H.2 and H.2.

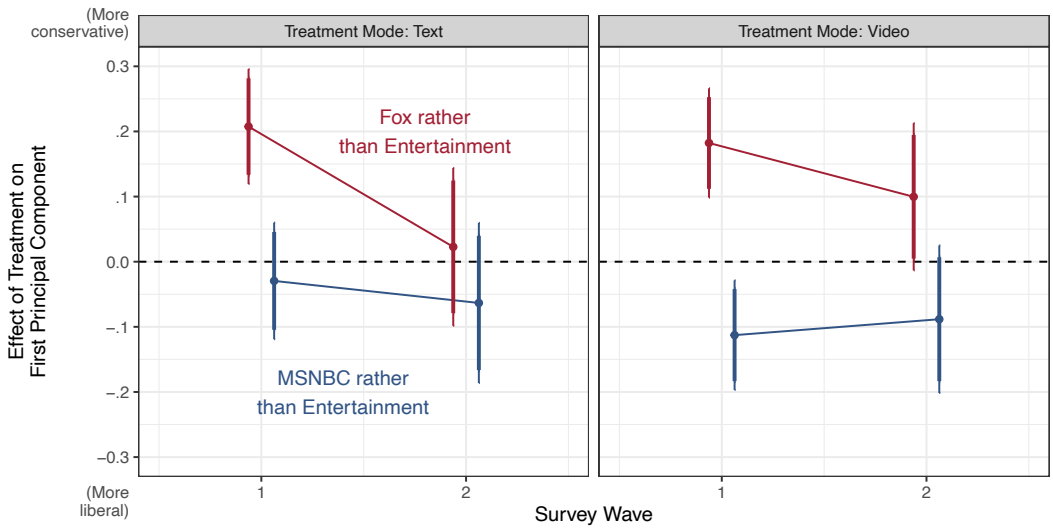


Figure 5: Effect of Treatment on First Principal Component in Experiments 2 and 3. Points represent the effect of being treated with partisan media instead of entertainment on the outcome measured in the wave identified on the x-axis, with 95% (thin lines) and 90% (thick lines) confidence intervals. Red shading identifies the effect of being treated with Fox News while blue shading identifies the effect of being treated with MSNBC. The left panel shows effects in Experiment 2 (text stimuli) and the right panel shows effects in Experiment 3 (video stimuli).

Both Experiment 2 (the text treatment, presented on the left side of both figures) and Experiment 3 (the video treatment, on the right side of both figures), show significant first-wave effects of partisan media. The effect of being treated with Fox rather than entertainment is statistically significant in both experiments for both outcomes in the first wave, while the effect of treatment with MSNBC rather than entertainment is significant for both outcomes in Experiment 3, as is the "number of companies broken up" outcome in Experiment 2.

Specifically, we see that respondents who received the Fox treatment wanted to break up 0.206 [0.068, 0.343] fewer companies than respondents who received the entertainment treatment. This effect is reflected in the raw percentages: while 59% of respondents indicated they would break up at least one big tech company after receiving the entertainment treatment, only 53% did after reading the Fox article. For the first principal component outcome, we observe a similar effect of 0.208 [0.119, 0.296] for the Fox treatment in Experiment 2. We also observe an effect of 0.171 [0.031, 0.310] for the number of companies broken up outcome

and -0.030 [-0.119, 0.060] for first principal component outcome for the MSNBC treatment in Experiment 2.

Most important for our purposes, we also observe some evidence of persistence into the second wave, which we administered roughly one week after the first wave in both experiments. In Experiment 2, we find a significant persistent effect from treatment with MSNBC on the "number of companies broken up" outcome of 0.241 [0.045, 0.436] and a suggestive effect on the first principal component outcome of -0.063 [-0.186, 0.060]. The effect of treatment with Fox seems to attenuate more strongly in Experiment 2, with the effect being near zero in the second wave.

