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Online calls for protest and offline mobilization in autocracies: evidence from the 2017 Dey Protests in Iran

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A body of research suggests that social media has afforded new opportunities for orchestrating mobilization in autocracies. However, the mechanisms linking online coordination with offline mobilization are rarely demonstrated. We address this lacuna by exploring the impact of Farsi-language social media posts that called for protest on precise days and locations in Iran during the 2017 'Dey Protests'. To conduct our analysis, we match a dataset of posts with an original protest event catalogue. Our results show that if a district was the subject of a protest call, it was much more likely to witness higher levels of mobilization on the target date. This relationship was especially pronounced for calls that received more online engagement. The findings suggest that the digital commons can play a role akin to an analogue protest flyer: social media posts can inform broad audiences of the where and when of upcoming mobilization.

Introduction

There is a growing consensus that increased digital connectivity has afforded new opportunities for street-level protest in autocracies, where traditional social movement organizations are largely absent due to repression. But if it is uncontroversial to state that the internet and social media matter for the possibilities of mobilization in such settings, the precise ways in which online action translates into offline contentious politics are rarely specified, let alone empirically demonstrated. Scrutinizing recent episodes of street protest against authoritarian regimes, it is oftentimes unclear whether the unfolding of offline protest is coincidental to the availability of online information about opposition to a regime—or whether protesters are directly taking their cues from content posted to social media sites and related platforms. A literature on 'slacktivism' suggests that online actions may even serve to demobilize street-level protest (see, e.g., Van Laer and Van Aelst, 2010; Hassanpour, 2014).

In what follows, we look to isolate one way in which online activism over social media can powerfully pattern protest: by providing coordination information on the timings and locations of street protests. In the context of a protest uprising, we argue that digital media can function to mobilize contentious action by providing logistical information on the key coordinates of future mobilization (Little, 2016; Enikolopov, Makarin, and Petrova, 2020; Hassan, 2024). In this, we suggest that the digital commons can play a role akin to an analogue protest flyer: social media posts can inform broad audiences of the where and when of upcoming mobilization. In expanding on the role of such online coordination information in autocracies, we add to the collective action literature, which examines how activists solve coordination problems in low information settings characterized by political disorganization (Pfaff and Yang, 2001; Truex, 2019; Ketchley and Barrie, 2020; Pearlman, 2021).

To illustrate the potential importance of online coordination information to offline mobilization in autocracies, we study the 'Dey Protests' in Iran, when anti-regime protesters took to the streets in a wave of small-to-medium-sized protests in what was, to that

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date, the most geographically widespread episode of mobilization since the 1979 Revolution (Fathollah-Nejad, 2020). For our purposes, this episode of mass mobilization provides us with an ideal test case for our argument. Within hours of protest breaking out in late 2017, Iranian opposition social media accounts began to publicize calls to protest at precise dates and locations in towns and cities across the country. To isolate the incidence of protest calls, as well as levels of engagement by social media users, we draw on a novel dataset of Farsi-language social media content posted to Instagram, one of the most popular social media sites in Iran at the time. We match these data with an original protest event catalogue, compiled by manually triangulating across thousands of protest videos and other open source news media. Fixed-effects models allow us to confine attention to variation in the incidence of protest in a given locality as a function of calls for protest posted online. As our results show, there is a substantively important and statistically robust relationship between online calls for protest on a given district day and subsequent protest in that location—and this is after accounting for a range of time-varying confounders. Sensitivity tests indicate that it is very unlikely that this relationship is vulnerable to an omitted variable. Additional analysis with spatial panel models rules out unobserved, time-varying spatial confounding as a threat to inference. Finally, we use the Lasso to disentangle the importance of an online protest call from online engagement with that call. The results show that, when viewed across several thousand district days, issuing an online call for protest is a key predictor of street-level mobilization in that locale on that date.

Our contribution to the literature on protest and the internet is both substantive and methodological. First, we demonstrate the importance of online logistical information to the incidence of street-level contention in a repressive autocracy. As our results show, such coordination information dictating the where and when of planned protest can meaningfully pattern offline mobilization in the absence of well-resourced social movements. In this, we demonstrate one pathway through which the digital commons matters for the possibilities of street protest in repressive contexts. Methodologically, we overcome the limitations of much existing research, which relies on ecological measures of internet connectivity in a given location. Here, we demonstrate the potential of digital trace data for testing precise mechanisms underlying the relationship between logistical information and protest—something that has traditionally been hard to evaluate for more analogue mediums due to the difficulties in collecting systematic data on the circulation of, for example, pamphlets, flyers, and radio broadcasts. Moreover, our approach allows us to parse the importance of time-varying calls for street-level protest made online from the time-invariant characteristics of the places that go on to see mobilization.

