ABSTRACT

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Social movements make decisions about the directions and character of the actions they undertake to highlight injustice. However, not all actions elicit the desired response from the public or media. Social movements aiming to build broad support may want to be aware of how particular protest tactics may be seen by outsiders. The environmental movement Extinction Rebellion (XR) has routinely chosen frequent and sustained disruptive actions which gain attention of social media and reporters. This paper seeks to examine the ways in which the sentiment about the movement's events changes given the level of disruption of movement actions. Using computational text analysis with data from GDELT and Twitter, I examine this relationship using sentiment analysis and show that the more disruptive an action is perceived to be in the news, the more negative sentiment there is towards XR. These findings suggest that movements should consider how to frame or engage in disruptive actions in order to positively sway public perception and news coverage and ultimately gain more support. This study also highlights the importance of social movement researchers examining the events movements execute, specifically, rather than focusing on movements as a whole.

Key Words: social movement framing, sentiment analysis, radical environmental movements, social media

Reacting to Rebellion: Sentiment Analysis of Tweets about Extinction Rebellion

by
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DEDICATION

First, I would like to acknowledge that this project is both mine and not mine—that is, it is a product of an ecosystem of support that allowed me to read, write, process, examine everything that was needed for this paper to be completed. I dedicate this project to Sam who should hold an honorary degree because of the unfailing support that he has shown me. To my children who were infinitely patient with me when my work spilled into evenings, weekends, and breaks. To my beloved chosen family who have shown me unconditional care and love and who continue to cheer me on as I pursue this goal. To my cohort for the solidarity while we figure out how to do this work during a global pandemic. This project is a small contribution to the beautiful lineage of everyone working to not only interpret the world but to *change it*.

BIOGRAPHY

Meghan Watts is a graduate student in the Department of Sociology at North Carolina State University (NCSU). They earned a Bachelor's Degree with majors in Sociology and Women's and Gender Studies and a minor in Social and Economic Justice from University of North Carolina—Chapel Hill in 2019. They currently teach a Social Problems course at NCSU that seeks to highlight the critical connections between myriad world issues. Their academic interests lie in Marxist Feminist and decolonial theories, social movement studies with a concentration on police repression, and cultivating a research praxis rooted in care and community. When not surrounded by books, they enjoy spending time with their children, partners, and chosen family.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

Climate change is an intensifying existential crisis facing the planet (Ahmed 2020). Climate scientists and activists have been urging governments, corporations, and individuals alike to take bold and decisive action to stem the rise of temperatures and carbon emissions (Ganguly, Setzer, and Heyvaert 2018; Ghadge, Wurtmann, and Seuring 2020; Hsiang et al. 2017). As years have passed and previously unaffected areas begin to experience climate disasters, these warnings grow more urgent. A recent study (Djalante et al. 2018) has predicted the planet has roughly a decade to put into place aggressive plans in hopes that current climate trends might be slowed or reversed. In response to the scientific community and those populations who are most directly impacted by current climate disasters, activist groups have been rallying to prompt dramatic changes around the globe.

Extinction Rebellion (XR) is one such environmental social movement organization that has been demonstrating in various ways across the globe to draw the attention of citizens and governments alike to the looming climate crisis. The sense of urgency regarding the intensifying environmental crisis has largely served as the basis for much of the movement's tactical repertoire. Most actions taken by XR are highly theatrical and involve bold displays—some including public nudity while others block bridges and roads. Because of the disruptiveness of these demonstrations, public opinion toward the movement can be polarized with some agreeing with the choice of tactics while others disapprove. Opinion polarization, then, should be of interest to social movement scholars focusing on framing as this is often a strategic choice on the part of movement organizations (Jasper 2004). Further, as Viterna (2014) suggests, scholars who ignore public perceptions of radical movements and tactics will be unable to fully understand (1) levels of participation in these types of movements and (2) the negotiated forms of "political violence"[1] undertaken by movement actors. When researchers neglect to examine these public perceptions, they fail to engage as deeply with a movement, thereby missing components of participation and tactical negotiations.

Yet, little research exists that examines the public response to various protests and protest tactics. In this paper, I explore the affective responses to XR through tweets on Twitter in the context of their actions. I examine whether Twitter sentiment shifts over time and in rhythm with the types of demonstrations XR executes. This study advances the literature in multiple ways. First, while research has focused on movements broadly writ on audience opinion, there has been scant research on the audience effects of protest *events* in particular. Second, while there has been recent scholarship on the role of grievances and framing on mobilization (e.g., Bergstrand 2014), there has been less focus on environmental justice movements specifically—particularly those that are seen as more radical. For example, Bergstrand (2014) suggests that frame development and resonance may be more difficult for abstract or larger, global issues (e.g., climate change). Yet she also argues that loss-based grievances can be particularly mobilizing[2]. Climate change ushers in multiple forms and magnitudes of "loss"—from biodiversity to habitats—which environmental social movements attempt to articulate—particularly ones focused on environmental justice. While work on framing has produced important contributions to social movement research, this body of work has not yet examined public responses on social media to protest events. Finally, from a methodological standpoint, this study takes a novel

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[1] While XR may not meet the definition of a politically violent organization, it is useful to apply Viterna's critiques to this case in order to highlight the ways social movement scholars have not engaged deeply with these issues with regards to framing.

[2] Loss aversion has been an element of study in social movement research as far back as Tilly's seminal work *From Mobilization to Revolution* (1978).

approach to the study of social movement framing by combining Twitter data and global protest event data pertaining to news coverage and sentiment.

This paper offers an examination of how contentious tactics can shape opinion on social media. I do this by linking data from the Global Database of Events, Language, and Tone (GDELT) and Twitter sentiment of tweets about XR. Findings from a fixed effects regression analysis show that tweets regarding XR are more positive when the organization conducts less destabilizing protest actions. I conclude with a discussion of the implications of these findings for the social movement literature on framing with regard to social media—focusing on the theoretical and empirical relevance of the case, as well as directions for future research on this and related topics.

Background: The Case of Extinction Rebellion (XR)

Extinction Rebellion (XR), based in the UK, emerged out of an existing organization (Rise Up!) in the Fall of 2018 to bring attention to the climate emergency. Its principal founders, Roger Hallam and Dr. Gail Bradbrook, state that the group developed out of "academic research and mass engagement" (Extinction Rebellion 2018). According to the XR global website they are "a decentralized, international and politically non-partisan movement using non-violent direct action and civil disobedience to persuade governments to act justly on the Climate and Ecological Emergency" (Extinction Rebellion 2018). Since their inception, they have grown to over 1,100 groups in 75 different countries. Hallam says they have " gone from 15 people in a room to creating the biggest organized civil disobedience campaign in British history" (Hallam 2019). They also have multiple subgroups such as "XR Disabled Rebels," "XR Grandparents," "XR Buddhists," and "XR Scientists" which demonstrate the apparent wide appeal and diverse community which make up the global organization. Even youth climate activist Greta Thunberg participated in early XR-led protests (Cannon 2019).

XR has put on hundreds of actions around the globe since its founding. Among their most provocative actions, these self-identified “Rebels” have disrupted the 2019 London Fashion Week (Cochrane 2019), glued themselves to the London Department for Transportation building (Marsh 2019), disrupted service at London’s public transportation system (a.k.a. “The Tube”) (Rowlatt 2019), and blocked Parliament Square (Murray 2020). The group’s actions have been largely unpopular, however, as an October 2019 poll conducted by UK YouGov showed only 37% of adults surveyed either somewhat or strongly agreed with the group’s tactics (YouGov 2019). These extreme and disruptive actions led them to be included on a counter-terrorism list entitled “Safeguarding young people and adults from ideological extremism” by the Counter Terrorism Policing South East (CTPSE) in the south-east of England (Dodd and Grierson 2020). This list included neo-Nazi and alt-right hate groups[3]. This is not the extent of the controversies surrounding XR as they have faced claims of being exclusionary and approaching climate justice from a white and middle-class lens. As previously noted, XR has several subgroups which appeal to various identities and, consequently, the XR Youth faction was developed in response to perceived shortcomings by the larger group in taking an intersectional approach to climate justice.

Since its inception, XR has published two printed books, *This is Not a Drill* and *Challenge Everything*, and has extensive materials available online which detail their values, organizational structure, and demands along with training materials and testaments from Rebels.

