Title: *Carbon Print: How Analyzing State-Sponsored Media can Provide Useful Inferences About Nations' Policy Priorities Regarding Climate Change*

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I. Introduction: Reading the News

Carbon Print used Python-powered analytics to try to draw inferences about how America's geopolitical rivals use their state-sponsored media to talk about climate change. The purpose of doing this was to determine whether Russian, Chinese, and American media frame climate change in ways to promote their foreign policy agenda. Our expanded goal is to highlight the relationship between climate change reporting and inaccurate information.

State-sponsored media is a valuable tool for inferring the intentions and agendas of authoritarian regimes.[i] Our project builds off the work that other academics have conducted using Chinese and Russian English-language publications to draw meaningful conclusions about how these countries think about U.S. elections.[ii] Our work is in a similar vein, but alters the focus from considering policy issues that affect bilateral relations between states (American elections) to a globe-spanning issue that touches on political, scientific, and humanitarian considerations: anthropogenic climate change.

This report will provide a theoretical framework which more fully explains our rationale for linking media reporting to understanding states' climate change agendas. We then detail the strategy and tools that we used to collect and analyze our data, with a particular emphasis on explaining the functions and limitations of our Python-based programs. We present what we consider to be our most interesting findings and discuss what inferences we can draw from these findings as they relate to illuminating what China, Russia, and the United States think about climate change. Finally, we conclude our paper with recommendations on how to improve our research methods, specifically to increase their validity and expand their applicability to other fields of climate change research.

We conclude that Chinese media has a demonstrated tendency to report on climate change in a way calculated to reinforce Beijing's aspirations for international leadership, while Russian and the U.S. outlets for framing climate change reporting around celebrities and prominent personalities. However, we also deduce that the motivations behind Russian and U.S. approaches are fundamentally different: the former likely seeks to foment societal division by accentuating divisive themes and narratives, while the latter caters to the media preferences of a domestic consumer base.

II. Literature Review

State-sponsored media has two competing goals. On one hand, it can serve the public by communicating valuable information without private sector bias. On the other hand, this type of media has historically distorted information to suit the interests of the ruling class. The sort of state-sponsored media employed by authoritarian regimes like China and Russia to communicate with the English-speaking world is a form of propaganda: it represents a "deliberate, systematic attempt to shape perceptions, manipulate cognitions, and direct behavior to achieve a response that furthers the desired intent of the propagandist."[1]

[1] Propaganda which emanates from a transparently identified source and which tends to be factually accurate is "white" propaganda; conversely, information coming from a concealed or deliberately misattributed source and which contains lies, deceptions, and fabrications is "black" propaganda. State media outlets exist on this spectrum and fluctuate between the theoretical white and black constructs, mostly typically conforming to "gray" propaganda: the identity of the messenger is usually known, but the veracity of the information they are conveying varies based on states' geopolitical interests at a

The digital age has transformed the range and reach of state-sponsored media's gray propagandizing. During the Cold War, Soviet outlets like *Pravda* could not reliably penetrate Western nations' media environment.[iii] The advent of social media allowed state-sponsored outlets to deliberately craft narratives which would resonate with a targeted, diffuse international audience: so long as an outlet knew how to cater to consumer preferences in a way that would generate viral hits and shares, that outlet could be assured of its ability to substantially shape the perceptions of large segments of foreign populations.[iv] This dynamic works particularly well when the ostensible subject of the "news" being reported touches on topics which are politically polarizing: such stories play to the tribal allegiances of their readers and in so doing foment agitation and generate attention.[v] In doing so, politically-fraught stories also implicitly advance states' ideological and political objectives by saturating the communications environment with any given state's preferred perceptions of fact and fiction, right and wrong.

There is evidence that the Russians deliberately employed this stratagem both during and after the 2016 presidential election in the United States. *RT*--which until recently was known as *Russia Today*--played a prominent role in amplifying narratives which supported particular candidates and which exacerbated known fault lines in American society; examples include continually highlighting baseless speculation about Hillary Clinton's health, repeating warnings of an imminent terrorist attack on the U.S. military base in Incirlik, Turkey, and covering race demonstrations organized by Russian trolls and bots on social media.[vi] What states have done in the past is a useful gauge for anticipating what they will do in the future--and few issues are as culturally and politically fraught in the United States as is climate change. There is a strong incentive for states like Russia to use climate change--an already-existing wedge issue--to further sow division within the United States.

