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Exploring Public Sentiment on Enforced Remote Work During COVID-19

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Due to the coronavirus disease 2019 (COVID-19) pandemic, many employees have been strongly encouraged or mandated to work from home. The present study sought to understand the attitudes and experiences of the general public toward remote work by analyzing Twitter data from March 30 to July 5 of 2020. We web scraped over 1 million tweets using keywords such as "telework," "work from home," "remote work," and so forth, and analyzed the content using natural language processing (NLP) techniques. Sentiment analysis results show generally positive attitudes expressed by remote work-related tweets, with minor dips during the weekend. Topic modeling results uncovered themes among tweets including home office, cybersecurity, mental health, work–life balance, teamwork, and leadership, with minor changes in topics revealed over the 14-week period. Findings point to topics of particular concern regarding working from home and can help guide hypothesis generation for future research.

Keywords: remote work, Twitter, Web scraping, COVID-19

The coronavirus disease 2019 (COVID-19) is a respiratory disease that was declared a public health emergency of international concern on January 30, 2020 by the (World Health Organization, 2020a). By the spring of 2020, as an attempt to stem the spread of COVID-19, many countries had issued orders for residents to social distance, and to stay home in quarantine or lockdown where possible. The number of cases has since grown exponentially, and there were over 79 million cases worldwide by the end of 2020 (World Health Organization, 2020b).

Responses to the pandemic elicited rapid changes in how work is designed, forcing most nonessential workers to adapt to working remotely in some way. In the U.S., for example, many states issued executive orders around the end of March 2020 instructing organizations to take reasonable measures for employees to work from home (The Council of State Governments, 2020). By late May 2020, 65% of the workforce was working remotely at least some of the time (Gallup, 2020). By October, most workers (71%) who reported they could perform their job duties remotely (but rarely did so) were working remotely in some capacity (Parker et al., 2020). Remote work is "a work arrangement in which the employee resides and works at a location beyond the local commuting area of the employing organization's worksite. The arrangement generally includes full-time telework and may result in a change in duty location to the alternative worksite" (U.S. Office of Personnel Management, 2013, p. 18). Other overlapping terms have been used (e.g., telework, telecommuting, distributed work; Allen et al., 2015), but we use "remote work" to refer to the common concept of "working from home."

As a result of government mandates in response to COVID-19, many individuals who were previously unwilling or never offered the opportunity to work remotely were suddenly left with no other choice but to work remotely (Anderson & Kelliher, 2020; Chong et al., 2020). Because of this large-scale societal shift, exploring how people feel about remote work during this time is crucial. Emerging evidence suggests that enforced remote work can have negative consequences (Palumbo, 2020). Enforced remote work differs from traditional remote work in two critical aspects. First, the typical remote worker has some combination of a few days of remote working and a few days of working in the office (Global Workplace Analytics, 2020a). Second, the typical remote worker has likely made the choice considering his/her personal situation and preferences. When the option is available, it is likely that those who choose to take advantage of it are those who benefit from it. In contrast, the current situation is that many nonessential organizations have strongly encouraged or mandated their employees to work from home. Therefore, this group of enforced remote workers may experience unique challenges.

Given the uniqueness and the sheer scale of the impact of the COVID-19 pandemic on the workforce, the present study achieves two goals. First, it is a large-scale effort investigating the currently understudied perceptions of and reactions to remote work. Second, it aims to identify the benefits and challenges associated with remote work. A substantial percentage (25–30%) of the workforce is forecasted to continue to at least partially work remotely post-COVID-19 by the end of 2021 (Global Workplace Analytics, 2020b). Therefore, results of the present study can contribute to the literature on remote work as well as inform organizations of its primary perks and concerns, some of which might shape future human resource management decisions.

The Effects of Remote Work

While statistics on remote work prior to the COVID-19 pandemic likely varied across countries, industries, and job levels, in the U.S., for example, an estimated 43% of employees sometimes worked

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remotely and 3.6% of the workforce worked as much or more often from home than in the office (Global Workplace Analytics, 2020a). Researchers have pointed out the paradox of remote work (e.g., Baruch, 2000; Ruth & Chaudhry, 2008). On the one hand, it can increase flexibility in how and where employees do their work and enhance perceived job autonomy, and thereby improve job-related attitudes and performance (Hill et al., 1996; O'Neill et al., 2009). For example, Gajendran and Harrison (2007) found that remote work, primarily mediated by job autonomy, was associated with higher levels of job satisfaction and performance, but lower levels of role stress and turnover intentions. On the other hand, it could increase the permeability of the work–life boundary, increase work overload and role ambiguity, leading to negative consequences such as exhaustion and poorer relationships with coworkers (Gajendran & Harrison, 2007; Hill et al., 1996; Weinert et al., 2015). Even benefits often associated with remote work may not be universal. Individual differences like openness to experience, social connectedness outside of work, and need for achievement can moderate effects on employees' well-being (Anderson et al., 2015) and performance (O'Neill et al., 2009).

Past research has focused on links between remote work and outcomes, but findings often stem from researchers' speculations about how employees' work experiences might be affected. Subjective perceptions toward remote work have pointed to benefits such as labor time flexibility, less commuting, and autonomy, and barriers such as resistance to change and lack of knowledge in remote work adoption (Pérez et al., 2002, 2003). It is possible that insight from the general public may highlight issues that have been traditionally overlooked.