[3] Authorities later agreed to recall this document and later described the inclusion of XR as an “error of judgement.” (Dodd and Grierson 2020)

XR relies heavily on scientific data to support (1) their claims surrounding the future impacts of climate change and (2) their goal of mass recruitment into their movement. They currently have nearly 1,700 signatories on a letter titled: "Scientists' Declaration of Support for Non-Violent Direct Action Against Government Inaction Over the Climate and Ecological Emergency" (Scientists for Extinction Rebellion 2020). They draw their recruitment goal from research by Erica Chenoweth and Maria Stephan (2011) who contend that non-violent movements comprised of just 3.5% of the population were twice as likely than violent armed movements to produce political change. The use of this statistic by XR has been critiqued, however, by those who contend that this is a misapplication of the so-called "3.5% rule"[4] (Ahmed 2019). However, even some materials from XR acknowledge that this has never occurred in Western democracy and never over ecological concerns[5].

Despite controversies, critiques, and the COVID-19 pandemic, the group continues to push for global actions as conventional political avenues have not succeeded in sufficiently addressing the climate emergency. They are not interested in "seizing power" but in building citizens' assemblies which would place power into the hands of communities (Extinction Rebellion 2020). XR regularly highlights the inability and unwillingness of those in power to meaningfully tackle climate change.

Given the characteristics of XR and their own extensive engagement on social media platforms, this group makes an ideal case to test how contentious tactics affect public sentiment on social media. XR situates itself outside of mainstream environmental movements. This

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[4] The main criticism stems from the fact that the events in Chenoweth and Stephan's study did not include any events which involved a political change in Western liberal democracies.

[5] The pamphlet "Truth and Its Consequences" also acknowledges this but takes this to mean that a greater number of people need to mobilize in order to enact change.

positioning combined with their choice of tactics offers a novel point of analysis for gauging public opinion of movements on social media. Below, I discuss in more detail relevant literature pertaining to social movement framing and social media sentiment of social movements and protest.

Making Frames and Measuring Feelings During Ecological Crises

In this section, I highlight existing literatures on social movement framing and sentiment analysis in order to situate my present study. I begin with showing how social movements often frame their organization and tactics in order to recruit members to the cause and reach the public at large. I then examine how social media can be a tool that helps to build movements and sway public perceptions about various issues. Through its presence on a variety of digital platforms, XR has used social media extensively for these exact purposes. Specifically, the group uses Twitter to frame the climate crisis: its causes and solutions as well as motivations for participation in the movement.

Social Movement Framing

The use of framing analysis for studying social movements came out of the social psychological tradition through the work of Erving Goffman (Lemert and Branaman 1997). Goffman (1974) points out that frames are schematic interpretations that help people make meaning and gain understanding of situations. Framing was introduced as a theoretical conceptualization in social movement studies as a way to develop an understanding of the meanings movements construct through their work (Snow et al. 1986). Ultimately, collective action fames allow movements to analyze and interpret the political context of the moment (Carroll and Ratner 1996). The core framing tasks of diagnosis, prognosis, and motivation used by movements can help to predict the success of the movement by understanding the depth and degree with which each of these tasks are undertaken—both individually and as a whole (Snow and Benford 1988). Framing is an important aspect in the recruitment of members, the identification of targets, forming collective identity, and planning tactics (See Fominaya 2010; Hewitt 2011; Taylor et al. 2009; Vasi 2006; Vicari 2010).

Because the development of frames is a social process, movement framing tasks must take into account the ways interaction helps to produce a particular stance. While more explicitly pro-environmental sentiments may be gaining traction, how might framing processes draw attention to environmental issues in a way that produces action and ultimately change (Hargreaves 2016)? According to Snow and Benford (1988), movements must (1) diagnose a problem and assign blame for that issue, (2) suggest solutions and identify the methods that will be used to address the problems, and (3) give a motivation for action in order to spur participation. Benford (1993), for example, describes the vocabularies used by the nuclear disarmament movement which framed collective action in particular ways. He identifies the following as those which provided the stimulus for action in that movement: severity, urgency, efficacy, and propriety (1993). Environmental movements have used a variety of collective action frames in order to address a variety of issues (Adams and Shriver 2017; Allan and Hadden 2017; Andrews and Edwards 2005; Benford 2005). Much of the writings of radical movements, then, use these vocabularies in an attempt to stir people into action for a variety of causes including climate change, animal rights, and abortion (Corry and Reiner 2021; Devall 1991; Ferree 2003; Ingalsbee 1996; Johnston and Johnston 2017).

However, as Benford also suggests, motives are situated in historical, cultural, and structural contexts (1993). This can become contentious if movement members do not share the same positionalities. If frames are schema for meaning creation, then surely the unequal and uneven distribution of environmental harms and benefits have a role in frame development. For example, researchers have found that movements have had to negotiate frames in order to determine which might be more salient for particular communities (Meyer, Cross, and Byrne 2016; Robinson 2008). Further, a movement's knowledge of the demographics of its target audience can be beneficial in articulating frames (Bergstrand and Whitham 2021) as different frames may be more salient to some groups than others. Yet, the organizational identity of XR means that the frames used by the movement are working to situate them as separate from other mainstream environmental movement organizations. For example, Occupy London tweeted on October 26, 2018:

> This is a very different operation to established climate activism and attracting a large amount of citizens to commit to action who are new to 'activism'. Not activists, but rebels. Using #Alabama civil rights approach @RealMediaGB #ExtinctionRebellion[6]

They are framing climate change and choosing tactics in order to recruit not just anyone but *rebels* for the cause.

Carroll and Ratner suggest that social movements must "*disorganize* consent and *organize* dissent" (1996:602). This means that part of the core framing tasks movements must undertake is that of countering hegemony which not only offers critiques of power but alternatives to the status quo. The rebels of XR clearly embody this goal in both their collective identity and their mobilization towards more disruptive tactics—they attempt to *disorganize* the status quo and *organize* a global mass-dissenting force. These authors continue to explore prevailing master frames (Snow and Benford 1992) and find that most movements use a "political economy master frame" that situates the root of various issues in the imbalance of various power structures. Master frames allow movements to develop particular frameworks for

[6] Occupy London Twitter account, accessed 12/01/2020, https://twitter.com/OccupyLondon/status/1055737149012824069

addressing a variety of issues such as an injustice master frame that is key to developing counterhegemonic narratives (Hardnack 2015). More recent scholarship, however, has shown that the use of "daily-life frames and more specific blame attributions" (e.g., a particular person or organization) can have a more positive influence on movement participation than the more abstract framing that is typical of environmental movements (Ketelaars 2016:354). XR has directed many of their actions in the UK at specific targets and place blame on specific institutions for their failure to take climate change seriously. The sociopolitical context, among other things, in which the movement is operating must also be taken into account when crafting potential frames. Present research on master frames (Charrad, Zarrugh, and Ha 2021) has articulated a new frame: the reclamation master frame. The developers of this master frame drew from their study of the Arab Uprisings in 2011 whose sustained mobilization led to the overthrow of governments in three different countries. As the Arab Uprisings have been an inspiration of sorts to the approach XR takes to recruitment, it would be useful to understand how the application of various frames are received or perceived in "non-authoritarian" or Western countries.

McAdam et al. (1996) suggest that because the internal character of the movement as well as the environmental context changes over time, frames must also adapt. This adaptation has been see in many environmental movements—from reform oriented to radical—and the focus on a more justice-oriented movement has been growing (Hadden 2015) as a way to increase recruitment and mobilization. As the movement evolves, frames must transform in order to meet the needs of movement members and in order to correct previous frames which no longer serve their purpose (Pellow and Brehm 2015). This becomes challenging in globally-oriented movements—particularly those centered on the environment as the effects of climate change are distributed unevenly across the globe and vary in both magnitude and kind. Despite this, some research supports the existence of a *global environmental justice movement* that “shares some common goals, frames and forms of mobilization” while targeting localized grievances (Martinez-Alier et al. 2016:747). With local groups across the globe, XR has largely tailored its actions to indict the powers-that-be present in country-specific locations (i.e., the targets of particular actions) as well as the most salient points of disruption (e.g., public transportation). In other words, the targets identified and the tactics used by XR reflect who they believe is to blame and to what degrees of inconvenience are they willing to subject the general population. Disruption and inconvenience are tactics that have long been used to push for change.