The video treatment used in Experiment 3 also shows evidence of persistence for certain outcomes. Specifically, we saw respondents treated with Fox support breaking up 0.307 [0.179, 0.435] fewer companies than after receiving entertainment, while respondents treated with MSNBC favored breaking up 0.485 [0.357, 0.613] more companies than after receiving entertainment. Similarly, 64%, 77%, and 76% of respondents favored breaking up at least one big tech company after receiving the Fox, entertainment, and MSNBC treatments, respectively. In the second wave, we found a persistent effect for the MSNBC treatment on the number of companies outcome, with respondents treated with MSNBC in wave 1 favoring breaking up 0.229 [0.054, 0.403] more big tech companies in wave 2 than respondents treated with entertainment in wave 1. We also found suggestive evidence of persistence for other outcomes: respondents who received the Fox treatment in wave 1 favored breaking up 0.113 [-0.06, 0.286] fewer companies in Wave 2 than after receiving entertainment. Overall, 75%, 77%, and 78% of respondents supported breaking up at least one tech company in Wave 2 after having been treated with the Fox, entertainment, and MSNBC treatments in wave 1, respectively. This compares with 77% of respondents wanting to break up at least one big tech company in the full sample, suggesting that treatment effects diminished in the second wave, but did not vanish completely.

For the first principal component outcome, we observed significant initial effects of -0.113

[-0.197, -0.029] for the MSNBC treatment and 0.182 [0.098, 0.266] for the Fox treatment in wave 1. These effects showed suggestive evidence of persistence, attenuating to -0.088 [-0.202, 0.025] for the MSNBC treatment and 0.100 [-0.013, 0.213] for the Fox treatment in Wave 2. Taken together, the results from these experiments suggest that both text and video treatments by partisan media can be persuasive, with different patterns of persistence across experiments: significant persistence of Fox News effects in Experiment 1, significant persistence of MSNBC's effect on the number of companies broken up in Experiments 2 and 3, and suggestive evidence of persistence for other outcomes.

Comparing Persistence Patterns Across Studies

The persistence patterns varied across our three experiments, reflecting differences in design, policy domain, and outcome measures. Specifically, Experiment 1 showed persistent effects of Fox News treatment on the principal component measure through Wave 3, while Experiments 2-3 showed significant persistence of MSNBC treatment on the "number of companies broken up" outcome but only suggestive for the principal component measures.

These differences likely stem from several factors. First, the experimental designs created different contexts: Experiment 1 allowed participants to self-select media in Wave 2, potentially reinforcing initial treatment effects, while Experiments 2-3 measured pure decay with no intervening treatment in Wave 2. Second, the policy domains—marijuana legalization versus tech company regulation—may engage different types of attitudes and considerations. Third, the concrete "number of companies broken up" measure demonstrated clearer persistence than the principal component measures. This pattern suggests that when people express specific policy preferences (breaking up particular companies), these choices persist better than shifts in general attitudes.

Despite these differences, all three experiments converge on a key finding: partisan media effects can persist for at least one week. These complementary designs—varying in reinforcement opportunities, policy domains, and measurement approaches—together pro-

vide robust evidence for the durability of media persuasion effects.[11] Our results also suggest more persistent effects among respondents who indicated that they prefer partisan media over entertainment across experiments (see SI Section B), highlighting how individual media preferences may moderate persistence patterns, though the precision of these subgroup estimates is limited by sample sizes within each media preference group.

Accumulation

Experiment 1

Beyond identifying a persistent persuasive effect of partisan media, we also designed Experiment 1 to allow us to test for the accumulation of partisan media's persuasive effects after multiple exposures. Such accumulative effects require us to examine how persuasive effects vary with repeated exposures to partisan media. Specifically, we focus on whether the effect of receiving two doses of partisan media treatment (once each in waves 1 and 2) is larger or smaller than the effect of being exposed to partisan media only in the second wave. A larger effect from repeated doses would suggest that the real-world effects of partisan media on the beliefs of its regular viewers are larger than a single shot experiment could reveal.