Conservation of Resources Theory and Workforce Sentiment

Conservation of Resources Theory (COR) provides a framework to explore public sentiment regarding remote work. COR theory posits that individuals are motivated to conserve their current resources, acquire new resources, and prevent loss of resources. Resources are "anything perceived by the individual to help attain his or her goals" (Halbesleben et al., 2014, p. 1338), loosely defined as objects, states, conditions, and so forth, that help individuals self-regulate to achieve goals (Hobfoll, 1989), often including social and organizational support, job autonomy, self-development opportunities, rest and respite, and family-friendly workplace policies (Chen et al., 2009). The value of resources is tied to personal experiences. Resource conservation and cultivation are associated with positive well-being (Gilbert et al., 2018), whereas resource loss is associated with psychological distress, anxiety, and depression (Halbesleben et al., 2014; Kessler et al., 1988). As workers transition to remote work, they may be losing resources not only at work (e.g., lack of coworker support) but also in life (e.g., social isolation, lack of services; Wanberg et al., 2020). Understudied areas of COR theory include identifying the resources workers deem valuable, as well as resource passageways, which refer to environmental conditions that change the rate of resource loss or gain (Halbesleben et al., 2014).

As remote work continues to become more ubiquitous, it will be valuable to study experienced benefits relative to traditional work modes (gains) and the challenges and barriers (losses). A thorough understanding of such experiences can help organizations prepare their members for remote work. Therefore, rather than converging on some specific consequence of remote work, we take a bottom-up approach by sampling discussions about working from home on social media to capture a wide range of opinions and concerns regarding remote work.

Twitter as a Data Source on Capturing Public Sentiment

Twitter is a microblogging social network website in which users can publish their own posts ("tweets") and interact with others, which provides a highly accessible trove of language data. Public attitudes on Twitter have been used to predict stock market fluctuations (Pagolu et al., 2016), elections (Ramteke et al., 2016), and crime rates (Chen et al., 2015). Increasingly, data web scraped from Twitter are used to tackle psychological questions as well (Landers et al., 2016). The access to large amounts of organic data provides a valuable opportunity to study sentiments and attitudes. Organic data are "generated without any explicit research design elements" (Xu et al., 2020, p. 1257) and are characterized as less structured, continuously generated digital data that can be automatically extracted for various research purposes.

Although Twitter users are not a perfect demographic representation of the general population, the coronavirus pandemic has seen more people communicating through digital and social media in record numbers. In fact, the Twitter user base grew by 34% in the second quarter of 2020 to 186 million average daily active users[1] (Twitter, 2020). Their projected daily user activity appears to be growing immensely, while simultaneously more workers are shifting to working from home. This provides a unique opportunity to capture opinions around remote work from the general public, a large proportion of which may be working remotely themselves.

In considering different sampling approaches, organic Twitter data provides better methodological fit with the goals of the present study than alternatives such as surveys. Edmondson and McManus (2007) propose that exploratory analyses using qualitative data provide a better methodological fit with nascent theory and research. While the fundamental concepts related to changes in resources and their implications for well-being have been well-researched and mature, the specific resources associated with remote work and the contextual passageways for strengthening these resources mark the more nascent elements of COR.

Consequently, the organic nature of Twitter data may be especially advantageous for the present study. Experiences with remote work due to COVID-19 likely differ from traditional remote work. Researcher-designed surveys will inevitably be constrained to existing knowledge or speculation, and much nuance could be lost. Twitter provides access to large amounts of open-ended data to explore open-ended questions such as general sentiment and attitudes toward remote work. Data scraped through Twitter's application programming interface (API) not only affords immediate access to tweets but only pulls one tweet from each user within a specified timeframe (e.g., within several days since time of pull), meaning that data are less influenced by prolific tweeters at daily or weekly levels. In terms of analyses, topic modeling can be particularly valuable for theory building in ways including detecting novelty and

[1] "Twitter defines monetizable daily active usage or users (mDAU) as people, organizations, or other accounts who logged in or were otherwise authenticated and accessed Twitter on any given day through twitter.com or Twitter applications that are able to show ads." (Twitter, 2020, p. 13)

emergence, and analyzing online audiences (Hannigan et al., 2019). Thus, in a time of major societal changes to work structure, collecting and analyzing organic data have benefits of being more immediately accessible, larger scale, and timelier than administering a survey to any single sample.

Of course, this approach is not without drawbacks. The size, richness, and timeliness of organic data come at the price of reduced experimental control. Further, Twitter users may not represent the full population and we have no means to separate responses of remote workers and nonremote workers. However, collecting data from defined samples does not guarantee representativeness of findings, and generalizability of findings could further suffer from sample characteristics (e.g., industry, job level, location, etc.). Thus, Twitter data may be a better representation of general attitudes and thoughts than data from any single survey sample. Overall, given that predictive ability of public sentiment on Twitter for various societal outcomes, Twitter's ever-expanding user base, the accessibility of Twitter's API functions, and the methodological suitability of using organic data with the objectives of this study, it is a valuable source of information useful for understanding public sentiment regarding remote work.

The present study utilizes two natural language processing (NLP) techniques, sentiment analysis and topic modeling, to analyze Twitter data starting during the onset of the COVID-19 outbreak. Sentiment analysis is commonly used to explore the opinions and attitudes of authors based on text that they have written by scoring the valence of component words on a negative to positive scale (Feldman, 2013), and it was used to examine the following research questions:

1. What is the overall sentiment of the general public regarding remote work?
2. Do remote work sentiments change over the course of the COVID-19 pandemic?

Topic modeling is an unsupervised machine learning technique used to generate semantic categories based on meaning and commonalities among words in a text (Blei & Lafferty, 2009), and was conducted to examine the following questions:

3. What are some common topics related to remote work expressed by Twitter posts? Specifically, what are topics that pertain to benefits (resource gains) of remote work? And what are those that pertain to challenges (resource losses) of remote work?