The framing process ultimately aids in the construction of tactical repertoires. The tactical repertoire model developed by Taylor et al. (2009) offers insight into the cultural performances deployed by movements as part of the collective claims making process. They argue that contestation, intentionality, and collective identity interact and vary in ways that facilitate meaning making. Cultural performances can be instrumental in the impact that social movements have on the broader society. Because social media has become a vehicle for broadcasting cultural performances, the audience of the performances must be taken into consideration during the framing process. Bergstrand and Whitham (2021) show that scholars of social movements should consider not only the frames themselves but the way the frames are conveyed. They argue that customized frame packaging (i.e., adapting frames to particular audiences) and tactic customization (i.e., “demographic-specific tactics”) can help to broaden the appeal of a given movement. Similarly, it has been argued that framing that centers loss-based grievances as opposed to gain-based grievances can be a powerful way to mobilize collective action (Bergstrand 2014). If loss-based grievances more strongly motivate action, it would reason that climate change and the myriad losses that are associated with it would also be mobilizing when framed through urgency even if a movement's tactical repertoires were perceived to be more radical. Given that climate change produces almost incalculable losses across the globe, how effective are these strategies in mobilizing for this particular cause? Is there a framework for challenging what Gunderson, Stuart and Houser call the "irrelevance" of climate change (2020:43)? Voskoboynik (2018:9) laments:

> …[T]he story of our environmental reality is evacuated of emergency…Over decades, the story of climate change has been predominantly encoded in the language of data, diagrams and jargon. It has been poorly illustrated through the narrow iconography of polar bears, collapsing glaciers and stylized temperature graphs. Its relevance has been defused through acronyms, abstract numbers and tired metaphors.

The onus, then, is on environmental movements to convey (i.e., frame) the *story of climate change* in ways that illustrate its urgency and translate to increased mobilization. If starving animals or melting icebergs are not sufficiently convincing, perhaps mass rebellion in the streets around the globe might be.

Social Media Sentiment of Social Movements

It can be useful to think of the internet as another type of ecology—one in which our lives become digitally connected to one another and produce forums for interaction beyond those available to us offline. Events and issues happening across the globe become visible in this online ecosystem through images and analyses—crafted by expert and lay alike. Because of this, the internet offers a field of study for social scientists wanting to understand a variety of social behaviors and interactions (Lazer et al. 2009). Over the past decade, the use of Big Data in the social sciences has exploded. This new methodology and source of data answered the call of sociologists Mike Savage and Roger Burrows who warned of a "coming crisis [in] empirical sociology" (2007:885). They contended that researchers needed to reevaluate their methodological and empirical repertoires to account for the changes in the post-war years. Big Data has the potential to transform the ways we study social movements in particular. The use of Big Data in this area can mimic or complement, not replace, other methodological designs, including surveys, experiments, and interviews (Evans and Foster 2019; Golder and Macy 2014).

This empirical crisis in sociology can be particularly salient in the field of social movement studies. Social movement researchers have long highlighted the difficulties in using traditional data sources for studying movements (See particularly Earl et al. 2004). With the methodological advancements of computational social science, rich data sources are now available to scholars in an array of fields. Big Data, encompassing a wide range of digital data, is particularly salient within the field of sociology. As our social world becomes more digitized, Big Data can offer insight and sources that would not be accessible elsewhere (Halford and Savage 2017). The use of computational social science opens up dynamic data sources from which rich analyses can be drawn—this rings even more true for the study of collective behavior (Edelmann et al. 2020). Various social media sites have allowed people to experience revolution "in real time" through live-streaming, Twitter threads, and more. However, there does seem to be some contention as to the impact and effectiveness of online activism (Lewis, Gray, and Meierhenrich 2014).

Since social media has become a ubiquitous form of communication—from quotidian activities to complex information—many turn to various platforms to make comments on social phenomena large and small including social movements (Tremayne 2014). This transformation of public dialog can facilitate moments of meaning making and political development (Fownes, Yu, and Margolin 2018). Twitter has become a site of public discourse that can yield rich data for social scientists to analyze various elements about the world around us as filtered through individual users and hashtags much like surveys or focus groups have in the past (Lin et al. 2013). For example, the topic of climate change alone has been tracked in various ways using Twitter data to reveal sentiment and emotions (Loureiro and Alló 2020), changes in opinion (Ebrey, Hall, and Willis 2020), information sharing and public interest (Abbar et al. 2016; Veltri and Atanasova 2017), media framing (O'Neill et al. 2015), and the organization of collective action (Segerberg and Bennett 2011). Most recently, research has shown that Twitter users are "more often reasonable" when discussing the topics of climate change and global warming (Cameron et al. 2021:18). In this research, I extend the work in this field by examining a range of dates spanning over two years that pertain to XR instead of selecting a single event date or a randomly sampled timeframe as previous studies have done.

Beyond issue-based interests, Twitter has also been studied by various researchers as a pathway for mobilization, organization, and communication (Bang, Lee, and Rao 2021; Freelon, McIlwain, and Clark 2018; LeFebvre and Armstrong 2018; Tufekci 2018). While these various applications of Twitter data to collective action and social movements have provided a richer understanding of contentious activity, there has been little research into the ways public perception and reaction to sustained, frequent, and disruptive protests change over time. Jungherr (2015) has used Twitter data to track spikes in the quantity of tweets as they relate to political events. He uses the 2009 federal election in Germany to determine if there are significant changes to the "volume of politically relevant message[s] [that] reliably coincide with events connected to the [election] campaign" (2015:107). Jungherr (2015) shows that Twitter often can be a reliable source for determining politically relevant events that are mediated by the biographies of individual Twitter users. Ceron et al. (2014) suggest that social media can be as reliable as traditional survey techniques in its representativeness.

As Fownes et al. (2018) suggest, analyzing the content of Twitter data can facilitate the "measure[ment] [of] the intensity of collective sentiment" towards issues and even be instrumental in building solidarity (3). In line with Jungherr (2015), they also show that organized events can impact Twitter discussions and draw more attention to particular issues. However, these researchers do caution against the assumption that increased activity is reflective of the level of concern for an issue. Further, other research has highlighted the importance of being aware of potential meaning loss when using sentiments from Twitter data as some information may be lost during the classification process (Bravo-Marquez, Mendoza, and Poblete 2014). In the case of XR, their tactics don't seem to be fully informed by public perception writ large. Again, they aim to recruit particular kinds of people who are willing to engage in sustained disruptive activities. Because of the competition for attention in a fast-moving digital age, movements can be at a disadvantage when it comes to framing themselves across multiple platforms—especially when they are not in control of how they might be perceived (Meyer 1995). Yet, it would seem that all press is good press to XR with the goal of having immediate and substantive system change in order to address the realities of climate change remains a priority.

The literature outlined above informs my research on the XR movement. My primary aim in this paper is to supplement sentiment levels derived from Twitter data with data regarding the character of protest events over time and suggest that action framing is an important aspect of movement building and protest. To examine this, I test the following hypothesis:

H1: Less disruptive protest events undertaken by XR should be associated with more positive sentiment in tweets about XR.

Data and Methods

Research Strategy

As discussed in the previous section, Big Data analytical techniques broadly and Twitter more specifically have been transformative in social science research and the development of the field of computational social science (Bail 2014; Edelmann et al. 2020). The development of computational techniques for the processing and analysis of large amounts of text has given researchers a way of gathering and interpreting massive amounts of data in an efficient and effective manner. In order to assess the sentiment of tweets over time, I used statistical software[7] to process Twitter data, such as hashtags, retweets, likes, and tweet text of individual twitter users pertaining to XR. I then collected scores relating to how negative or positive the text of these tweets were as well as their corresponding emotions by running sentiment analyses. I describe in greater depth below the data collection and preprocessing processes. I merge these data with data on protest events from the GDELT dataset that contains information on how disruptive particular protest events are. I then estimate linear regression models with fixed effects at the unit (twitter user) and time (time of tweet) levels to explore the relationship between protest event disruptiveness and the sentiment of tweets about the organization at that time.

My analysis proceeds in two steps. First, I provide a descriptive analysis of the data. This includes tweet frequency, polarity distribution (i.e., proportion of negative and positive tweets), and emotion distribution (i.e., the proportion of each EmoLex emotion term measured in tweets). I also show the changes in the Goldstein scale over time as it relates to polarity scores. Then, I describe the results of the fixed effects analysis.