Information, protest coordination, and protest diffusion

How activists overcome collective action problems is a central puzzle for the study of protest and social movements (Oliver, 1993). In particular, a body of scholarship looks at the importance of coordinating street-level mobilization; that is, the process of communicating information on the 'when, where, and how to protest' (Little, 2016: pp. 153). In this, we must distinguish between what is sometimes referred to as 'political' or 'strategic' coordination and 'logistical' and 'tactical' coordination (Little, 2016; Enikolopov, Makarin and Petrova, 2020). Political coordination builds from the work of Granovetter (1978) and Kuran (1997). It refers to the self-augmenting process by which the observable participation of individuals in a protest cycle can signal a change in the distribution of preferences in a population, thereby impelling the participation of individuals who previously erred on the side of caution. By contrast, logistical coordination refers to the transmission of information, through relational or non-relational channels, on the where, when, or how of protest (Tarrow, 1994). Here, we understand relational channels to refer to local networks of trust and non-relational to refer to print and digital media.

Historically, logistical coordination of this sort could be achieved with analogue print technologies such as the poster, pamphlet, or flyer (Darnton and Roche, 1989; Coglianese, 2001; Rubin, 2014). These materials provided information on the coordinates of street protest (Tarrow, 2013). In this way, they helped solve a coordination problem familiar to the study of collective action (Macy, 1990; Oliver, 1993). In very repressive settings, where it is often impossible to publicly disseminate such materials, protesters might rely on focal point solutions to generate this common knowledge of where and when protest will take place (Pfaff and Kim, 2003; Truex, 2019; Ketchley and Barrie, 2020). Alternatively, a first protest might be advertised in advance, thereby setting in motion an uprising as protest grows through self-fulfilling logics of inspiration and interdependence (Biggs, 2003; Gunning and Baron, 2014; Clarke and Kocak, 2020).

As a resource, print media has historically fostered the 'common knowledge' central to coordination (Thomas *et al.*, 2014). Here, to produce and communicate this information, social movements have relied on printed materials and media broadcasts (McCarthy and Wolfson, 1996). Bennett and Segerberg (2013,

748) argue that the affordances of digital media mean a reduction in 'the resource costs of public outreach and coordination' precisely because of the democratization of access to digital resources. This means that top-down resources in the form of 'bricks and mortar' organizations are no longer as relevant or necessary. Instead, protest can be coordinated by interlinking, horizontal ties between would-be protesters and their supporters. And these ties are responsible for the production of information relating to the organization and coordination of protest (Bennett, Segerberg and Yang, 2018). What is more, research shows that recruitment through social media often results in a more diverse set of participants (Walgrave and Verhulst, 2009). This is especially relevant in authoritarian contexts where the publicly visible opposition often required to bring together a protest coalition risks severe repression. In these contexts, social media functions as a singular informational resource in the arsenal of dissident coalitions (Eltantawy and Wiest, 2011).

Not only do digital media provide activists with the opportunity to coordinate protest, they also provide onlookers with clues as to the likely success of a given protest. Engagement metrics such as 'views' or 'likes' available on platforms like YouTube, Instagram, and Twitter indicate the number of individuals who have meaningfully engaged with information about a given protest. In this, individuals can derive some expectation about the behaviour of fellow citizens and thus the likelihood of success (Klandermans, 1984; Bernburg, 2021).[1] While it is difficult to empirically observe the precise ties between those who engaged with these posts, existing research does suggest that interactions indicating future participation serve information and persuasion functions as well as providing more direct promise of company (Walgrave and Ketelaars, 2019). These data are also of use for the researcher as they enable us to see not only whether a protest was advertised for a given time and place but also whether a broad audience was paying attention. That said, they also have the potential to confound two different mechanisms. As stated above, we are interested principally in logistical rather than political coordination. By focussing on posts that contain not only logistical information but also information on the amount of engagement (a potential proxy for likely participation), these two affordances of online media risk becoming blurred. Because of this, we must also disentangle the logistical function of protest calls from the potential effect of observed engagement on a given post.