Method

Data Collection and Preprocessing

Tweets created during a 14-week period from March 30 to July 5, 2020 were obtained through the Twitter API and the *twitteR*[2] R package (Gentry, 2016). This was intended to capture the early period of remote work due to COVID-19 lockdowns. Search terms included *telework, remote work, work from home*, and their derived forms, various acronyms such as *WFH*, and hashtag versions of all terms.[3] The initial web scraping process excluded retweets and non-English tweets, for a total of 1,364,742 tweets from 672,931 unique individuals. Raw data were preprocessed prior to analyses (Kharde & Sonawane, 2016), including replacing emojis and emoticons with their corresponding meaning in words via the *lexicon* R package (Rinker, 2019) and replacing abbreviations and contractions with their expanded forms. All text was converted to lower case, and URLs, numbers, punctuations, and whitespaces were removed. All words were then lemmatized (e.g., *worked* and *works* reduce to *work*), and tokenized into unigrams (i.e., single words) and bigrams (i.e., two-word phrases).

Sentiment Analyses

Sentiment analyses classified tweets on a continuum ranging from negative to positive. Sentiment values were assigned to each token by referencing a combination of three separate pretrained sentiment dictionaries: SenticNet (Cambria et al., 2016), SentiWordNet (Baccianella et al., 2010), and SlangSD (Wu et al., 2016). These three sentiment dictionaries were sourced from the *lexicon* R package (Rinker, 2019). Sentiment for each tweet was computed as the mean of each tweet's token sentiments. To evaluate possible changes over the data collection period amid the developing COVID-19 crisis, sentiments for individual tweets were aggregated to daily sentiment values, computed as the mean sentiment of tweets generated on each day.

Topic Modeling

Bag-of-words modeling was conducted to discover semantic themes by treating individual words or two-word phrases as independent and grouping them into linguistically meaningful variables without concern for word order (e.g., Turney, 2002). Tokens made up of only uninformative stop words (e.g., *the*) were removed to reduce the likelihood of extracting uninformative topics. A sparse token count matrix was created, with tokens in columns, tweets in rows, and the number of times each token appeared in each tweet in cells. To ensure model convergence, extremely sparse terms that appeared in fewer than 1,000 tweets were removed (i.e., less than .08%). Tweets that then no longer contained any tokens were also removed. Frequencies of commonly appearing terms can be found in Figure 1. The most frequently used terms included *much*, *good*, *day*, *time*, and *covid*, each comprising between 1 and 1.5% of all terms analyzed: 28% of tweets contained at least one of these top five most frequently used terms. Frequently used work-related terms included *office, team, job, business, employee,* and *company*.

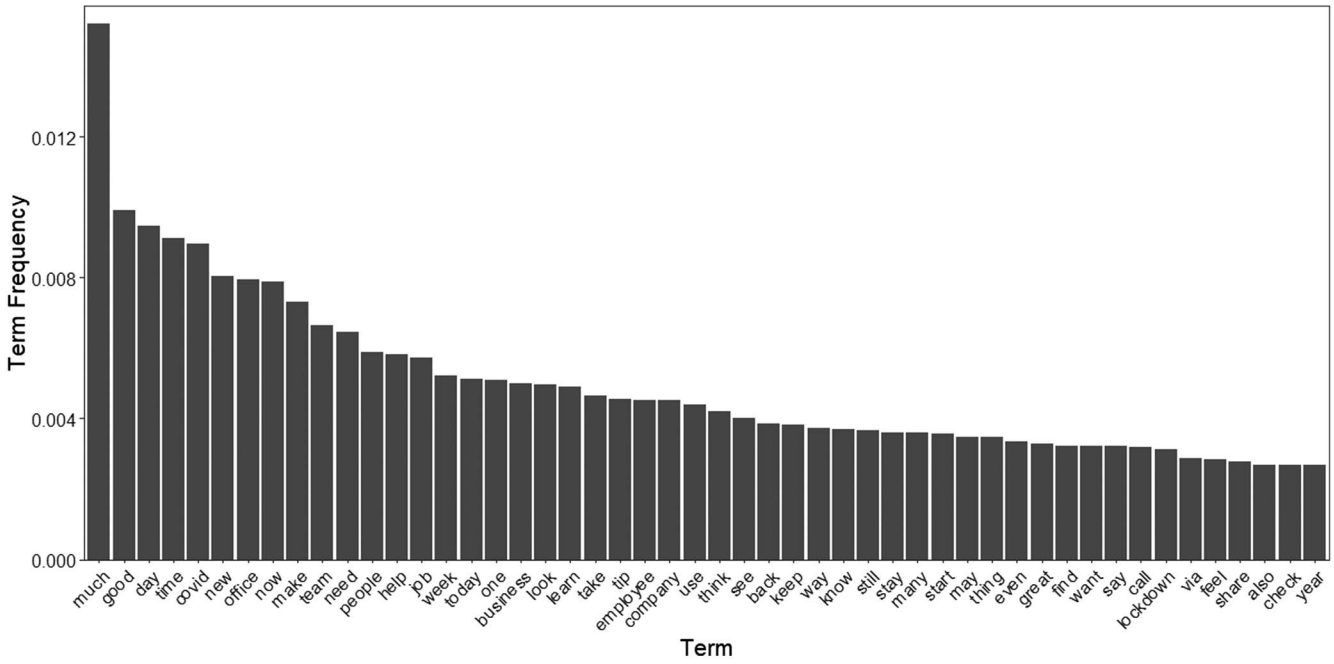
Topic models were fit for each week of tweets (Monday to Sunday) to balance the investigation of change in topics over time versus computing time. Topic models were estimated using the *stm* R package (Roberts et al., 2014) and initialized using a

[2] The *twitteR* package abridges any tweet longer than 140 characters whereas the maximum character count for Twitter as of 2020 is 280. A follow-up web scraper was written in R to obtain entire tweets from abridged links. Because Twitter only makes the past 7 days of data readily accessible via its API, the same web scraping procedure was performed every day to collect tweets dated the day of and the day before to ensure overlap between each daily dataset. All daily datasets were combined prior to analyses and duplicate tweets were removed.