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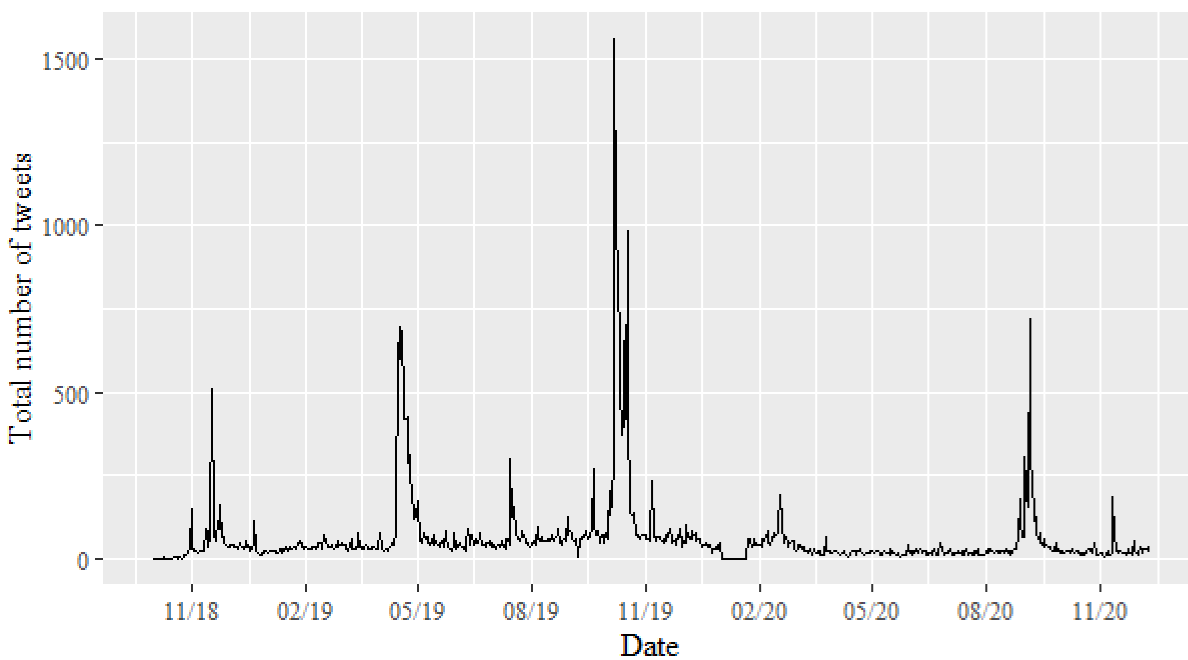
[7] For the initial processing of tweets, I used RStudio Version 1.4.1106.

Data Collection

Twitter data

The data for this project were gathered from Twitter using specific search parameters. I included tweets which referenced "Extinction Rebellion," "#ExtinctionRebellion," and "#XR." I did not include "XR" in my search terms because that most tweets associated with the XR abbreviation are captured by the #XR search term nor did I include retweets[8]. Despite XR having a global presence, I chose to only include English language tweets. I was able to access 57,601 tweets by 22,211 unique Twitter users from October 18, 2018 through December 10, 2020[9]. The frequency of these tweets is shown in Figure 1.

Figure 1: Frequency of Tweets about XR



[8] While Extinction Rebellion is often abbreviated as "XR," there are other concepts which use this abbreviation as well, such as "extended reality." In order to avoid potentially unrelated tweets, I chose to exclude this from my search terms.

[9] I was able to obtain this data via Date Crux Technologies which had the capacity to gather more data via their API as Twitter limits the historical date ranges and number of tweets that can be accessed through an individual account.

After gathering Twitter data, I then gathered data regarding the actions taken by XR as described below.

Event data

Data regarding the actions taken by XR were gathered through the Global Database of Events, Language, and Tone (GDELT) Project (Leetaru and Schrodt 2013). GDELT is an open database that contains a collection of historical news coverage dating back to January 1, 1979 and continues to scrape the web multiple times per day for event data regarding contentious political events. This has resulted in a global catalog of news media that measures various aspects of events such as event and actor attributes, geographical data, and Conflict and Mediation Event Observations (CAMEO)[10] (Schrodt, Gerner, and Yilmaz 2005). The GDELT Project is hosted on the Google Platform and is searchable via BigQuery. I used the integrated SQL workspace to access news articles pertaining to XR actions. I narrowed the search field to include articles from October 18, 2018 through December 10, 2020, which corresponds to the timeframe of tweets in my dataset. To further tailor my search, I searched for actors listed as "REBEL" or "REBELLION" to capture XR events. Finally, I filtered this to include events that took place in the UK as the bulk of the actions were executed here and were coded within this dataset to have been directed towards known targets of XR actions. Ultimately, I was left with 10,225 mentions. I exported this file to Google's Data Studio to create a visualization of the final dataset. I graphed the number of mentions and average tone of the coverage over time as they corresponded to the Goldstein Scale that ranks events via their CAMEO score on a scale of -10 to +10 with +10 indicating more cooperative events and -10 indicating more potentially

[10] See the CAMEO manual for further details:
https://www.gdeltproject.org/data/documentation/CAMEO.Manual.1.1b3.pdf

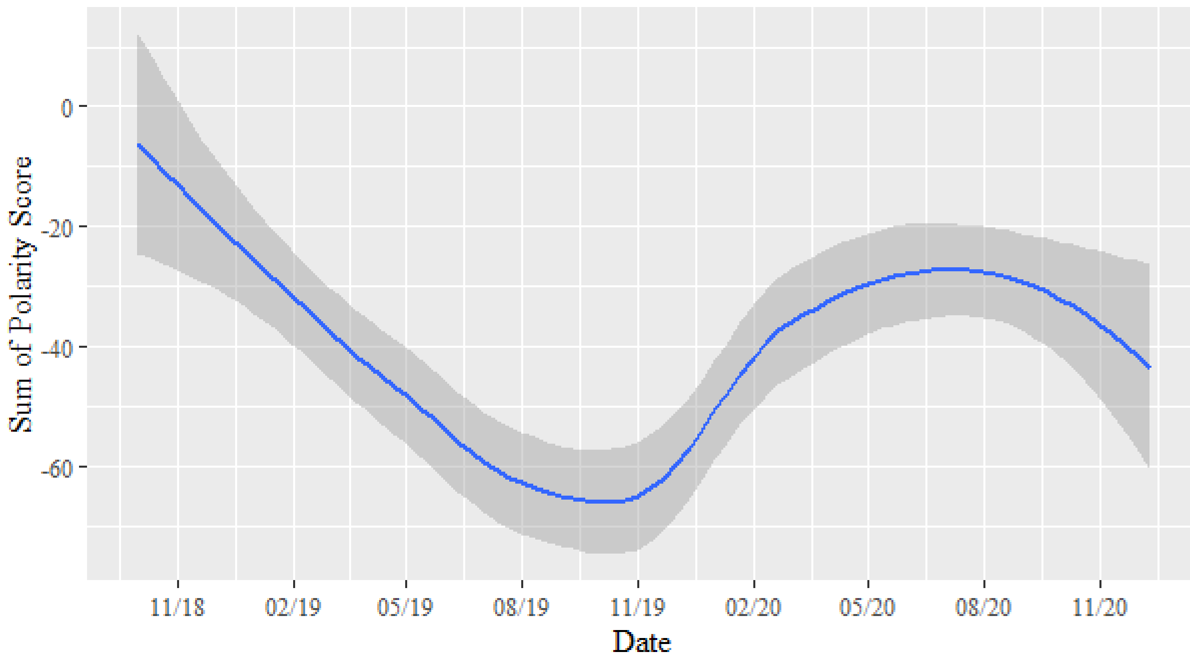
destabilizing events. This scale indicates the "theoretical potential impact that type of event will have on the stability of a country" (gdeltproject.org). The more negative a number, the more threatening the event is coded to be. I used this to determine the profile of a given event such that the more negative an event was scored, the more radical the tactics deployed and the larger the scale and intensity. Likewise, more positive events were those that were considered less destabilizing (i.e., more cooperative) and therefore comprised of less radical tactics.

Data Preprocessing

In order to perform a sentiment analysis of the tweets, I first undertook commonly used pre-processing techniques, beginning with removing common stop words, punctuations, numeric values, hyperlinks, and user handles (i.e., words that began with "@") from all tweets. I then stemmed the words so that I was left with their root. I utilized the NRC Word-Emotion Association Lexicon (EmoLex) (Mohammad and Turney 2010) in order to determine the sentiments associated with the tweets. To date, EmoLex has received very little application in the social sciences. It has been used in conjunction with topic modeling (Koltai, Kmetty, and Bozsonyi 2021), topic modeling and media framing of the Tea Party Movement (Rafail and McCarthy 2018), measures of subjective well-being (Weismayer 2020), emotional desensitization to gun violence (Li, Conathan, and Hughes 2017), online grievance framing of the Men's Rights Movement (Rafail and Freitas 2019), and, most relevant to the present study, the role of emotion in online collective action (Shahin and Ng 2021).