Online logistical coordination and offline protest

Despite the potential richness of these data, empirical studies of online logistical coordination have largely relied on only coarse measures of connectivity, online activity, and actual offline protest. A first body of work uses large digital trace data to examine the dynamics of protest and movement mobilization online. This scholarship has provided key insights into core-periphery dynamics, network structure, and online culture in both protest mobilization and recruitment to high-cost behaviour (Gonz´alez-Bail´on *et al.*, 2011; Barber´a *et al.*, 2015; Bail, 2016; Steinert-Threlkeld, 2017; Carlsen, Toubøl, and Ralund, 2021; Hsiao, 2021; Lutscher and Ketchley, 2022). In their focus on digital data alone, however, these contributions are unable to illuminate the connections between online network dynamics and protest in the streets. Larson *et al.* (2019) do investigate this link but, by relying solely on network measures of online connectivity, cannot comment on the mechanisms underlying access to online logistical information and offline protest.

A parallel body of work uses aggregate measures of online connectivity in subnational and cross-national settings to assess the relationship between the internet and the incidence of protest or conflict offline (Warren, 2015; Fergusson and Molina, 2019; Weidmann and Rød, 2019; Enikolopov, Makarin and Petrova, 2020). These contributions advance our understanding of the relationship between online and offline protest by demonstrating that access to the internet does have a positive relationship with actual recorded protest at the street level. They are nonetheless again silent on the actual mechanisms underlying this relationship and rely on ecological inference.

A final body of work aims to uncover the connections between individual online participation and offline protest behaviour. These draw on evidence derived from surveys fielded across a number of different contexts. Common to these contributions is an emphasis on the informational role of social media and its influence on actual or reported participation in offline protest activity. Using general measures of online activity to probe this association, these contributions tend to find a correlation between participation online and offline protest participation (Tufekci and Wilson, 2012; Vissers and Stolle, 2014; Onuch, 2015; Boulianne, Koc-Michalska and Bimber, 2020; Anderson, 2021; Chayinska, Miranda and Gonz´alez, 2021). Others use either measures of network ties or sharing behaviour to study the effects of information access on protest participation, finding that online activity facilitates access to protest-relevant information (Valenzuela, Correa and de Z´u˜niga, 2018; Chen, 2020), and may alter the psychological incentives for protest participation (Hsiao, 2018). The little experimental work that exists also places its emphasis on issue exposure—or social media use more generally—to study the relationship between online media on participating in street protest

(Vissers *et al.*, 2012; Theocharis *et al.*, 2015), and finds that both forms of information are causally related to a heightened propensity to engage in contentious action. In summary, while we now have a substantial body of literature indicating that online connectivity and information access generally lead to heightened levels of protest, the exact informational mechanism driving these findings remains unclear (Freelon, Marwick and Kreiss, 2020). This is important because protest might rely on both political and logistical coordination. While there is a wealth of literature exploring the general informational role of social media, far less research engages exactly how it functions to mobilize protest.[2] What is lacking then is a systematic analysis of online communications that relates the circulation of logistical coordination content with offline protest. In what follows, we look to fill this gap by analysing an ideal test case: a major protest wave in Iran that was characterized by the online circulation of information relating to the where and when of protest.

Dey Protests in Iran

The Islamic Republic of Iran is a hybrid (or electoral authoritarian) regime with a mixture of electoral and non-electoral institutions. The electoral institutions include a presidency and parliament that is vetted by an unelected Guardian Council, as well as non-electoral institutions. These mixed institutions facilitate competition among various regime factions, including hardliners, reformists, and moderates. 'Hardliners' in Iran refers to a political elite in favour of an aggressive anti-imperialist foreign policy and heavily repressive domestic policy. Iran's supreme leader, commanders of the Revolutionary Guards, and members of the Guardian Council are among the most powerful members of the hardliner faction in Iran (Kadivar, 2013; Kadivar and Abedini, 2020). Outside of this narrow political field, independent centres of civilian political organizing, including independent trade unions and anti-regime activists, are often harshly repressed.

Seven months after the victory of Hasan Rouhani—a centrist 'moderate'—in the 2017 presidential elections, a group of hardliners organized a protest rally against his leadership (Fathollah-Nejad, 2020).[3] This event marked an instance of state-sponsored mobilization, a strategy not uncommon under the Islamic Republic (Khani and Kadivar, 2023). The rally, which took place on December 28 in Khorasan province, northeastern Iran, initially targeted high prices and the figure of the president. But as more people joined the crowd, the tone of the slogans radicalized with protestors chanting slogans against the entirety of the regime. Responding to this turn of events, Alamolhoda, the hardline representative of Iran's leader in the city of Mashhad, attempted to subdue the crowd, declaring the next day that: '[P]eople are right about their demands regarding high prices, but such problems should not become tools in the hand of the enemies [of the country]' (Alef, 2017).