[3] Complete list of keywords: *telework, teleworking, teleworked, remote work, remote working, remotework, remoteworking, work remote, working remote, worked remote, work remotely, working remotely, worked remotely, workremote, workingremote, workedremote, workremotely, workingremotely, workedremotely, teleworker, teleworkers, remote worker, remote workers, remoteworkers, work from home, working from home, worked from home, workfromhome, workingfromhome, workedfromhome, wfhday1, teleworkday1, wfhday2, teleworkday2, wfhday3, teleworkday3, wfhday4, teleworkday4, wfhday, teleworkday, wfh.*

Figure 1

Top 50 Most Frequent Terms in Telework-Related Tweets (March 30–July 5, 2020) Based on Term Frequency



Spectral algorithm for Latent Dirichlet Allocation (Arora et al., 2013) per the *stm* authors' recommendation for modeling a large number of documents. Additionally, due to the large number of models to evaluate, the Mimno and Lee (2014) method was used to algorithmically set the number of topics to extract. The 14 weekly models consisted an average of 69 topics (min = 51, max = 99).

Topics for each model were ordered by their average probability or distribution across tweets (θ), and the top 50 topics each week were qualitatively coded. For each topic, the first and third authors independently assigned a label where possible by examining the top eight terms identified based on term probability within topic (i.e., modeled likelihood of term within topic) and the top eight terms identified based on FRequency and EXclusivity (FREX) (harmonic mean of word frequencies within a given topic and exclusivity of words to that given topic; Bischof & Airoldi, 2012). In one topic, for example, the top eight terms based on probability included *team, manage, build, client, project, manager, member, your team,* and the top eight terms based on FREX *included build, manage, to manage, to build, remote team, build a, distribute,* and *manage a*. Both coders labeled this topic "team management." There was agreement on 69% of the topic labels and disagreements were then resolved by discussion with the second author. Topics where none of the three authors identified a meaningful label were excluded from the results.

Results

Sentiment Analysis

Figure 2 shows sentiment values of tweets by day. Average sentiment was slightly positive and day-to-day variability was relatively small. However, examination of the trend by day of the week revealed a cyclical pattern where sentiments regarding remote work remained steady through weekdays and dropped slightly over the weekend (i.e., Saturdays and Sundays). Regression of the tweet sentiment values on a dichotomous weekday versus weekend variable showed a statistically significant but practically minor difference for the less positive sentiments of remote work-related tweets created on weekends versus weekdays ($B = -.009$, $p < .001$).

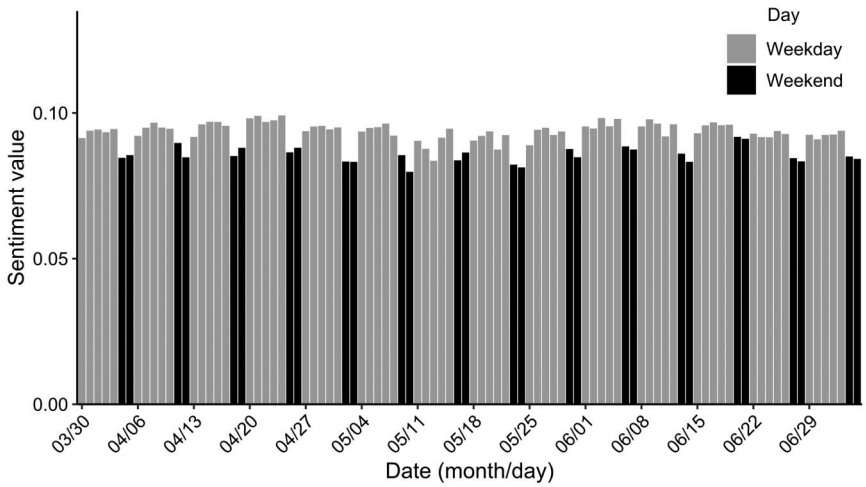
To investigate the possibility that this day-of-the-week pattern was simply a characteristic of generic tweet sentiment, we identified a public tweet data set that contains 1.6 million generic tweets that targeted no particular subject (Go et al., 2009). Although this is a relatively old data set containing tweets created from April 6 to June 7, 2009, it is large, already annotated with sentiment values, and representative of a broad snapshot of tweet content, making it a reasonable benchmark comparison for this purpose. Figure 3 shows that there was no distinguishable weekly pattern among these generic tweets. Further, the same regression model showed that tweets made on weekdays versus weekends did not significantly predict their sentiment ($B = -.000$, $p = .980$).

Topic Modeling

As a visual aid, topic model results are displayed as word clouds created using the *wordcloud2* R package (Lang & Chien, 2018), weighting each topic by their respective θ value. A word cloud for the top 50 topics that emerged during this period is presented in Figure 4. Overall, by definition due to our search parameters, topics specifically related to working from home (WFH) were the most common during this period, including explicit mentions of working from home or remote work, and more specific topics including productivity, flexibility, technology issues, home office setup, teleconferencing, and cybersecurity. Advice topics were also common, often including links to blogs, webinars, and other remote learning opportunities. The terms

Figure 2

Sentiment Value of Telework-Related Tweets Over Time (March 30–July 5, 2020)



able and *still* were often paired together as being "able to still [do something]," including work and WFH. Topics related to COVID-19 were also commonly discussed, including COVID-19 itself, social distancing, the new normal, and stay home/safe, as well as work-related challenges due to COVID-19, including mental health, work–life balance, lack of structure, essential work, searching for jobs, business continuity, and going back to the office.

Topics by Week

We evaluated the top topics for each week to determine whether and how prominent topics changed over time (Figure 5). There was considerable stability in the topics that were most prominent from week to week, with topics that were more directly related to working from home or COVID-19 being the most consistent over time. In other words, the topics that people were concerned about or were commonly discussing at the beginning of the pandemic and the social distancing orders were still prevalent several months later.