The EmoLex dictionary processes English words on the basis of positive or negative sentiment and further categorizes them based on eight emotions: anger, anticipation, disgust, fear, joy, sadness, surprise, and trust. This dictionary provides a more robust and nuanced categorization of sentiments than the Bing or AFINN dictionaries (Silge and Robinson 2017) and is better suited for the purposes of this project. This sentiment analysis technique yields a basic polarity scale that scored tweets based on a binary negative or positive sentiment which ranged from -1 to 1 to further examine relationships. Figure 2 shows the change in tweet polarity over time which gives a preliminary look at the change in sentiment (i.e., positive or negative) over the course of the time frame of study.

Figure 2: Change in Polarity Over Time



Variables

Predictor

My main predictor variable is a measure of how disruptive a protest event is. According to the GDELT Event Database Codebook, the Goldstein Scale measures on a scale of -10 to +10 the “theoretical potential impact [an] event will have on the stability of a country” (https://www.gdeltproject.org/). I use this score in order to determine the sentiment expressed on Twitter. Because XR attempts to use more disruptive events to their advantage, the Goldstein score can highlight the “success” of a given event. For example, a date that was coded as -10 on the Goldstein Scale was November 17, 2018. On this date, hundreds of XR rebels took part in a "day of rebellion" during which they blocked five bridges in London. This was a culmination of a week-long series of protests and resulted in 80 people being arrested and city officials suggesting that emergency services and citizens of London were directly impacted by this sit-in demonstration (Taylor and Gayle 2018). In a highly cooperatively scored event, XR participants—many of whom were elderly—attempted to blockade a portion of roads on September 21, 2019. Reports stated that most of the demonstrators stayed within an area that was designated by police officers to avoid as much disruption as possible, yet nearly a dozen were arrested after moving outside of this zone (Baynes 2019). This event also occurred shortly after the global Climate Strikes.

Outcome

Social media sentiment regarding XR is tested against the Goldstein score of each event. It is measured as positive and negative, generally, as well as across the following more specific emotions: anger, anticipation, disgust, fear, joy, sadness, surprise, and trust. Though EmoLex offers this degree of specificity of emotion, they are the focus of my descriptive analysis not my regression analysis. As previously discussed, this measure ranges from zero to ten for positive and negative polarities and the eight emotions measurements. One example of a negative tweet comes from user who calls the group "counterproductive" and suggests that their tactics of delaying traffic amount to an "attack[] [on] the working class going to work." Another Twitter user remarked that he was on his way to work but a blockade by XR caused him to "join the protest." This tweet received over 1,100 "likes" on Twitter. One Twitter user commented on the validity of the cause but was critical of the tactics chosen:

> Extinction Rebellion has lead [sic] to more people wanting to not listen to them, than to actually want to understand what they say. They're completely valid in what they're saying, but their actions are directed at the wrong people and it's impacting on the lives of ordinary people

Control

I make an effort to control for several factors that might prove to be threats to spuriousness to my theorized relationship. First, I include the log of Twitter followers. This is important because of the high degree of skew on Twitter followers that would likely lead to skewed residuals. Second, I include the log of tweet "Likes." In controlling for this, I attempt to ensure that tweets more likely to receive a large number of "likes" (i.e., those tweets that are especially positive or negative) do not impact the results. Finally, I control for verified accounts. This allows for me to ensure that established news publications and well-known thought leaders are not skewing my results. I am particularly concerned with news publications as these are the source for the GDELT data. Without controlling for this factor, my analysis is at risk for comparing the language of those news articles *in toto* with the language used in tweets aimed at disseminating those same articles.

Estimation Strategy

In order to test the association between sentiment and event disruptiveness, I use a fixed effects (FE) procedure to estimate my models. FE models are widely used in social sciences for studying time-series cross-sectional (TSCS) or panel data. FE models help to minimize unobserved heterogeneity and omitted variable bias (Allison 2009). In their study, Jorgenson, Austin, and Dick (2009) suggest that using FE models "provide a stringent assessment" of the relationships between variables. This type of modeling is highly useful in longitudinal data and, in the case of time point FE coefficients, is interpreted as "the average change in the dependent variable for each one-unit increase in the explanatory variable *between cases* [emphasis in original]" (Hill et al. 2020:365). In this study, I expect that each one-unit increase in the event disruptiveness will be associated with the average change in the sentiment.

Step 1: Descriptive Analysis

Though the group held actions during the global pandemic in 2020, this data may not reflect the potential of these events to have been in line with or even more extreme than their events in 2018 and 2019. Even the quantity of events dramatically declined with dates prior to March 1, 2020 having 489 events and the dates after March 1, 2020 having 284.The significant drop in number of events over time suggests that the pandemic may have also had an impact on the nature of the events. With many countries instituting lockdown orders and quarantining procedures, large group gatherings would not have been possible at the same frequency as before the pandemic.

As previous research suggested regarding the relationship between Twitter metrics and events (Jungherr 2015), the frequency of tweets regarding XR had several spikes during the dates under study. Figure 1 (above) shows that one of the most prominent of those spikes coincides with one of their most contentious events—the protest at the London Tube on October 17, 2019 which disrupted morning commutes and led to eventual regret from XR in their choice of tactics (Gayle and Quinn 2019). As previously mentioned, the global pandemic may have had an impact on this data as the movement had to necessarily alter their tactics to accommodate safety restrictions put in place.

The frequency of emotion words increased in number over the course of the timeframe under study with obvious increases in line with spikes in tweets seen in Figure 3. Additionally, the emotion of tweets has also changed over time in rhythm with the events. Twitter data shows that people display overall negative emotions with fear and anger being largely represented (See Figures 4 and 5).