Protest continued to escalate in the following days. Several social media accounts posted calls for further street-level mobilization in a number of Iranian cities. The most famous among these accounts was Amadnews, a tabloid oppositional channel with a presence on Instagram and Telegram. These calls would continue throughout the protest period, with the list of cities and locations changing daily. As protests spread, Amadnews's subscriber based increased from three hundred thousand to over one million.[4] In response to a request from the Iranian government, Telegram initially shut down Amadnews on 30 December, but the channel's administrators soon started a new channel while also simultaneously publishing protest materials on Instagram. The next day, 31 December, the Iranian government blocked access to the Telegram app and Instagram altogether. Iranians nonetheless continued to access these services through virtual private networks that allow users to circumvent government censorship.[5]

While many have emphasized the role of Amadnews during the Dey Protests, it was not the only digital account that issued calls for protest. As we detail below, accounts publishing protest-related information included monarchists—those opposed to the 1979 Revolution and in favour of the restoration of the Pahlavi monarchy—as well as numerous groups representing Iran's ethnic and religious minorities. Over the following days, protests would break out across districts (shahrestan) across the country. These protests advanced demands that broke entirely with the accepted bounds of political contention as participants chanted anti-systemic slogans in favour of the monarchy and against Supreme Leader Ali Khamenei'i.

A distinguishing feature of the information shared online was the sheer number of protest calls included in anti-regime posts. These came in the form of digital flyers and comprised easily shareable images emblazoned with text detailing the future dates and locations of planned protests, and were tagged with one or several protest-related hashtags. Figure 1 provides a sample of some of these images. These digital flyers constituted a type of information targeting logistical coordination. In this, the Iran Dey Protests provide us with an ideal case for an empirical test of the coordinating role of online information. It is ideal because it constitutes what Seawright and John (2008) call a 'low residual case'; that is, typical of the phenomenon of interest.

We would have also liked to study the reaction of users to protest calls. While we lack systematic evidence

for this, the case details underscore the importance of these protest calls. First, the government took action against Amadnews, the prominent social media channel responsible for disseminating protest calls. This saw government agents hacking into channel and subsequently imposing blocks on Instagram and Telegram across the country. So important were these calls that Ruhollah Zam, the main administrator of Amadnews, was abducted from Iraq and later executed for his role in using online platforms to orchestrate protest. Moreover, as the protests unfolded, Iranian officials themselves issued statements emphasizing the internet's pivotal role in stimulating protest. The Minister of Interior acknowledged online calls for protests, denouncing them as illegal and urging Iranians not to participate (BBC, 2017). Various regime officials, including a member of parliament, the Tehran prosecutor, and a senior figure in the judiciary, confirmed that detainees had taken to the streets in response to online protest calls (Aftabnews, 2018; EtemadOnline, 2018; Jonoubnews, 2018). Taken together, this qualitative information all suggests that opposition social media channels played a crucial role in disseminating information about the timing and locations of the protests.

Data and method

Despite its importance to understandings of protest dynamics, it has historically been difficult to gather systematic data on the circulation of information relating to logistical coordination.[6] The affordances of digital media mean we can now overcome this. Detailed protest-related information now circulates as online digital traces across platforms that are 'always on' (Salganik, 2017; Barrie and Frey, 2021). This means that, unlike the protest poster that is torn down by the authorities or the flyer that is discarded by a pedestrian, we can now collect data on protest coordination systematically and at scale.

To identify calls for protest, we focus on Instagram as a key channel for the dissemination of protest information. At the time of the protests, opposition groups maintained accounts on both Instagram and Telegram, simultaneously uploading content to both. As previously noted, the most important of these was run by Amadnews, Iran's leading independent news site. Telegram and Instagram were the two most popular social media platforms in Iran at the time, with around 50 per cent of Iranians using Telegram and 30 per cent having an Instagram account (Parsa, 2019). Ideally, we would use data from both Instagram and Telegram—the two largest social media platforms in Iran by user base. Given the shutdown of Telegram, however, and its subsequent blocking by the Iranian government, we are forced to rely solely on Instagram.[7] This does not threaten the reliability of our data since high profile accounts like Amadnews used parallel accounts on both platforms to increase their visibility. And as described below, the majority of information originated from a small number of accounts with high exposure, with their protest calls then being recycled and reposted by regular users. Instagram therefore represents a reliable digital archive of online protest-related information during this episode.