Figure 6 visualizes the evidence for accumulative effects in Experiment 1. Specifically, the vertical axis represents the estimated effect of treatment with different doses of partisan media (rather than exposure to entertainment in both waves) on respondents' attitudes as reported in the second wave. The horizontal axis breaks down the results based on the dosage of partisan media treatment — either once (in wave 2, after being exposed to the entertainment treatment in wave 1) or twice (in wave 1 as well as wave 2) — with a panel for each partisan media outlet. While the results are noisy, they offer little evidence of accumulative effects of partisan media. For the subgroup of respondents who received entertainment in the first wave, the treatment effects of consuming Fox or MSNBC in the

[11] While a meta-analysis pooling across our three experiments is technically feasible, the overall effect estimate would be difficult to interpret meaningfully due to these differences across the experiments.

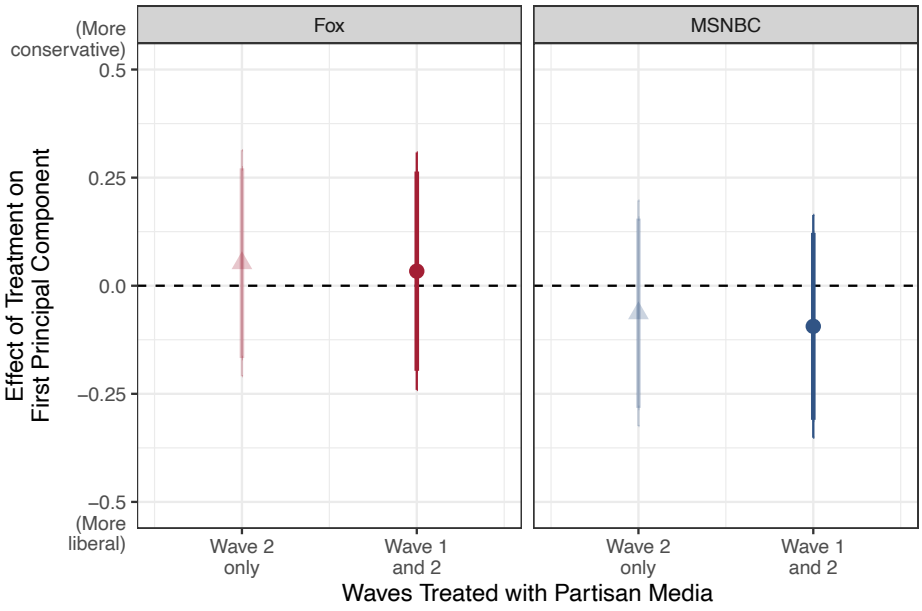


Figure 6: Accumulation Effects in Experiment 1. Points represent the effect on respondents' attitudes from one exposure to partisan media in wave 2 after exposure to entertainment in wave 1 (partially transparent triangles) or two exposures to partisan media in both wave 1 and 2 (non-transparent circles), both relative to exposure to entertainment twice, with 95% (thin lines) and 90% (thick lines) confidence intervals.

second wave (relative to entertainment in the second wave) are in the expected direction. Yet neither effect is statistically significant — and neither effect is statistically significantly larger for those people who received that same partisan media treatment in wave 1 as well. In other words, we see no reliable evidence that two doses of partisan media treatment is more powerful than one. However, these estimates are too noisy to allow us to conclusively say that the treatment effect is small. This imprecision results from the large number of treatment combinations we needed to asses the accumulative effects of partisan media. Consequently, we present the results of power analysis aimed at estimating the number of respondents needed for an adequately powered experiment in the next section.

The Infeasibility of an Adequately Powered Experiment on Accumulative Effects

Our estimates regarding the presence of accumulation effects were very imprecise, leading us to consider the feasibility of conducting an adequately powered follow up experiment on

this topic. In this section, we present results from power analyses of a potential follow-up experiment to assess these effects. We assumed an experimental design in which we randomly assign respondents to one of three treatment groups in each of two waves: MSNBC, Fox, or Entertainment. We focused on identifying the difference in treatment effects between respondents who were exposed to partisan media in both the first and second wave versus those who were exposed in only the second wave.