Figure 3: Emotion Words Expressed in Tweets About XR

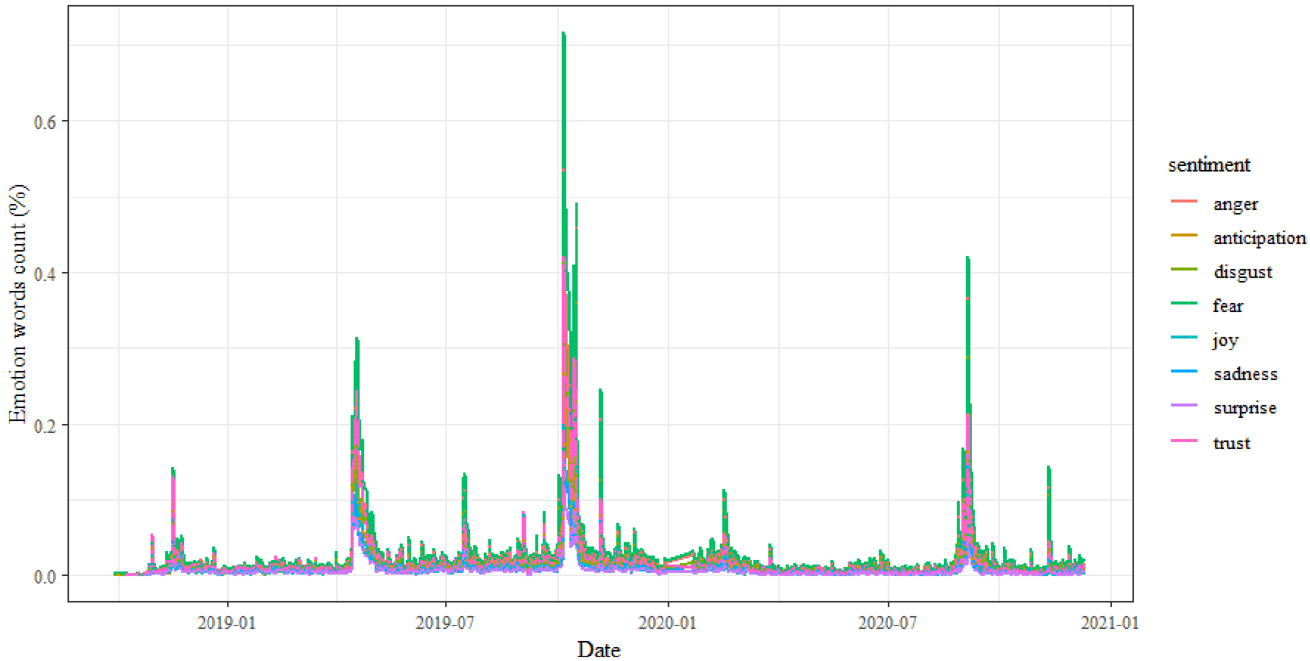


Figure 4: Distribution of Emotion Terms

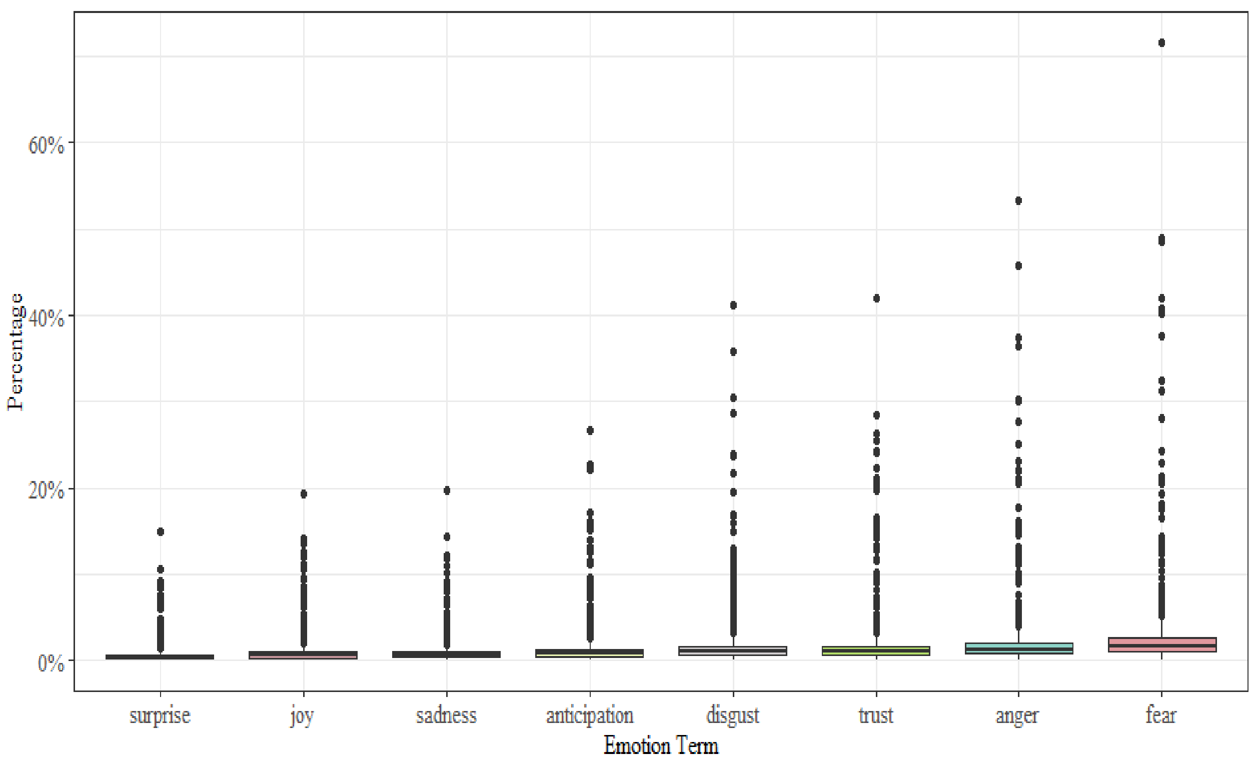
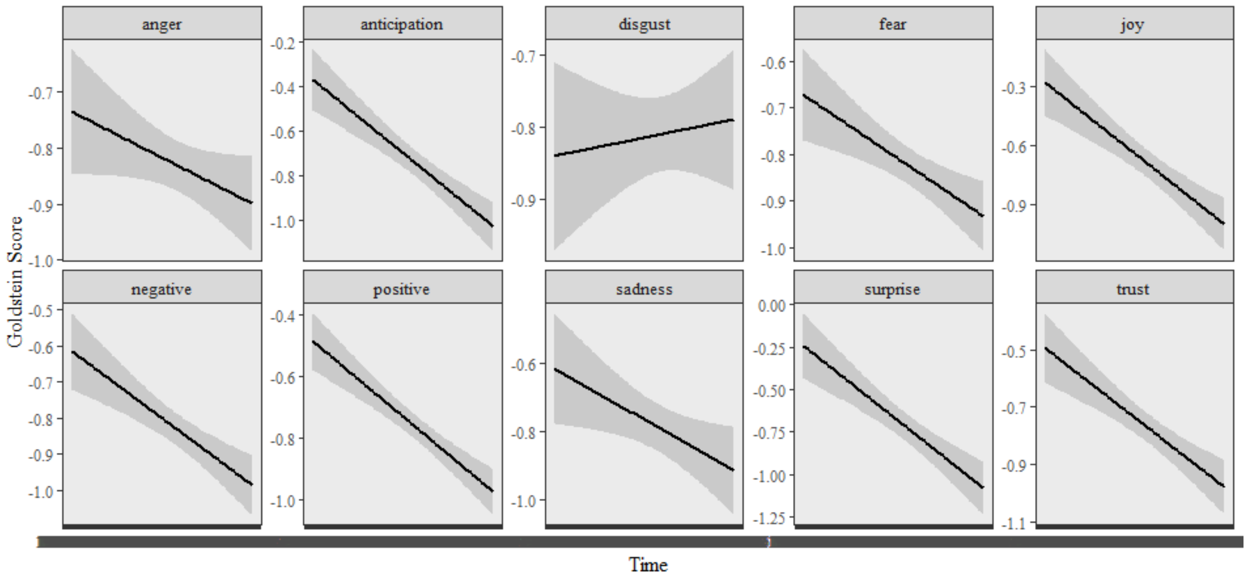


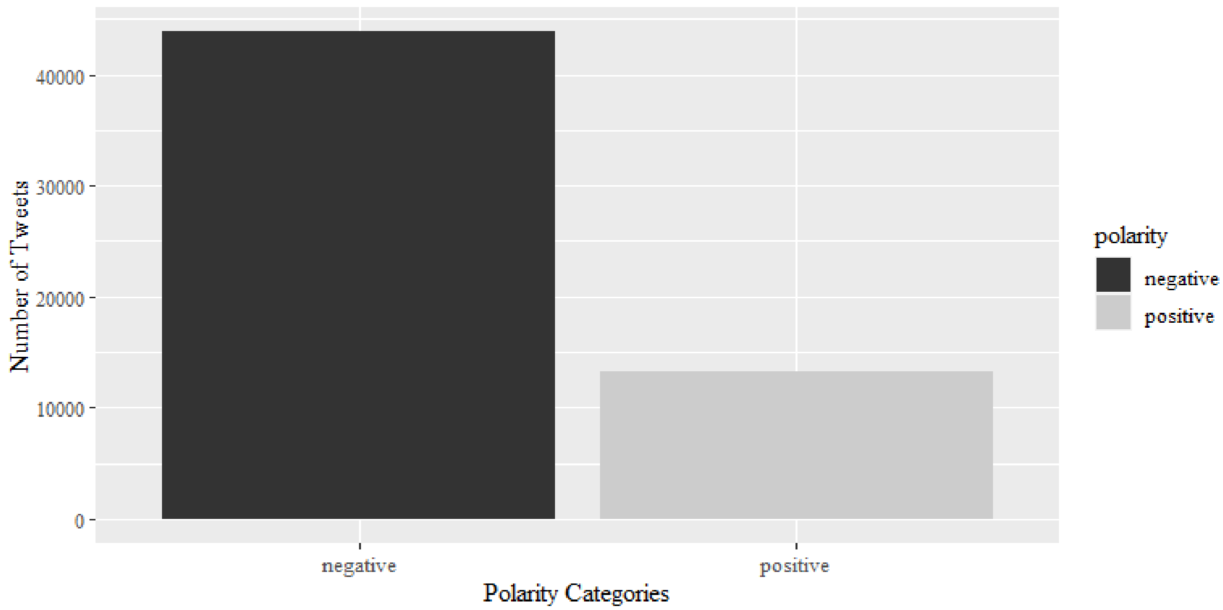
Figure 5: Sentiment Analysis of Tweets Mentioning XR Over Time



One possible alternative explanation for the emotions expressed in tweets would be that even supporters of the movements would be using language with seemingly negative connotations. Much of XR's own writings uses strong emotive language to describe the urgency of addressing climate change. They use a tactic they call "fear visioning" and have outlined in internal documents that they "must encourage more extreme actions to achieve meaningful change… Extreme self-sacrificial actions can act as a vanguard for the movement, inspiring people in their rebellious journey and focusing the world's attention" (Rose 2020). As shown in the figures above, fear and anger account for the largest proportion of emotions found in the data.