Next, we extracted only the new topics that were identified in the top 50 topics for each week (Figure 6). There were several topics that were idiosyncratic to each week, primarily describing current events during each of their respective weeks. These included "Easter" for the week of April 6, "Mother's Day" for the week of May 4, "summer" for the week of June 22. Perhaps more interesting than tracking events that occur annually were the occurrence of the topics of "diversity" for the week of June 22 and "terrorist" for the week of June 29. Diversity as it relates to the workplace grew into a prominent topic of discussion due to the upturn in the Black Lives Matter movement and protests across the U.S. and worldwide following the death of George Floyd on May 25, 2020 (Buchanon et al., 2020). The "terrorist" topic reflected the terrorist attack on the Karachi stock exchange in Pakistan on June 29, 2020 (Masood, 2020).

Figure 3

Sentiment Value of Benchmark Tweets Over Time (April 6–June 7, 2009)

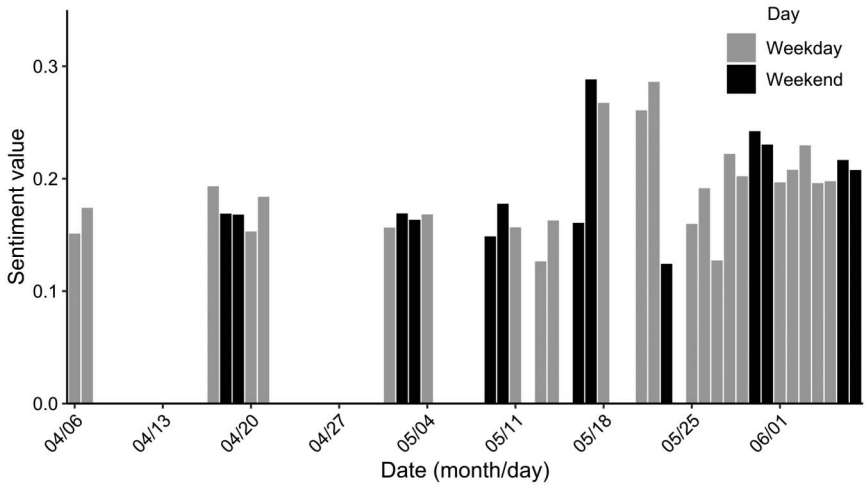


Figure 4

Wordcloud of Top 50 Topics Among Telework-Related Tweets Over March 30–July 5, 2020

Besides topics related to current events, many of the new topics each week were still subjectively related to many topics identified from the first week, but some appeared to represent the evolving idea that the pandemic was not going to be a short-lived problem. For example, the week of April 13 saw topics of "routine" and "grateful for job" that emerged in the top 50, and "permanent WFH" became a common topic in the week of May 11. During the week of June 8, tweets about "forever" became more prominent, as did tweets about "cost of living," often referring to living in a location with a high cost of living while staying at home most of the time.

Follow-up Topic Models Evaluating Sentiments and Weekdays Versus Weekends

Because the sentiment analyses revealed a minor but statistically significant reduction in positive sentiment on weekends compared to weekdays, we fitted separate topic models to compare tweets posted on weekdays versus those posted on weekends (Figure 7). Results showed that topics discussed on weekdays considerably overlapped with those discussed on weekends and covered the range of topics previously described regarding topics per week.

We fitted additional topic models to investigate differences in topics discussed among tweets with negative sentiment values (greater than one standard deviation [*SD*] below zero), neutral sentiment values (between one *SD* below and above zero), and positive sentiment values (greater than one *SD* above zero) (Figure 8). Prominent topics for negative tweets included staying home in lockdown or quarantine, information security risks, and expressing uncertainty, frustration, discomfort, or burnout. Neutral topics included teleconferencing, meetings, and remote teamwork, the internet, general advice, the "new normal," taking breaks, and home office. Positive topics included access to support and resources, productivity and management advice, the digital shift in the future, remote hiring or job search, remote learning, good practices, expressing gratefulness, taking breaks, and improving work–life balance. Therefore, while topics differed between tweets with negative, neutral, or positive sentiments, differences in sentiment between weekday and weekend tweets were not evident from these topic models given the practically small differences in sentiment between weekday and weekend tweets.

Discussion

Research on remote work has largely focused on outcomes differentiating between individuals who do and do not engage in remote work, but little attention has been given to the possible mechanisms for these outcomes. During the COVID-19 pandemic, many employees have been forced to work remotely, making it even more valuable to understand their experience. The prevalence of Twitter usage has provided an opportunity to examine public perceptions of remote work during the COVID-19 pandemic and to reveal possible benefits and challenges. We used NLP techniques to analyze a large amount of Twitter data collected during the early stages of lockdown due to COVID-19, and identified resource gains and losses expressed by the public, as well as possible passageways or environmental conditions that shape resource trajectories.

Results of the sentiment analyses demonstrated that overall, attitudes conveyed by remote work-related tweets were mildly positive. Interestingly, a weekly cyclical trend was observed such that sentiment peaked on Fridays and took a dip during weekends. Positive tweets on Fridays often reflected the end of the work week, as demonstrated by the popular hashtag #TGIF (thank god it's Friday). The less positive tweets on weekends were possibly more reflective of individuals' feelings about working on weekends rather than working remotely. Yet, although the difference in sentiment between weekday and weekend tweets was statistically significant, it was practically small. Follow-up analyses revealed that there were no meaningful differences in topic content when comparing tweets made on weekdays versus weekends. A recent study used a similar approach of web scraping Twitter data to longitudinally examine the emotional sentiment of the general public toward working from home during COVID-19, and found that stay-at-home orders affected the public's emotions (Min et al., 2021).