Although Experiment 1 provides some evidence for the magnitude of this difference, the estimates from this experiment were extremely imprecise. Indeed, the 95% confidence interval for the effect of two doses of the Fox treatment on the second wave outcome ranged from -4.62 to 5.92 times the effect of a single dose of the Fox treatment on the first wave outcome. Similarly, the 95% confidence interval for the effect of two doses of the MSNBC treatment on the second wave outcome ranged from -2.57 to 5.52 times the effect of a single dose of the MSNBC treatment on the first wave outcome.

This imprecision is fundamentally driven by the number of different treatment combinations included in our experiment. Although the forced exposure arm in Experiment 1 included 1,194 respondents in total, there were 9 distinct treatment combinations that respondents could have received across the two waves. Consequently, no pair of wave 1 and wave 2 treatments received more than 148 respondents. This rendered any attempt to estimate the difference in outcomes between respondents in any two pairs of treatment combinations under-powered.

Here, we instead focus on what we consider the plausible range of effects of two doses relative to one. Specifically, we calculated the Minimum Sample Size (MSS) required for us to conduct an experiment with a power level of 0.8 aimed at distinguishing the effect of two doses of the same partisan media from the effect of just a single dose. We do so under different assumptions about the effect of two doses as a percent of the effect of one dose. Our estimates assume that the effect of a single dose of partisan media (as well as the variance of the outcome measure) are fixed at the levels we observed in the first wave

of our first experiment.[12] Larger treatment effects would result in more optimistic power calculations.[13] While it is theoretically possible that a carefully constructed experiment could produce treatment effects that are significantly larger than this, we consider it highly unlikely.[14]

Figure 7 visualizes the results of this power analysis. The x-axis represents the assumed effect of two doses of partisan media as a percent of the effect of a single dose. The y-axis visualizes the MSS needed for an adequately powered experiment under the assumed decline in persuasive effects. The left panel highlights the MSS needed to distinguish the effect of a second dose of the Fox treatment from a first dose of the Fox treatment, while the right panel does the same for the MSNBC treatment.

Our original experiment randomly assigned respondents to each of the three treatment conditions in both of the first two waves, so that all respondents ultimately received one of 9 different treatment combinations. However, the analysis of accumulation effects really only makes use of 5 treatment groups (i.e., entertainment-entertainment, entertainment-Fox, Fox-Fox, entertainment-MSNBC, and MSNBC-MSNBC). A more streamlined experiment might improve the power by randomizing respondents only among these combinations. Indeed, if we were willing to focus on the effects of only one type of partisan media (and thereby eliminate either the Fox or MSNBC arm), we could further improve the power of the experiment by using only 3 treatment groups (e.g. Fox-Fox, entertainment-Fox, and entertainment-entertainment). The color of points and lines in Figure 7 varies based on this assumption about the number of treatment groups used, with the red points and lines indicating the

[12] In Wave 1, we observed standardized treatment effects of 0.139 and -0.068 for the Fox and MSNBC treatments, respectively, which are similar to the wave 1 effects we observed in Experiments 2 (0.208 for Fox and -0.030 for MSNBC) and 3 (0.182 for Fox and -0.113 for MSNBC), suggesting much larger treatment effects may be difficult to achieve.

[13] For example, if the true effect of a single dose were twice what we observed in the first wave, our original experiment would have been adequately powered to detect the difference in the effect of one and two treatments under the assumption that the effect of two treatments is double the effect of a single one.

[14] We designed our treatments to be maximally effective and followed best practices for research of this type. That is, we deploy (relatively) strong interventions in a controlled setting. It may be possible to have stronger treatments, but those kinds of experiments are resource intensive and would not be common – either in social science research or in real-world persuasion campaigns.