Alternatively, few issues have such far-reaching and long-term economic and political implications for global order as climate change does. This implies that state media could approach climate change in a way designed to portray their parent regimes in a positive international light or, alternatively, to showcase the irresponsible behavior of rivals. Chinese leaders, for example, have publicly emphasized the importance of addressing climate change as part of China's development and rising international profile. President Xi has also commented on the U.S.'s withdrawal from the Paris Agreement, stating that China is "taking the driving seat in international cooperation to respond to climate change."[vii] Since the establishment of the Clean Development Mechanism (CDM), China has begun seeing the opportunities climate change can afford through other countries' investment and technology flows into the country; China has reverse engineered these technologies to later become a manufacturing leader in the field, simultaneously allowing it to portray itself as a responsible power and address its significant domestic environmental problems.[viii]

From then until now, China has shifted its status within international climate negotiations to a presumptive responsible world leader of positive change. China's foreign policy ambitions can be seen in its One Belt, One Road Initiative, which involves massive investments in developing countries; the

particular moment in time; see Garth S. Jowett and Victoria O'Donnell, *Propaganda & Persuasion*, 6th. Ed., Los Angeles: SAGE Publications, Inc., 2015: 7-21.

ambitious goals it declared in the Conference of the Parties since Donald Trump won the U.S. presidency; and its south-south cooperation and EU joint energy transition initiative in 2017.[ix]

Unlike China, Russia has not established itself as a climate leader. In fact, with a growing demand for renewable energy, Russia's oil and gas export-dependent economy has a lot to lose from proactive responses to climate change.[x] Despite some ambitious goals it has set, it is criticized for lack of sufficient action and for generally lagging behind other countries; Moscow only ratified the Paris Agreement in 2019.[xi] Yet, climate change can also afford some opportunities to Russia, such as access to previously unavailable natural resources due to receding polar ice.[xii] This opportunity has not escaped China or the U.S., either: strategic positioning remains an overriding geopolitical concern of great powers, and both the U.S. and China have bolstered their arctic military presence alongside Russia.[xiii]

Climate change is reshaping the geo-political battle ground. It creates new spaces for conflict and dispute and brings new issues to light from intense water scarcity to climate induced migration, complicating international relations.[xiv]

As a result of the wide changes created by climate change and the past use of state media by America's rivals, we investigated the following hypotheses to infer how America's geopolitical rivals approached climate change from a substantive perspective: what they say, and how they say it, about climate change should provide powerful clues as to how they view this issue.

- ***H1: Countries' climate coverage will be consistent with their international climate agenda***
- ***H2: Russia and China will leverage climate change to promote their agenda against the U.S.***

III. Data Collection and Analysis Strategy

We constructed four distinct groups to test our hypotheses. First, we developed proxies for Chinese and Russia state media. The Chinese control group contained articles from both *Xinhua* and *Global Times;* the Russian group entailed articles culled from *RT* and *Sputnik*. We deliberately chose to focus on state-controlled media organizations with a robust English language communication apparatus: we wanted to understand the messages these countries tried to project to the world beyond their own citizens. Our third group contained American outlets *NPR* and *PBS*. While these are not the same type of state media as *Xinhua* or *RT*, we felt that it made sense for us to constrain our cross-country comparisons to outlets which are at least partially subsidized by the state. Finally, we constructed an international control group containing *BBC* and *Al-Jazeera*; we anticipated that these outlets would be less tethered to great power politics and might provide useful counterpoints to the Russian, Chinese, and American perspectives. These groups would inform our data collection strategy because they identified the places we would pull our data from.

We relied mostly on programs written in Python to compile and analyze our database. Our first step was to capture data from websites of the outlets in our control groups. We achieved this using a script centered around the method cse.list(), short for Custom Search Engine. This is a fairly versatile

API that Google offers.[2] With a broad range of parameters, it allows the user to make highly customized calls and requests. We made liberal use of four key parameters of cse.list():

- exactTerms = <*string*>, which indicates the keyword or key phrase we wish to find in our news articles;
- q = <*start date*> + <*end date*>, in which we establish our time frame;
- siteSearch = <*string*>, where we specify the domains from which we wish to scrape data; and
- fields = <*string*>, in which we specify what information we wish to scrape from our domain of choice.

For our pilot study, we used 'climate change' as our keyword, and all eight news outlets we identified above as our domains. We set a six-month time frame, from October 2019 to March 2020. In our script, we set the number of articles we wished to randomly scrape from each website at five per month. We saved each news article as a separate text file, then combined them into a pandas data frame to facilitate future analysis. This gave us an initial dataset of 240 news articles—five each month, over six months, for eight news websites.