Whereas results of the sentiment analysis spoke to general attitudes expressed by tweets, the goal of topic modeling was to extract underlying and common themes. We identified work-related topics such as teleconferencing, cybersecurity, and work–life balance. To better understand the context under which these topics were discussed, we screened 50 tweets with the highest modeled probabilities per topic and identified representative examples (Table 1). To evaluate gains or losses of resources based on COR theory, we focused on topics that have the potential to highlight benefits or challenges associated with working from home.

Regarding benefits of remote work, tweets mentioned the availability of collaboration and communication tools being helpful in making the transition from in-person to virtual connections. Many regarded working remotely as beneficial to their productivity. They also expressed enjoying the opportunity to engage in remote learning and flexible work. Lastly, tweets mentioned being able to stay connected with others via technology. These topics point to resources that may be gained from remote work (e.g., flexibility, productivity, social connections) as well as passageways that enable such resource gains (e.g., technological tools).

On the other hand, tweets also highlighted several topics that described difficulties or challenges associated with remote work. Tweets mentioned that long hours of teleconferencing could be draining, and that individuals' capacity to work remotely was impeded by suboptimal home office setups or poor internet connections. Individuals expressed that there was a need to

Figure 5

Wordcloud of Top 50 Topics by Week Among Telework-Related Tweets Over March 30–July 5, 2020

cultivate work team engagement as members become more decentralized. As information-sensitive work became virtual, the issue of cybersecurity was also commonly discussed. Lastly, a unique challenge to working from home resulting from the COVID-19 pandemic was the need for parents to balance work and childcare. Many tweets stated that remote work during COVID-19 was more taxing than it would have been if children were not also remote learning at home.

Interestingly, several topics were discussed both positively and negatively. Regarding mental health, some tweets viewed working remotely as beneficial, whereas others suggested that working from home was more stressful than working from the office, suggesting that there may be individual difference and contextual moderators to whether emotional well-being is a resource gain or loss. Further, work–life balance emerged as a prominent topic of conversation. Some experienced improved work–life balance because of less commuting time and greater scheduling flexibility. However, others' work–life balance was harmed due to difficulties maintaining the boundary between family and work because of a lack of structure and separation.

Figure 6

Wordcloud of New Topics by Week Among Telework-Related Tweets Over March 30–July 5, 2020

Theoretical Implications

The present study takes a rare bottom-up approach to capture broad perceptions and sentiments around remote work. Consistent with COR theory, our findings identify gains or losses in resources associated with working from home with regard to the level of structure and flexibility, work–life balance, interpersonal connections, as well as resource passageways that may influence the trajectory of changes in resources, including the availability of technology, technology use, and childcare duties. While some themes coincide with those traditionally studied, others shed light on directions for future research. For example, experiences with mental health while working remotely seemed to differ across individuals. Further research should examine specific mental health challenges faced by remote workers, factors that make someone especially susceptible to experiencing decreased well-being, and potential interventions or safeguards for these challenges. Another example is the emphasis on leadership and teamwork. Past research often treated individuals who do and do not work remotely as two distinct groups and neglected the network nature of the organizational setting. Pandemic-induced remote work has highlighted the importance of considering unit-level behaviors like leadership and teamwork.

Figure 7

Wordcloud of Topics by Weekday or Weekend Among Telework-Related Tweets Over March 30–July 5, 2020

Practical Recommendations

These same themes also point to issues to which practitioners and organizations should pay attention. As employees transition to part-time or full-time remote work (pandemic-related or not), management can anticipate issues identified in the present study to guide policy decisions. Topics regarding simultaneous benefits and challenges facing remote work point to important environmental passageways that managers can capitalize on to protect and enhance remote workers' resources. Managers can provide structure for employees' daily work (e.g., delegate specific tasks and set clear timelines), help employees maintain work–life boundaries (e.g., keep work-related communications within business hours), ensure that employees have the home office setup and virtual technology they need, support training and development (e.g., online courses, webinars, and virtual conferences), encourage frequent breaks to combat risk of fatigue or burnout, and facilitate interpersonal connections among remote workers (e.g., periodic group meetings and virtual team happy hours).

Additionally, while we applied NLP methodologies to Twitter data, these techniques are not specific to any single form of text or social media platform. They can be applied to capture reactions toward topics outside of remote work, and they can be used to analyze text posted on other social media platforms. For example, if an organization has a busy company intranet, employees' posts on the intranet can be evaluated using the same analyses as described in the present study. As events unfold, these NLP techniques can continue to be applied to provide a broad view of the evolving thoughts and attitudes presented by individuals on social media.

Limitations and Future Directions

Although the use of organic Twitter data provides access to large amounts of public text, it is important to note several of its caveats. The first issue is the data generation process and how it influences construct validity through ad hoc data prefiltering and post hoc measurement (Xu et al., 2020). Prefiltering organic data on subjectively decided keywords deemed relevant for the research question is associated with past experiences about a topic (Zhang et al., 2016). Data sets that contain web scraped tweets could therefore be systemically biased depending on which search terms researchers are filtering on, which is partially influenced by researcher familiarity of relevant hashtags and/or experiences with Twitter (or lack thereof).

Data were only sourced from public users on Twitter, who may differ from the general public with regard to their age, education level, and socioeconomic status (Wojcik & Hughes, 2019). However, we do not yet know the implications of the pandemic on changing demographics and daily user activity between users. In addition, the nature of web scraping social media data means that some error is inevitably included, such as bots and spam posts. But given the wide reach of social media, it provides a much broader cross section of individuals across geographic locations, job types and levels, and industries than any single- or even multi-organization study can offer. Lastly, although we topic modeled tweets by week to examine whether the general theme underlying remote work-related tweets changed during the first months of COVID-19, the collection of Twitter data was a random sampling of all available tweets, which limited our ability to evaluate within-person changes in sentiments and topics. While our results show that topics remained relatively stable, it is possible that individual concerns evolved over time, and future research should explore such within-person changes.