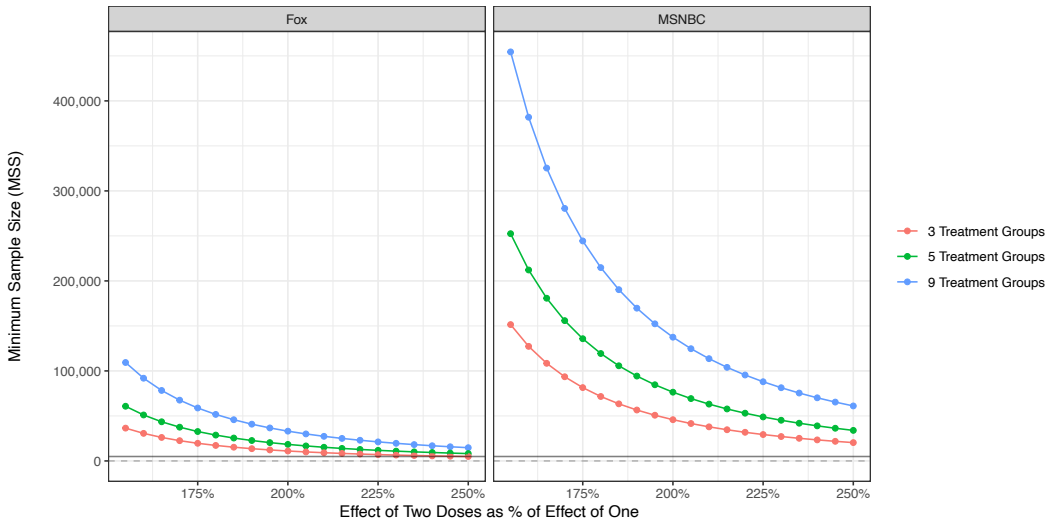


Figure 7: Minimum Sample Size (MSS) Needed For an Adequately Powered Experiment. This figure visualizes the number of observations needed to conduct an adequately powered experiment distinguishing the effect of a single dose of partisan media from the effect of two doses of partisan media. The x-axis represents assumed effect of two doses as a percent of the effect of a single dose. The solid gray horizontal line highlights our sample size in Experiment 1 (4,926), and the dotted gray line is at zero. Line colors indicate whether we assumed there were 3, 5, or 9 treatment arms.

most pared-down version of an experimental design for assessing accumulation.

These power analyses indicate that an adequately powered experiment to test hypotheses about accumulative effects of partisan media, using stimuli comparable to those employed in real-word persuasion campaigns, would require an extremely large sample size. We consider it most plausible that the persuasive effect of a stimulus would be smaller in the second instance of exposure compared to the first exposure — meaning that the effect of two doses would be less than 200% of the size of the effect of a single dose. However, even in the unlikely case that the effect did not decline in size, an adequately powered experiment with all 9 treatment groups would require 33,083 respondents for the Fox News treatment. Indeed, even if we were willing to reduce the experiment to 5 or 3 treatment groups, a choice that would eliminate our ability to estimate many other interesting quantities of interest — for instance, comparing the effects of Fox News vs. MSNBC relative to entertainment — an adequately powered experiment would still require 18,379 or 11,028 respondents, respectively. These calculations

are more pessimistic for the MSNBC treatment, but the substantive conclusion is the same — a very large sample would be needed to conduct an adequately powered experiment.[15] These power analyses suggest that — even under favorable assumptions — examining the accumulative effects of partisan media in an experiment may be out of the range of feasibility for many researchers.

Of course, several other changes to our experimental design might improve our statistical power. We already use an outcome from PCA that is likely to have a higher degree of measurement reliability than, for instance, a single outcome measure. Yet there are other improvements that could gain us additional power. One of those changes would be to use fewer treatment groups and focus on one partisan media source instead. This would, of course, limit the potential conclusions that could be drawn about multiple types of partisan media. Another potential improvement to the design would be to use informative covariates, such as pre-existing media preferences (de Benedictis-Kessner et al., 2019) as controls in our experiments. Covariates such as these would allow us to model the heterogeneity in treatment effects and variation in outcomes that limit our statistical power, and thereby improve our ability to detect accumulation.