IV. Research Methods

How we obtained an overview of climate reporting trends

As we moved forward with our research, we gradually adjusted our scraping program and collected additional data to suit different analysis objectives. First, we thought it would be helpful to contextualize our research—that is, to make some comparisons between trends of news coverage prevailing in the past six months and those of years past. We thus expanded our time frame of search to include President Obama's second tenure, and President Trump's first few years in office.

Our initial scrapes for more dated articles yielded highly uneven amounts of data across time. There were earlier months, mostly in 2013 and 2014, for which we could not find a single article pertaining to climate change on Chinese or Russian websites. On the other hand, there were periods such as Q1/2017, for which we managed to get full sets of five articles per month from each news outlet. A perfunctory manual search on each of our eight websites of interest showed that during these months of data abundance, there were many more than five articles per website on the topic of climate change.

We found ourselves concerned that perhaps we were constraining the explanatory power of our data by putting a cap on the number of articles to retrieve per month: There are only so many times one can mention the phrase 'climate change' over the scope of five articles. We subsequently adjusted our scraping program so that it retrieved *all* articles on climate change over a specified period. A combination of word frequency and article count, we thought, would reflect more accurately the wax and wane of media attention over time.

[2] *API*, short for Application Programming Interface, refers to software intermediaries that deliver the user's requests to the provider—in this case, Google—then brings the provider's response back to the user. For more information, please refer to: Google. (2020). *Custom Search API*. Retrieved from developers.google.com/custom-search/v1/reference/rest/v1/cse/list

Finally, we thought it would be rewarding to plot news coverage of climate change against that of other policy issues, to see if there was some form of resonance between areas of a country's foreign policy over time. To this end, we used the parameter `orTerms` to specify a second keyword or phrase that cse.list() should look for in an article. We cycled through a list of secondary key phrases including 'Presidential election', 'Paris Agreement', 'Arctic', 'sanctions' and tariffs', which reflect issues of geopolitical importance.

While we expanded our search time frame to better identify broad patterns of news coverage, we also focused the bulk of our research on the 6-month period between October 2019 and March 2020. We hoped that a smaller scope of analysis would allow us to hone in on subtle changes in trends. We also re-imposed the five-article cap on monthly output, realizing that the highly uneven distribution of data over time would create challenges of data normalization when we conduct our sentiment analysis.

How We Determined What Countries Are Talking About

We used NLTK to assess the most common words used in different outlets over our focused six month window as a proxy for the prevailing themes they use in the context of climate change. We built several functions taking a list of articles in different outlets and returning the most used words. We wrote functions that check word frequency per article, month and 6 months to get both a broad idea for the entire time period and to spot changes over time. We also checked for bigrams frequency per month and 6-months for every outlet to check for any discrepancies in themes. We kept the outlets seperate to account for any differences that might occur between outlets and different writing styles and formats that can change word frequency making one outlet's words more dominant than the other.

To clean the data we used stopwords[3] and extended the default stopwords list by running text files through cleaning functions several times to eliminate as many insignificant words as possible. The same list was used for all functions. To make sure we were not deleting words that were important for one outlet but not the other, we familiarize ourselves with the content of some of the articles. Some inconsequential words were frequently used in outlets, since our scraping method kept not only the content of the article but also links, ads, and privacy notices; this necessitated us ensuring that we captured these words and phrases on a case-by-case basis within each outlet.

How We Determined States' Tone of Voice

After we determined *what* states were saying about climate change in their media outlets, we next wanted to determine the *tone of voice* in which they were saying it. We used two sentiment analysis tools to facilitate this task.[4] The first of these was the Valence Aware Dictionary and

[3] *Stopwords* refers to a process of employing a Python library to remove common and generally inconsequential words from the body of a text before commencing analysis on it; typical examples are "I," "and," and "the."

[4] *Sentiment analysis* refers to the process of computationally identifying and categorizing opinions expressed in a piece of text to determine a writer's attitudes; this has been one of the main focus areas of research in Natural Language Processing (NLP) since the early 2000s; see Lexico,"Sentiment Analysis", February 28 2020, available at https://www.lexico.com/en/definition/sentiment_analysis; Federico Alberto Pozzi et al, "Sentiment Analysis in Social Networks", Elsevier Science and Technology Books, Inc., 2016.

sEntiment Reasoner, or Vader; Vader is a lexicon-based Python library that has demonstrated utility in assessing the positive and negative sentiments of social media texts, editorials, and movie reviews.[5] Our second sentiment analysis tool was TextBlob, which is also lexicon-based. Both Vader and TextBlob display the average polarity for a given passage of text on a normalized scale running from -1 (perfectly negative) to 1 (perfectly positive).