Given that the Instagram API does not provide any filter stream comparable to the now defunct Twitter API end point, we used the micro-blogging platform Twitter as an initial source to seed our main data collection. To do so, we used the twint Python package (Zacharias, 2020), collecting at midnight (EST) all Persian posts for each day of the protest period.[8] With these data, we were able to compile an initial list of relevant hashtags (for more on this strategy, see, e.g., Lutscher and Ketchley, 2022). With reference to the Amadnews data, we then identified a further 12 protest hashtags (see Supplementary Table A.1 for the list of hashtags).[9] We then proceeded to collect posts from Instagram by searching for posts containing any of the relevant hashtags. To do so, we scraped posts programmatically using a Selenium headless browser (Muthukadan, 2011).[10] This resulted in 41,183 unique Instagram posts—21,642 photos and 17,558 videos. Supplementary Table A.2 provides descriptive statistics on the data. We see that just 303 unique users contributed photos containing protest calls. The top 5 per cent of these accounts contributed over 70 per cent of the total number of followers, demonstrating their importance for the dissemination of information. Finally, we manually coded image posts containing a call for protest like those displayed in Figure 1. We use these posts as the basis for our key independent variables, which we go on to describe below.

Consistent with our descriptive understanding of the constituencies who participated in the Dey Protests, our manual coding of these users demonstrate that they represent the margin of the political domain—43 per cent of the accounts have monarchist tendencies, with another 21 per cent displaying other anti-regime politics (see Supplementary Table A.3).[11] There are also some pages promoting the rights of religious and ethnic minorities, such as Sunnis, Christians, Kurds, and the Balouch.

Dependent variable

To explore the association between online calls for protest and offline activism during the Dey Protests, we construct a dataset where our unit of analysis is the district day. Our analysis period runs from the 28 December 2017 to 6 January 2018. Our dependent variable measures protest participation in a given

Figure 1 Example digital protest flyers. See Supplementary Appendix for image descriptions.

district day, which we construct by triangulating across Instagram videos and conventional news sources.[12] This is transformed to the inverse hyperbolic sine.[13] To construct this measure this, we followed a three-step process. First, we identified 17,558 protest-related videos from our Instagram data for the period 25 December 2017–6 January 2018. We then filtered the location of these videos by the place name mentioned in video captions. Many of these posts were the same video with an identical caption. We manually reviewed all the video posts with unique captions. For each protest, we aimed to find at least two unique videos. For protests with only one unique video, we verified its occurrence by searching for reported protests in conventional news media for a given location and date. In total, we found 318 unique videos of protests. Overall, our data suggests that there were 216 protest days occurring in 96 districts.

We estimated the size of each protest using the size of the crowd visible in each video. To do so, coders independently counted how many people were visible along the width and length off the frame and then multiplied these figures to arrive at an estimate. For videos in which people were moving, we counted how many individuals were entering the image during the video and used the same formula for estimation.[14] It was often difficult to distinguish whether a video captured the same or a different protest, and so we summed our estimates and then averaged across the number of videos for a given district day.[15] To verify our outcome measure, we then had a third coder independently code all of our protest videos. That coding produced a measure that is very highly correlated with our outcome variable when observed across district days (Pearson's $r = 0.95$). Of course, our estimates of crowd size contain error, and so the dependent variable is most accurately thought of as capturing the relative change in protest crowd sizes, rather than as an exact count of protestors. In supplementary analyses, we also test a binary outcome measure for whether any protest occurred on a given district day.

Independent variables

Our main independent variable of interest is a binary measure for whether any Instagram posts called for protest on a given district day. This variable is directly equivalent to an analogue protest flyer in communicating the where and when of mobilization. As an additional measure, we also count the number of likes on an Instagram post calling for protest, transformed to the inverse hyperbolic sine. This provides a measure of engagement with online protest calls.[16] Note that these two variables are naturally very highly correlated (Pearson's $r = 0.95$) and so we begin by modelling each separately.[17] If online calls for street-level protest patterned the sites and timings of offline mobilization, one or both of these variables should be positive. In a supplementary analysis, we model both of these variables together using the Lasso.

Time-varying controls

In a bid to demobilize the Dey Protests, the Iranian government blocked a number of websites to stop social media platforms from spreading calls for protest. To account for this, we enter a dummy variable for the period 30 December to 6 January, when Iranians would have had to use a VPN to access social media sites propagating calls for offline mobilization. We also account for four fundamental, time-varying confounders arising from the endogenous and processual nature of the mobilization itself. As noted above, the circulation of information about protests can serve as a coordination mechanism in its own right. Here, individuals could watch videos of recent protests in nearby districts or view recent calls to protest in nearby districts. To account for these dynamics, we use an exponential weights matrix to calculate spatially weighted measures that give greater weight to happenings in proximate districts. The first measures the number of videos of protests in nearby districts the previous day. The second captures the number of likes on Instagram posts calling for protests in nearby districts at $t - 1$. An alternative mechanism sees individuals taking inspiration from the actions of visible protest crowds (Andrews and Biggs, 2006; Barrie and Ketchley, 2018). To capture this, we calculate a spatially weighted measure of protest participation in nearby districts, lagged by one day. Finally, to account for the recursive effects of recent protest in a given locale, in which protest breeds protests, we include the number of protestors in a district on the previous day. All of these variables are transformed to the inverse hyperbolic sine to reduce the impact of heavy tails. Note that our data suggest that all protests during this period were repressed by state forces, and so our protest measures are capturing both visible mobilization and repression.