Conclusion

Increasing consumer choice has to led to concerns that viewers self-sort into ideologically consonant partisan news programs. If such partisan media is able to exercise a large persuasive effect over its viewers that accumulates over time and is durable, it may play a significant role in exacerbating political polarization. This may be coupled with increasing self-selection into silos of in-party news sources that limit the degree to which partisans trust news from the other side of the partisan aisle due to increasing hostility towards out-party news outlets (e.g. Peterson and Kagalwala, 2021). However, examination of the temporal dynamics in the

[15]Note, estimates of the MSS with confidence intervals are presented in Table A2 in Section B of the Supplementary Information.

persuasive effect of partisan media requires research designs that deviate from the typical single shot experiments used by political scientists.

In this paper, we presented the results of three experiments focused on exploring the accumulation and persistence of persuasive effects. All three experiments included multiple waves, allowing us to examine the persistence of persuasive effects. Across these experiments, we found evidence of persistent effects that varied by source and outcome: in Experiment 1, our Fox News treatment showed significant persistence across waves, while in Experiments 2 and 3, our MSNBC treatment showed persistent effects for certain outcomes. We also found suggestive evidence of persistence for other outcomes. Together, these results indicate that even a fleeting exposure to partisan media can result in durable opinion changes. It remains unclear, however, exactly which types of media may have effects that are most persistent.

This finding suggests that large effects of partisan media on political attitudes and politics more generally are plausible. For example, chance exposure to a partisan news segment or clip a week before an election could lead to a significant change in policy preferences that extends through the time of the election. Any study of the electoral effects of media exposure should therefore seek to investigate not only the immediate time period before an election, but also a longer time period preceding it. Our findings also suggest that the effect of partisan media on infrequent viewers may also be meaningful. While only hardened partisans are likely to regularly consume partisan media, a much larger, less polarized audience may be briefly exposed to partisan media within a week of voting or answering a survey. Given that effects among this subgroup of people also do not completely decay, such exposure may have persistent effects that could affect an election.

In contrast to our findings about the persistence of the persuasive effects of partisan media, we find that the accumulation of persuasive effects from multiple doses of partisan media is effectively unknowable in an experimental framework. Indeed, we present power calculations suggesting that, based on our results from Experiment 1, an experiment adequately powered to detect this accumulation would need tens of thousands of respondents —

outside the realm of the financial feasibility for most social scientists and the logistical possibility of most survey panels (e.g. Stewart et al., 2015). Consequently, we conclude that our results approach the limit of what can be learned from such multiwave experiments within the resource constraints that most researchers face without introducing strong modeling assumptions about the accumulation of these persuasive effects.

Together, these findings affirm the importance of examining the temporal dynamics of partisan media persuasion to understand its effects on politics more broadly. Time-limited experiments have shed little light on whether partisan media's effects decay and have only temporary effects of politics. Our results point to an opposite conclusion for politics: the effects of partisan media may have longer-term impacts due to persistent effects from even a single exposure.

References

Allen, Jennifer, Baird Howland, Markus Mobius, David Rothschild and Duncan J Watts. 2020. "Evaluating the Fake News Problem at the Scale of the Information Ecosystem." *Science Advances* 6(14):eaay3539.

Ansolabehere, Stephen, Jonathan Rodden and James M Snyder Jr. 2008. "The Strength of Issues: Using Multiple Measures to Gauge Preference Stability, Ideological Constraint, and Issue Voting." *American Political Science Review* 102(2):215–232.

Arceneaux, Kevin, Martin Johnson and Chad Murphy. 2012. "Polarized Political Communication, Oppositional Media Hostility, and Selective Exposure." *Journal of Politics* 74(1):174–186.

Ash, Elliott, Sergio Galletta, Matteo Pinna and Christopher Warshaw. 2021. "The Effect of Fox News Channel on U.S. Elections: 2000-2020." Available online: `https://dx.doi.org/10.2139/ssrn.3837457`.

Baden, Christian and Sophie Lecheler. 2012. "Fleeting, Fading, or Far-Reaching? A Knowledge-Based Model of the Persistence of Framing Effects." *Communication Theory* 22(4):359–382.

Broockman, David E and Joshua L Kalla. 2024. "Selective Exposure and Echo Chambers in Partisan Television Consumption: Evidence from Linked Viewership, Administrative, and Survey Data." *American Journal of Political Science* .