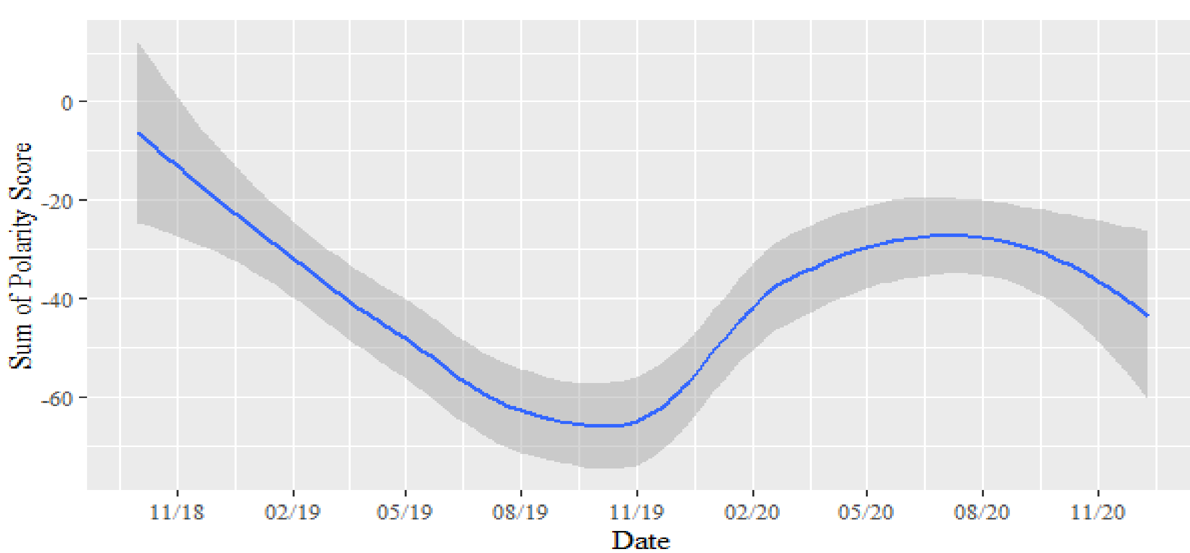
Next, I looked at the classification of tweets based on polarity. I analyzed the tweets based on a binary positive-negative classification. Negative tweets (N = 43,856) outnumbered positive tweets (N = 13,245) by nearly 4:1 (See Figure 6). While a certain degree of polarization does not have to be a necessarily harmful thing for movements, extreme polarization could have consequences which movements would have to contend with in order to build a broader base of support.

Figure 6: Total Negative and Positive Tweet Polarity



In order to explore the contours of this polarization, I looked at the change in polarity over time by taking the sum of polarity scores for each date available. Further evidence of shifts in polarity over time can be seen in Figure 7 with the lowest score, again, occurring at their most contentious protest. This also reinforces the overall negative sentiment towards XR given that the sum did not go above zero at any given time.

Figure 7: Change in Tweet Polarity Over Time



This negative sentiment is particularly prominent when actions score more negatively on the Goldstein Scale. When mapped together, it shows a clear picture of the change in polarity and the event coding (See Figure 8). In order to map these together, I scaled the scores by a factor of 93 so that they would be proportional to each other and reveal a clearer relationship. As shown, the lowest sum of polarity (i.e., the most negative) occurs in conjunction with the lowest (i.e., the most threatening) average Goldstein Scale score. Results from my linear regression model show that there is a statistically significant relationship (β=0.29, p<0.001) (See Table 1)

Figure 8: Tweet Polarity and Average Goldstein Scale Score Over Time

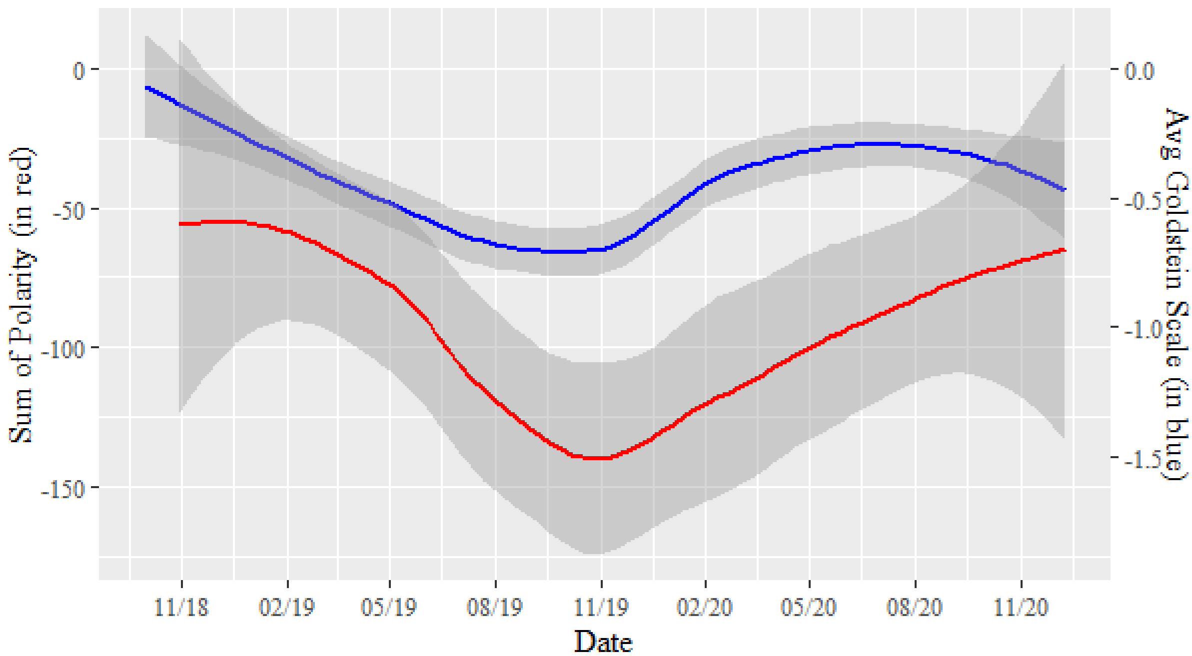


Table 1: OLS Regression of Polarity Score and Goldstein Scale

	Goldstein Scale
Polarity Score	0.29**
	(0.10)
Constant	-0.97***
	(0.10)
N	702
R-squared overall	0.01

All continuous predictors are mean-centered and scaled by 1 standard deviation
*** p< 0.001, ** p < 0.01, * p < 0.05

Step 2: Fixed Effect Analysis

As previously stated, I argue that positive sentiment on Twitter towards XR should be positively associated with the scale and perceived lack of extremism of events that are conducted by XR. Results from my linear regression model of the polarity and Goldstein scores show a small yet statistically significant and positive relationship between more cooperative protest events and the sentiment of tweets regarding the organization (β=0.004, p<0.05). This relationship persists when including Twitter user-level attributes such as the logged number of followers the user has, the number of likes a tweet gets, or the verification status of the account. All results from this analysis are available in Table 2 below.