Estimation strategy

We model the incidence of protest during this period using linear regression:

$$arsinh\,(y_{it}) = \delta IG_{it} + arsinh(y_{it-1}) + \mathbf{W}X_{kit-1} + M_t + \alpha_i + \epsilon_{it} \quad (1)$$

where y_{it} is the number of protestors in district i at time t transformed to the inverse hyperbolic sine, IG_{it} is a binary measure for whether an Instagram post called for protest in a district on a given day, y_{it-1} is a transformed measure of protest size in a district the previous day, X_{kit-1} is a vector of spatially lagged controls capturing protest and online engagement in proximate districts the previous day, estimated using $\mathbf{W}$ exponential weights matrix, M_t is a time-varying dummy variable measuring government censorship of the internet, and ϵ is the error term. To account for unobserved differences between districts influencing the incidence of protest participation, a fixed intercept, α_i, is included in the regression, which absorbs the unique characteristics of each district. This alters our interpretation of the estimand to the scale of protest within a district over time (Mummolo and Peterson, 2018). The coefficient of interest throughout the analysis is δ, the association between an online call for protest and offline mobilization in that district on the specified date. In supplementary analyses, we replace this variable with a measure of likes on Instagram posts calling for protest. To account for the panel nature of our data, we cluster our standard errors on the district.

Results

Table 1 displays the results. Per Lenz and Sahn (2021), Model 1 begins with the bi-variate association between a post on Instagram calling for protest on a given district day and subsequent protest participation in that district. Models 2–3 add controls and test both district and date fixed effects. Models 4–6 follow the same structure but test our measure of likes on an Instagram post calling for protest.

Reviewing the results from Models 1–3, we see that posting an online call for protest with logistical information on the date and location of that protest is a substantive and significant predictor of subsequent protest participation in the target district day. Per Model 1, district days that were the subject of an online call for protest saw on average larger protest crowds, compared to district days that were not the subject of online calls to protest ($P < 0.001$). In Model 2, after adjusting for relevant time-varying confounders, we see that an online protest call is associated with increased protest crowd sizes in a district on the target date, all else being equal.[18] Note that in Models 1 and 2, we include a district fixed intercept which confines

Table 1 How social media posts calling for protest in a given district day predict subsequent protest participation

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Instagram post calls for protest in a district	1.149*** (0.086)	0.815*** (0.061)	0.853*** (0.077)			
Likes on Instagram posts calling for protest in a district (arsinh)				0.151*** (0.011)	0.106*** (0.008)	0.115*** (0.011)
Protest in a district (arsinh, $t-1$)		0.310*** (0.037)	0.203*** (0.036)		0.297*** (0.036)	0.188*** (0.036)
Protest participation in nearby districts (arsinh, $t-1$)		−0.063 (0.047)	−0.045 (0.048)		−0.063 (0.048)	−0.047 (0.050)
Videos of protests in nearby districts (arsinh, $t-1$)		0.336* (0.166)	0.226 (0.184)		0.335 (0.171)	0.230 (0.190)
Likes on Instagram posts calling for protest in nearby districts		−0.004 (0.007)	−0.002 (0.008)		−0.004 (0.007)	−0.001 (0.007)
Government blocks websites		−0.139*** (0.030)	Omitted		−0.113*** (0.030)	Omitted
District fixed intercept	✓	✓		✓	✓	
Date fixed intercept			✓			✓
District day	4,290	4,290	4,290	4,290	4,290	4,290

Cluster robust standard errors in parentheses.
P-values (two-tailed); $*P < 0.05$, $**P < 0.01$, $***P < 0.001$.

attention to variation *within a district over time*. Model 3 tests a date fixed effect, confining attention to variation in the incidence of participation in the Dey Protests across districts *on the same day*.[19] Here, inclusion of a date intercept naturally omits our variable capturing days when the Iranin government blocked the internet as it does not vary cross-sectionally. The results are substantively unchanged.