Broockman, David E and Joshua L Kalla. 2025. "Consuming Cross-Cutting Media Causes Learning and Moderates Attitudes: A Field Experiment with Fox News Viewers." *The Journal of Politics* 87(1).

Capon, Noel and James Hulbert. 1973. "The Sleeper Effect—an Awakening." *Public Opinion Quarterly* 37(3):333–358.

Carey, John M, Andrew M Guess, Peter J Loewen, Eric Merkley, Brendan Nyhan, Joseph B Phillips and Jason Reifler. 2022. "The Ephemeral Effects of Fact-Checks on COVID-19 Misperceptions in the United States, Great Britain and Canada." *Nature Human Behaviour* 6(2):236–243.

Chong, Dennis and James N Druckman. 2010. "Dynamic Public Opinion: Communication Effects over Time." *American Political Science Review* 104(4):663–680.

Coppock, Alexander. 2022. *Persuasion in Parallel: How Information Changes Minds about Politics*. Chicago: University of Chicago Press.

Coppock, Alexander, Emily Ekins, David Kirby et al. 2018. "The Long-Lasting Effects of Newspaper Op-Eds on Public Opinion." *Quarterly Journal of Political Science* 13(1):59–87.

de Benedictis-Kessner, Justin, Matthew A. Baum, Adam J. Berinsky and Teppei Yamamoto. 2019. "Persuading the Enemy: Estimating the Persuasive Effects of Partisan Media with the Preference-Incorporating Choice and Assignment Design." *American Political Science Review* 113(4):902–916.

Dowling, Conor M, Michael Henderson and Michael G Miller. 2019. "Knowledge Persists, Opinions Drift: Learning and Opinion Change in a Three-Wave Panel Experiment." *American Politics Research* (forthcoming).

Druckman, James N and Thomas J Leeper. 2012. "Learning More from Political Communication Experiments: Pretreatment and Its Effects." *American Journal of Political Science* 56(4):875–896.

Gaines, Brian J., James H. Kuklinski and Paul J. Quirk. 2007. "The Logic of the Survey Experiment Reexamined." *Political Analysis* 15:1–20.

Gillig, Paulette M and Anthony G Greenwald. 1974. "Is it Time to Lay the Sleeper Effect to Rest?" *Journal of Personality and Social Psychology* 29(1):132.

Guess, Andrew M. 2021. "(Almost) Everything in Moderation: New Evidence on Americans' Online Media Diets." *American Journal of Political Science* 65(4):1007–1022.

Guess, Andrew M., Pablo Barberá, Simon Munzert and JungHwan Yang. 2021. "The Consequences of Online Partisan Media." *Proceedings of the National Academy of Sciences* 118(14).

Hill, Seth J, James Lo, Lynn Vavreck and John Zaller. 2013. "How Quickly We Forget: The Duration of Persuasion Effects from Mass Communication." *Political Communication* 30(4):521–547.

Hopkins, Daniel J and Jonathan M Ladd. 2014. "The Consequences of Broader Media Choice: Evidence from the Expansion of Fox News." *Quarterly Journal of Political Science* 9(1):115–135.

Hovland, Carl I, Arthur A Lumsdaine and Fred D Sheffield. 1949. *Experiments on Mass Communication*. Princeton, NJ: Princeton University Press.

Hovland, Carl I and Walter Weiss. 1951. "The Influence of Source Credibility on Communication Effectiveness." *Public Opinion Quarterly* 15(4):635–650.

Huber, Gregory A and Kevin Arceneaux. 2007. "Identifying the Persuasive Effects of Presidential Advertising." *American Journal of Political Science* 51(4):957–977.

Jensen, Jakob D, Jennifer K Bernat, Kari M Wilson and Julie Goonewardene. 2011. "The Delay Hypothesis: The Manifestation of Media Effects over Time." *Human Communication Research* 37(4):509–528.

Kalmoe, Nathan P, Raymond J Pingree, Brian Watson, Mingxiao Sui, Joshua Darr and Kathleen Searles. 2019. "Crime News Effects and Democratic Accountability: Experi-

mental Evidence From Repeated Exposure in a Multiweek Online Panel." *International Journal of Public Opinion Research* 31(3):506–527.