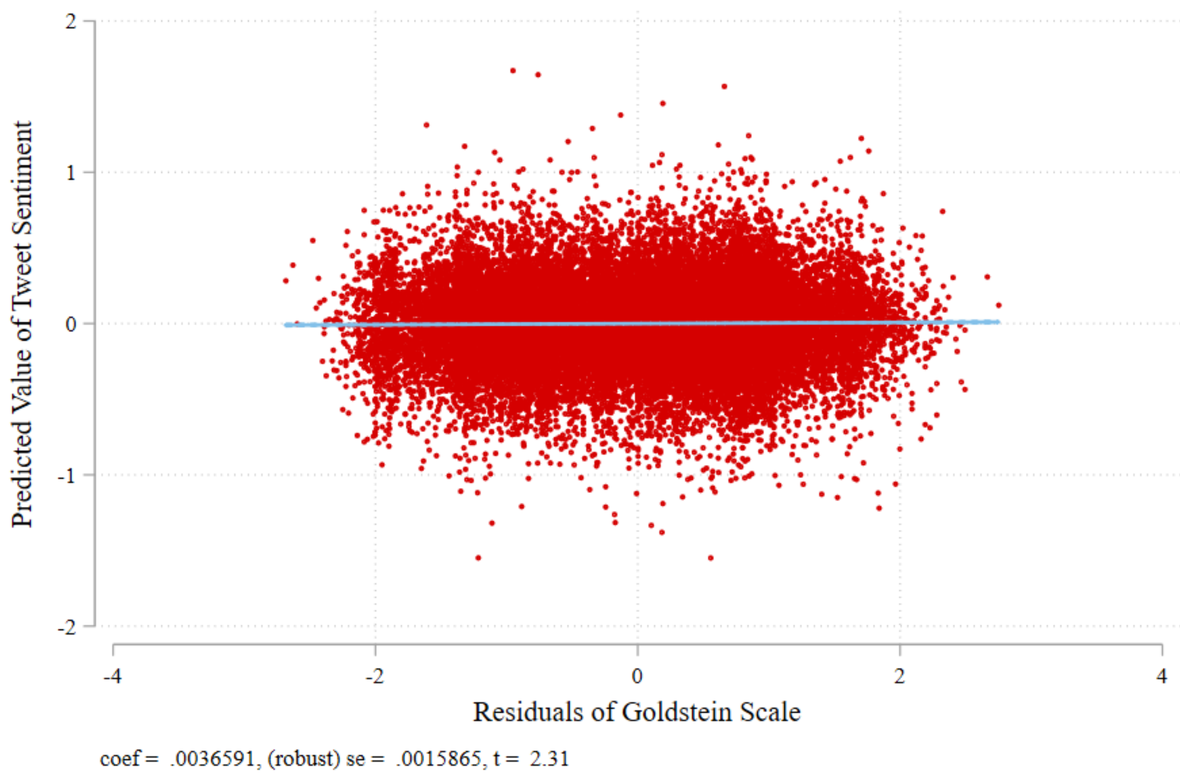
Table 2: Fixed Effects Estimates of XR Tweet Sentiment

	Model 1	Model 2
Goldstein Scale (z score)	0.004*	0.004*
	(0.002)	(0.002)
Followers (ln)		0.000
		(0.002)
Likes (ln)		-0.003+
		(0.002)
Date		-0.000***
		(0.000)
Verified Accounts (ln)		-0.000
		(0.006)
Constant	--0.051***	1.456***
	(0.002)	(0.295)
R-squared within	0.000	0.002
R-squared between	0.000	0.005
R-squared overall	0.000	0.003
N	22,211	20,044

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

I also visualize this relationship using an added-variable plot that shows the (full model) net coefficient based on the residuals of the Goldstein Scale and the residuals of Twitter sentiment (see Figure 9). While the coefficient is significant, it is small. However, this does show that a one standard deviation unit change toward more cooperative events is associated with a 0.004 unit change towards a more positive sentiment. This model suggests that the more cooperative an event is reported to be, the more positive the sentiment on Twitter will be regarding the movement generally.

Figure 9: Fixed Effects Model



From the outset of the movement, XR has relied heavily on describing the urgency and severity of climate change throughout their literature and even symbolism (their logo is a stylized hourglass). This framing led to their first demonstration attracting more than 1,000 participants (Taylor 2018). XR has worked to craft both political economic frames as well as environmental justice frames (albeit to a lesser extent) (Pellow 1999) in order to diagnose the dangers we are facing from climate change. However, as the above results show, their framing has not seemed to reduce the negative sentiment towards the group. Below, I discuss these results further as well as some limitations to this study and, finally, suggest areas for future research.

Discussion and Conclusion

While climate change is certainly an urgent issue—particularly in the coming years—and one that has increasing broad public support for action (Brulle, Carmichael, and Jenkins 2012), the tactics that are used can be detrimental to organizations who are trying to appeal to a mass audience and recruit a large base of members throughout the globe. This is vitally important as mobilization has been shown to resolve political conflict (Brulle et al. 2012). XR is attempting to recruit 3.5% of the global population in this movement, which would equate to over a quarter of a billion people. This is no easy feat—particularly if the movement's tactics and framing are alienating to a broad audience of could-be climate justice rebels.

Despite the fact that social movement studies have greatly expanded over the last 60 years, there still remains a relative dearth of studies which research more polarizing or "radical" movements. Further, studies generally examine movements as a whole rather than the specific events or actions taken on by those movements. The present study attempts to address this gap in social movement research while also utilizing novel dataset combinations. XR is a useful case to study. Unlike some issues, climate change—and even climate *justice*—has been gaining broad attention across the globe despite the unequal distribution of environmental harms. In the largest survey of public opinion of climate change ever conducted, the United Nations Development Programme (UNDP) found in their Peoples' Climate Vote that nearly two-thirds of the 1.2 million respondents across fifty countries agreed that climate change was a global emergency

(Flynn et al. 2021). However, could there be any potentially negative consequences when a popular issue is taken up by a seemingly unpopular movement? As with many social movements, public critique of the tactics chosen are frequent. Disruption of daily activities for the average person is a well-known and often used tactic. Yet, even subtle forms of protest are often deemed inappropriate (e.g., kneeling during the U.S. national anthem by athletes) and can elicit the ire of the public.

These findings indicate that climate justice organizations focused on base building should be cognizant of the way they frame their demands and tactics. Some more radical actions can negatively impact public perception. That is not to say that certain performative or "threatening" elements should not be a part of a movement's repertoire. However, understanding the way certain actions are perceived by the public can be helpful as movements determine what actions might assist in recruitment and what actions might be harmful to increasing participation with their movement. As such, movements should take into consideration the framing surrounding their goals and strategies as well as the ways they diagnose social harms, place blame for these harms, and motivate others to participate in their cause. This paper seeks to highlight this aspect of the social movement literature that has not adequately addressed radical or polarizing movements.

This study also serves to contribute to and reinforce recent scholarship on the use of Twitter data in the social sciences to determine sentiment towards a host of issues (Edelmann et al. 2020). Social movement researchers should make efforts to incorporate computational text analysis in order to find new and exciting ways to approach the study of social movements and collective action. As time passes and the world becomes more and more digitally connected, social media platforms such as Twitter may be integral to data collection and could potentially replace other methods of data collection which opening up temporal and geographic data previously unavailable.

Because XR has only been a formal organization since late 2018, the number of tweets about them have not accumulated to the volume that other social movements may have (e.g., BLM) which is also reflective of their low profile relative to other movements. This is one limitation of the study, yet one that could also serve as an advantage given that my analysis is more likely to capture the *effects* of the protest events themselves rather than feedback. Another potential limitation of this study discussed prior is the impact of the global pandemic on the ability to organize “on the ground” and partake in mass public events. This leads to potential complications in the data that might lead to weaker associations than expected. XR has been a victim in this as their main strategy has been bold and sustained outdoor public protests. Finally, regarding methodology, computational text analysis of contentious activity may lead to erroneous categorization of sentiments. Given that the language used by XR and its supporters regarding climate change and the perceived lack of action by world leaders on this issue has been emotionally charged—including words that might be classified by various statistical lexicons as negative—there may involve a skewed result. As such, these sentiments may also benefit from a thorough human-coded examination or self-made sentiment dictionaries for textual analysis that might provide a more nuanced classification.

Despite its ubiquitous use in the social sciences, FE modeling can have its limitations as well. Hill et al. (2020) thoroughly document a dozen potential limitations of using this strategy for panel data. While the current study seeks to minimize or address these limitations, there may be some still present. For example, the aforementioned authors point to *mysterious undefined variables* as a source of oversimplification or misinterpretation of results. They suggest that researchers "often assume (without direct confirmation) that certain characteristics (e.g., biology, personality, or culture) do not change over time" (2020:363). In this study of Twitter users' sentiment, this assumption is indeed present. Changes in opinion or cultural differences are not controlled for or addressed in this model.

Overall, this is an area ripe for future researchers. It would be useful to track the ongoing Twitter response to actions that are planned in the future. This would give a better understanding of how different levels of actions relate to various sentiments on Twitter. A greater amount of information and sentiment analysis could provide useful for XR and other social movements as they make decisions about what kinds of actions to undertake. Future research might also incorporate media coverage to gain a more comprehensive understanding of the way a XR is portrayed and viewed. It would also be beneficial to examine other movements who have been protesting in the era of social media—particularly ones that are more identity based than issue based. For example, the protest cycle against police violence in the United States that began in the summer of 2020 could provide illuminating data to examine. As COVID-19 continues to ravage many parts of the world, including the ones in which XR has been most active, bold public tactics may not be as feasible or desirable as they once were. Shifts in strategy and framing might be necessary as the movement moves forward and attempts to draw more people into the fight for climate justice and a sustainable future.

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