We can also examine how online engagement with a protest call is associated with subsequent protest participation. Note that this measure is capturing both the visibility of online calls for protest and visible online engagement with that call, which could also inspire action in its own right. Note also that some portion of the likes on Instagram posts may also be post-treatment. These caveats aside, we find that district days targeted by protest calls that received more likes on Instagram went on to host larger protests (Supplementary Figure A.2 shows the predicted marginal change from Model 5).

Alternative specifications and robustness

Our measure of crowd size is undoubtedly measured with error. As an alternative, Supplementary Table A.4 tests a binary dependent variable for whether a district saw any protest on a given day. Here, we estimate a series of linear probability models with either panel or date fixed effects and include all covariates included in equation 1. All else being equal, online calls for protest in a district day are positively, substantively, and significantly associated with protest occurring on that district day.

Are our models too sparse? District fixed-effects account for heterogeneity between different locations—but there could be some other unobserved, within district, time-varying factor patterning the incidence of mobilization that is also correlated with why some districts were the subject of protest calls. To gauge the sensitivity of our findings to such an omitted variable or variables, we follow the procedure set out in Cinelli, Ferwerda and Hazlett (2020) and benchmark the importance of our two different measures of online coordination against the observed importance of all of the control variables included in equation 1. Supplementary Figure A.3 shows the sensitivity of the t-statistics from Models 2 and 5. The results suggest that any omitted variables would have to be greater than three times more important than the sum of all of the controls included in our models to render our results statistically insignificant at $P < 0.05$.

Another concern relates to time-varying, unobserved spatial confounding affecting the incidence of mobilization. To rule out spillover effects and spatial autocorrelation, Supplementary Table A.5 shows the results of spatially autoregressive panel models with spatially lagged dependent variables and spatially lagged error terms, calculated using an inverse distance weights matrix. Reassuringly, the results for our theoretically

relevant variables are statistically and substantively identical to those reported in Table 1. We also get statistically and substantively identical results when using either propensity score matching or entropy balancing.

A final concern that we raised discussed earlier relates to parsing the importance of an online protest call from online engagement with that call. This is important as a secondary consequence of visible likes on a protest call may be to inspire forms of mobilization. As already noted, our binary measure for whether a protest call was issued for a district day is very highly correlated with the amount of engagement that call received. To address this, we use the Lasso, which mitigates variance inflation arising from multicollinearity by penalizing coefficients and then algorithmically selecting relevant covariates. The results are in Supplementary Table A.6. Reassuringly, while the model selects likes as a relevant covariate, our binary measure for an online protest call remains a statistically significant and substantively important predictor of mobilization. This result underlines the importance of online coordination information for predicting the timing and location of subsequent street-level protest net of the engagement with that information.

Discussion and conclusion

Recent years have seen the emergence of a sizeable literature on new media and their connection to protest. With few exceptions, this literature does not distinguish between different types of information sharing afforded by new communication technologies. In this article, our focus has been on the logistical coordination role of online information. Our empirical test of this mechanism demonstrates that online information targeted at logistical coordination has a robust positive association with the size of subsequent protest.

The importance of our contribution rests, first, on its unpacking of online information sharing to focus on one mechanism of theoretical interest: the possibilities of online logistical coordination autocracies. In this, we provide evidence for a key mechanism connecting online media to offline protest. The Iranian case provides an ideal context for this empirical test. The wave of protest that unfolded from December 2017 onward was characterized by the sharing of digital flyers aimed specifically at the coordination of protest offline. Second, we illustrate a technique for triangulating across multiple media sources to capture information on both protest, logistical coordination, and online engagement. Through this pairing of large digital trace data with careful manual coding, we are able to construct a rigorous test of the connection between online coordination and offline protest.

Our findings also illuminate the role of logistical coordination within protest more generally. While our data derive from online platforms, we argue that the results are relevant to how we understand the role of logistical coordination in the outbreak of protest generally. Previously, systematic data on the circulation of flyers, posters, and other broadcasts would have been unrecoverable. Now, the digital traces left by online media and user engagement mean we are able to reconstruct these dynamics. In this way, we see how exploiting and carefully unpacking new sources of data may illuminate questions in the social movements literature that have traditionally been difficult to answer.

Our contribution has acknowledged limitations. The data we use are observational and, given the ubiquity of digital media, does not permit any as-if random variation attributable to, for example, differences in connectivity (Pierskalla and Hollenbach, 2013; Yanagizawa-Drott, 2014). Nonetheless, our fixed-effects setup does allow us to estimate the size and direction of any within-unit association between online information and protest. Sensitivity tests also suggest that omitted variable bias is unlikely to be a threat to inference. What is more, our fine-grained attention to the location, size, and contents of digital information means that we mitigate many of the concerns that normally attend the use of aggregate event and connectivity data.