Knox, Dean, Teppei Yamamoto, Matthew A Baum and Adam J Berinsky. 2019. "Design, Identification, and Sensitivity Analysis for Patient Preference Trials." *Journal of the American Statistical Association* 114(528):1532–1546.

Larsen, Martin Vinæs and Asmus Leth Olsen. 2020. "Reducing Bias in Citizens' Perception of Crime Rates: Evidence from a Field Experiment on Burglary Prevalence." *The Journal of Politics* 82(2):747–752.

Lecheler, Sophie and Claes H de Vreese. 2013. "What a Difference a Day Makes? The Effects of Repetitive and Competitive News Framing over Time." *Communication Research* 40(2):147–175.

Leeper, Thomas J and Rune Slothuus. 2014. "Political parties, Motivated Reasoning, and Public Opinion Formation." *Political Psychology* 35:129–156.

Levendusky, Matthew. 2013*a*. *How Partisan Media Polarize America*. Chicago: University of Chicago Press.

Levendusky, Matthew S. 2013*b*. "Why Do Partisan Media Polarize Viewers?" *American Journal of Political Science* 57(3):611–623.

Levy, Ro'ee. 2021. "Social Media, News Consumption, and Polarization: Evidence from a Field Experiment." *American Economic Review* 111(3):831–70.

Martin, Gregory J and Ali Yurukoglu. 2017. "Bias in Cable News: Persuasion and Polarization." *American Economic Review* 107(9):2565–99.

Nisbett, Richard E and Lee Ross. 1980. *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, NJ: Prentice-Hall.

Nyhan, Brendan, Ethan Porter and Thomas J Wood. 2022. "Time and Skeptical Opinion Content Erode the Effects of Science Coverage on Climate Beliefs and Attitudes." *Proceedings of the National Academy of Sciences* 119(26):e2122069119.

Pariser, Eli. 2012. *Filter Bubble: Wie wir im Internet entmündigt werden*. Munich: Hanser.

Peterson, Erik and Ali Kagalwala. 2021. "When Unfamiliarity Breeds Contempt: How Partisan Selective Exposure Sustains Oppositional Media Hostility." *American Political Science Review* 115(2):585–598.

Prior, Markus. 2013. "Media and Political Polarization." *Annual Review of Political Science* 16:101–127.

Slater, Michael D. 2004. "Operationalizing and Analyzing Exposure: The Foundation of Media Effects Research." *Journalism & Mass Communication Quarterly* 81(1):168–183.

Stewart, Neil, Christoph Ungemach, Adam JL Harris, Daniel M Bartels, Ben R Newell, Gabriele Paolacci and Jesse Chandler. 2015. "The Average Laboratory Samples a Population of 7,300 Amazon Mechanical Turk Workers." *Judgment and Decision Making* 10(5):479–491.

Sunstein, Cass R. 2001. *Republic.com*. Princeton University Press.

Tufekci, Zeynep. 2018. "YouTube, the Great Radicalizer." *The New York Times* .

Wittenberg, Chloe, Ben M Tappin, Adam J Berinsky and David G Rand. 2021. "The (minimal) persuasive advantage of political video over text." *Proceedings of the National Academy of Sciences* 118(47):e2114388118.

Wittenberg, Chloe, Matthew A Baum, Adam J Berinsky, Justin de Benedictis-Kessner and Teppei Yamamoto. 2023. "Media Measurement Matters: Estimating the Persuasive Effects of Partisan Media with Survey and Behavioral Data." *Journal of Politics* (forthcoming).

Wojcieszak, Magdalena, Ericka Menchen-Trevino, Joao FF Goncalves and Brian Weeks. 2022. "Avenues to News and Diverse News Exposure Online: Comparing Direct Navigation, Social Media, News Aggregators, Search Queries, and Article Hyperlinks." *The International Journal of Press/Politics* 27(4):860–886.

Zaller, John. 1992. *The Nature and Origins of Mass Opinion*. Cambridge University Press.