Another concern is measurement. Organic Twitter data are not measures of constructs but are rather behavioral indicators (Landers et al., 2016). Tweets are created as a person-situation interaction where a mix of individual differences and situational characteristics

Figure 8

Wordcloud of Topics by Negative, Neutral, or Positive Sentiments Among Telework-Related Tweets Over March 30–July 5, 2020

Table 1
Example Tweets for Top Topics Regarding Benefits and Challenges of Remote Work

Benefits		Challenges	
Topic	Example Tweets	Topic	Example Tweets
Tools for collaboration and communication	"If your teams weren't already using popular collaboration tools such as Slack, Microsoft Teams, Zoom and Google, chances are they are now." "Our team is already used to remote work and communicating online, and we started working from home a month ago. There are so many great tools for communication and project management. I know it's harder in some industries, but how on earth can so many people find it so difficult?" "Since we started using teams at work communication and collaboration has been much better, especially now that everything has moved remote and we are the Help Desk for a very large University"	Video call	"Lol absolute remote working pet peeve, you have. A skype meeting and they call 5 min early. You do know that I don't just sit at home chilling with my hijab on at all times" "My introversion has reached new levels. Just wanna be alone on the sofa after a long hard day remote working over Microsoft Teams." "I spoke to an old therapist friend today, and finally understood why everyone's so exhausted after the video calls. It's the plausible deniability of each other's absence. Our minds tricked into the idea of being together when our bodies feel we're not. Dissonance is exhausting."
Productivity	"It's great, I can finally work fully remote. My productivity never been so high." "My productivity while remote was always higher than in the office. This past 2 months with this whole Corona thing I've been struggling to get anything done. It's okay if you're struggling as well, this is a hard time for everyone. [weblink]" "So true, I've been working mostly remote for the past few years, and no I'm not "fully peoductive" right now. Context matters, a lot! [weblink]" "Working from home not only helps workers by reducing their daily commutes, but also improves productivity and contributes to healthier lifestyles. Let's embrace it. [weblink] #remotework #productivity #visibility #worklifebalance #adaptability #thenewnormal [image]"	Home office setup	"Oh this pt, yes, a lot of sg offices aren't set up for remote working. And not just the SME's. So a lot of IT depts are scrambling now. Financial svcs are essential so they don't need to WFH though encouraged to." "HOW TO SET UP CHROME REMOTE DESKTOP FOR YOUR NEW WORK FROM HOME LIFE [weblink]" "also I do my remote work on my bed (I know I shouldn't but my room is the only quiet place in my house and I dont have a desk lol) but I don't have a mousepad" "A ring light and a dedicated—and decorated—home office. (I have neither, despite working remote for over 3 years . . . housing is too expensive in Victoria)" "@[user] I am an NHS GP working in a busy surgery. My colleagues and I are now working from home but lots of them don't have laptops or their laptops are too out of date for remote working software. Any chance you could help by sending laptops?"
Remote learning	"I'm remote working until June. I plan to complete at least 5 courses from coursera and possibly some certs I can add to my resume. Already have them bookmarked." "One of the many silver linings of remote learning is families have the flexibility to flip days to accommodate their work time! [image]"	Cybersecurity	"Remote work heightens risk of data breach: As financial institutions transition employees to working remotely during the coronavirus pandemic, cybersecurity threats have made them more vulnerable, . . . [weblink] @[user] @[user] #fintech #infosec [image]" "The #WorkFromHome movement during #COVID19 has led to an increase in vulnerable remote employees, the ideal target for #cyberattacks. The need for robust #cybersecurity policies for individuals and organizations has never been more vital. Learn more here: [weblink]" "As employee migrate from in-office to remote locations, this new way of working highlights the importance of implementing procedures to avoid cybersecurity risks and business interruptions [weblink] #cybersecurity #remoteworking #VPN"
Breaks	"Three awesome things on this remote work day: 1. Boyfriend made amazing Dutch apple bread! 2. Lo9ng lunch walk in the sunshine with the pups! 3. Video chat with a coworker friend I've been missing!" "Can't help but think how useful this lockdown is for businesses in realizing that employees don't need to be locked up inside offices everyday. Remote working works. It's so nice to see my parents take a break and work in their own comfort without the stress of public transport."	Internet connection	"Currently unable to remote in my work computer. What fresh hell is this?" "Today's #Remote Work Tip—Having good WiFi is pretty important, but so are noise-canceling headphones when you're quarantined with loved ones! [image]" "Half the country is working from home. Infrastructure services are using more remote technologies than ever before. Mobile hospitals are being set up and will transfer patient information across the internet. All of which requires a reliable internet connection." "I wasn't really trying to work today . . . But man the WiFi/remote access is so spotty, I actually can't work [emoji]"
Flexibility	"Remote workplaces are not new. Many organizations manage across distance & time zones worldwide.	Lack of structure	"My butt, back and brain hurt. I had almost 6-hours straight today. Just enough of. A break to change a dirty baby

Table 1 (*continued*)