Finally, our article provides fertile ground for future research. Several questions emerge from our findings. Given our focus on one repressive regime, this naturally raises the question of whether digital media play a similar role in more open polities. In democratic contexts, coordination materials may also be shared online, but a liberal media environment may mean that protestors can also rely on traditional media—and have no need to subvert censors. Second, our analysis period is relatively short. Previous research demonstrates that online media may play an outsized coordinating role at the onset of protest (Clarke and Kocak, 2020) and, more generally, that protest exhibits cyclical trends (Tarrow, 1994). The question of whether digital coordination generates offline forms of organization and coordination over a longer protest cycles provides another important avenue for future investigation.

Notes

1. Though see Barbera and Jackson (2020) on why these signals are likely weak. What does distinguish these clues from those encoded in the observed participation of others is that they can be viewed in advance of the protest taking place.
2. While some scholarship does infer a coordination role for online media (Bursztyn *et al*., 2019; Manacorda and Tesei, 2020) using evidence from associations between aggregate

connectivity and recorded protest and violence, no work to date has systematically disaggregated the actual contents of digital material shared online to explore the link between online coordination and offline mobilization.

3. Here, by moderate, we mean relative to the broader political field in Iran.
4. This aligns with the insight of Wolfsfeld, Segev and Sheafer (2013) that social media use tends to increase in response to protest rather than precede it.
5. Supplementary Figure A.1 shows the Google Trends data for people in Iran searching for a VPN during our analysis period. The large uptick in search interest after 31 December is a clear indication that Iranians were continuing to access blocked materials.
6. We do have a reasonable body of evidence pointing to the role of different media in the spread of ideas that underpinned major episodes of social upheaval such as the Reformation and French Revolution (Bailyn, 1992; Crabtree, Kern and Pfaff, 2018).
7. Note that Telegram channels were subsequently reinstated. However, posts and information relating to protests from before the period of the shutdown were deleted, and so are unrecoverable.
8. At the time of collection, Twitter had yet to release their Academic Research Product Track, which would have permitted access to the full historical archive. Connecting to the streaming endpoint nonetheless has advantages as it reduces the amount of missing data attributable to subsequent post deletion.
9. We searched for hashtags that Amadnews had used in its posts related to protests in this period. We specifically focussed on Amadnews because this channel was identified both by the government and the media as the most important digital media channel in this episode of protest.
10. We were forced to scrape these data because the Instagram API endpoints do not permit data collection of this sort. Data collection was conducted in the aftermath of the protest episode.
11. We classified the Instagram pages based on their about section and their content. If they had content in support of the monarchy, for example, we coded them as monarchist; if they contained content denouncing the Islamic Republic and clerical rule, we coded them as anti-Islamic. The relatively small number of unique accounts meant we could verify the outlook of each account manually.
12. Per Biggs (2018), we look to explain participation as it is more theoretically related to collective action than event frequency.
13. We use an inverse hyperbolic sine transformation due to its ability to assign a value to zero. Alternative transformations, for example, the started log, produce substantively and statistically similar results.
14. Following Francisco (2000), if the estimated figure was in the tens, we coded as '31;' if hundreds, '301;' if thousands '3001.'
15. We get substantively identical results taking the sum without averaging.
16. In order for this variable to be valid, we need to be confident that it accurately measures engagement prior to an event occurring. To ensure this, we only included posts containing protest calls advertising protests happening the next day (i.e., they were not posts circulating information on protests that had already taken place). Nonetheless we will inevitably capture some level of engagement after the event has taken place. Note, however, that empirical tests of the temporal evolution of engagement on social media posts suggest that the number of engagements after thirty minutes or an hour are very highly correlated with total engagement (Vassio *et al*., 2021, 2022). This provides confidence that these post-protest measures accurately proxy pre-protest engagement.
17. When modelled together, the variance inflation factor score for likes on Instagram posts calling for protest is 10, indicating very high multicollinearity.
18. It is not straightforward to interpret coefficients in units of an inverse hyperbolic sine. Transforming the dependent variable back to its original scale suggests that district days that were the subject of a protest call saw an additional 31 protestors ($P < 0.001$), all else being equal. This is equivalent to the modal protest. Interpreting the elasticity from a started log transformation puts this as equivalent to a 71 per cent increase in protest, when compared to district days without a protest call ($P < 0.001$).
19. Per Kropko and Kubinec (2020), we do not report two-way fixed effects as these are not statistically identified outside of a 2 × 2 difference-in-differences framework.

Supplementary data

Supplementary data are available at *ESR* online.

Data Availability

Replication files are available from the authors.

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