Benefits		Challenges	
Topic	Example Tweets	Topic	Example Tweets
	Workplace flexibility has emerged as a standard accommodation in the HR playbook. Take advantage of the opportunity to learn from this experience. #protiviti #remoteworking #COVID2019"		diaper, refill my cups and grab a snack. Remote work without structure is out of control. I'll do better next week."
	"For companies, one benefit of remote work is it can improve #diversity. Flexibility at work can open the door to talent pools that are more diverse in gender, accessibility and race @[user] @[user] [weblink]"		"Trading in the structure of a day in the office for the I-can-stay-in-sweatpants freedom of remote work can be jarring. Read "Four Things to do Every Day for Your Mental Health" for ways to incorporate structure into your daily routine: [weblink] #WonderlandKids [image]"
	"@[user] Remote work offers a lot of convenience like no travel time and flexible working hours."		"We are all working sis, I even work more than I do when I am in the office cos there is no structure to it. As late as 10 pm last night I was still responding to emails, I grab my laptop at 6 am as soon as I get up. Remote working doesn't mean you are sleeping, just out of office."
			"zoom isn't necessarily the issue as it has been part of my work routine for a couple of years (remote head office) but it's the structure of the day and keeping motivated that I am struggling with. Hard to see the point of an arts/cultural degree right now."
Mental health and wellbeing	"Can we finally get rid of cubicles and make remote working mainstream? Good for mental health, physical health, families, and the environment"	Mental health and well-being	"Remote work is more stressful than working from an office"
	"UK: employees can uphold their mental well-being during remote working #Jobs #HackingHR #HR #Leadership #Recognition #Trust #PulseSurvey #HRTech [weblink]"		"We are trying. She's getting worn really thin between remote work, her department being understaffed, and not having all the tools she needs while making sure our son does his school work while lack lacking proper tools. I'm almoot more worried about stress levels atm."
			"Bruh I'm so tired. This whole corona situation is so draining, and work has been even more stressful since we went remote. Really need to escape"
Work–life balance	"The future of work is a more balanced life. Work organized around your life rather than the other way round. Commuting is a tax on your quality of life. Remote work has accelerated 10 years. Do we let the office come back?"	Work–life balance	"As most Nevadans continue to work from home, they may be feeling a little more stressed. Turning off work from home isn't as easy as it seems. If you're having a hard time adjusting, try these three tips that are help your work-life balance. #MyHeatlhNV [weblink]"
	"Remote working leading more flexible work patterns, 2 in days, 3 days from for example. Better work–life balances, reduced congestion, and pollution"		"Remote work is turning work-life balance into work-life integration"
	"Four years ago I made the commitment to yourself to only work in a remote capacity. It eliminates potential opportunities, but the personal payoff is EASILY worth it. This was most obvious when I was living on my boat and working while cruising the san juan islands full time."		"workingfromhome means post-covid more jobs become flexible by becoming more remote but I think it's also going to help erode the work-life balance many are tenuously hanging on to"
Social connection	"Hope you feel better . . . & have a fabulous Bday! FWIW last night I participated in my first ever Zoom (we use MS Teams, FaceTime or google duo at work) and first ever remote birthday party w/dear friends in Canada. It was amazingly fun. These new experiences can be kind of cool."	Children	"Set aside a few cool toys that your kids can play with, or arrange playdates or special movie viewings only during "Mommy's work time." If your children having something to look forward to, they'll be less likely to interrupt you." Keep them busy, cause you are busy! #remote [image]"
	"After a productive week of working remote, many of us at FWI host virtual happy hours with teammates to stay connected & raise a glass together. As we're adapting to this new normal of WFH, we hope that all of you are staying safe, health & adjusting as well. #MyFourWinds [weblink]		"Can't work with children Clinging to my every limb I am a plaything!" Sounds about right [emoji] [weblink]
			"So the key lens here is "parents" (and the missing label on that graph). I'm with you re:remote work in general. It's the observation that for parents now caring for kids, working full time AND educating them, "productivity" is spared into 18 hr of the day"
			"Even as a full-time remote worker for the last 7ish years, this is totally different. Because kids and school. It's like summer break except I have to keep conference call appointments for two kids and make them do work."
			"Parents working from home with kids nearby need additional flexibility from their employers. But make sure you aren't focusing all your attention on supporting

(*table continues*)

Table 1 (*continued*)

Benefits		Challenges	
Topic	Example Tweets	Topic	Example Tweets
			working parents while the needs of employees in other family types are underserved. [weblink]"
		Team management	"Working remotely shouldn't mean less engagement with your team. This article from @[user] shares tips on how to keep your team engaged: [weblink] 1. Manage Expectations 2. Establish New Rules of Engagement 3. Get Creative About Maintaining Team Culture 4. Be There [image]"
			"One tip to help manage remote workers? Don't underestimate the socialization factor. While we hold meetings to share information, brainstorm ideas, and make decisions, they also serve to build social bonds and help teams work better together. [weblink]"
			"While the swift shift to remote work can cause stress and many complications to daily activities, your job as a manager is to remove as many barriers to forward momentum as possible."

Note. WFH = working from home; For reasons of anonymity, all usernames contained in tweets were replaced by [user]; all website links were replaced with [weblink]; and all links to images were replaced by [image]. Most tweets contain terms that represent more than one topic but these example tweets were ones chosen to be representative of each topic.

leads to tweet behaviors. The societal context of remote work given the COVID-19 pandemic might be similar across individuals, but reactions may vastly differ due to individual differences in affectivity, prior experience with remote work, personality, and nature of work. Information that is extracted from tweets is similar to information that can be extracted from observational data (Marres & Weltevrede, 2013), but without the risk of influencing digital behavior during measurement.

Conclusions

Given the current and unprecedented nature of the COVID-19 pandemic's effects on the workforce, it is in organizations' best interests to stay informed of sentiments and opinions regarding remote work. The present study uses NLP techniques on Twitter data, specifically sentiment analysis and topic modeling, to evaluate the public's attitudes, perceptions, and thoughts about remote work during the COVID-19 pandemic. Findings highlight a number of common benefits and challenges associated with remote work as perceived by the general public that are particularly relevant to employees who face no alternative but to work remotely (e.g., when the entire work team is virtual or when relocation is impossible). As remote work becomes a more common mode of work, an improved understanding of the possible resource gains and losses characteristic of transitioning to remote work will help organizations better cope with such circumstances in the future.

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