Our basic sentiment analysis methodology involved writing the contents of every article in every outlet into a single .csv file; as each article was written to the .csv, it was also analyzed by both Vader and TextBlob and its sentiment scores (positive-negative-neutral) written in as additional columns. This functionally consolidated all of the sentiment information about every article within every outlet in a single database.[6]

We first analyzed the sentiment database to determine the proportion of articles in each outlet that were predominantly positive, negative, and neutral; this provided us with insights as to the general emotional tone--at least as construed by Vader and TextBlob--within different state-sponsored media companies. We suspected that this information would be valuable as a heuristic to help frame our understanding of the second analysis we conducted, which involved looking at the variation in each outlet's sentiment scores for every month from October 2019 to March 2020. We would finally relate the monthly sentiment variations in each outlet to the monthly top words to build a composite picture of what was being said, and how the content of state media outlets' messaging related to the variations in their sentiment.

We intended to use the similarities between Vader and TextBlob to have the latter serve as an honesty check on the former. Unfortunately, the two tools came to dramatically different conclusions about the relative positivity and negativity of different media outlets; we will discuss this at greater length in Section V: Limitations and Mitigation Strategy.

Finally, we converted the monthly word frequency for each outlet into .csv files and used pandas to create a bar chart for each outlet showing the top 5 words each month over the 6 month period. We compared these top words with sentiment analysis displayed over the same time period.

V. Limitations and Mitigation Strategy

The one major weakness of our scraping program was its inability to process data from news websites that do not use the HTML <p> element to indicate paragraphs (*Global Times* and, to our surprise, *PBS News*). For these websites, we were forced to scrape all the text on each page, including headlines, hyperlinks, privacy notices and copyrights.

This had the effect of skewing the results of some of the word frequency counts we conducted as well as our sentiment analysis efforts; the most frequent words in many articles would be special

[5] *Lexicon-based tools* score each word in a given body of text according to a prefabricated dictionary of words and scores; they are distinct from supervised machine learning tools, which can train neural networks to score text based on training with large samples of data; see David Zimbra et al, "The State-of-the-Art in Twitter Sentiment Analysis: A Review and Benchmark Evaluation", *ACM Transactions on Management Information Systems*, Vol. 9, No. 2 August 2018; Parul Pandey, "Simplifying Sentiment Analysis using VADER in Python (on Social Media Text)," *Medium*, 23 September 2018, available at https://medium.com/analytics-vidhya/simplifying-social-media-sentiment-analysis-using-vader-in-python-f9e6ec6fc52f.

[6] We subsequently interpreted these databases by converting them into DataFrames using the Python Pandas library.

characters or common words, such as the "privacy," or "withdraw." Meanwhile, the prevalence of such words in our sentiment analysis would potentially skew the aggregated polarity scores for each article by retaining characters and words that were devoid of meaning but which Vader or TextBlob might construe as emotional. We ultimately mitigated this problem by expanding the list of generic stopwords we used in each article with tailored words, phrases, and characters which we observed in particular outlets.

Our sentiment analysis efforts were hampered by the limitations inherent to lexicon-based tools. Chief among these were the problems that both Vader and TextBlob have with understanding context, colloquialisms, and sarcasm.[xv] This was especially pronounced in the TextBlob results of sentiment analysis, which found that 100% of the articles in many outlets were positive even when this was manifestly not the case.

We attempted to mitigate this problem by employing a third natural language processor, the Stanford CoreNLP package. This tool has the advantage of having been trained by academics on a trove of movie reviews, which makes it inherently better at parsing out both positive and negative sentiments that might occur in the same sentence.[xvi] Unfortunately, we were not able to successfully establish a connection with the Stanford server that powers this package during the time span of this project. Were we to continue to refine our methods and analysis, we would both again attempt to integrate the Stanford CoreNLP package, and attempt to train our own neural net to provide a more tailored assessment of the data we would analyze.

VI. Findings

To get a brief overview of how news coverage of climate issues have changed over the years, we first plotted counts of the word 'climate' against time (Figure 1).

All three countries of interest have witnessed a conspicuous rise in mentions of 'climate' since President Trump took office. Most dramatic is the increase in coverage by Chinese outlets. In fact, China had seemed poised to overtake the United States in terms of climate change reporting before the COVID-19 pandemic began dominating the headlines in March 2020.

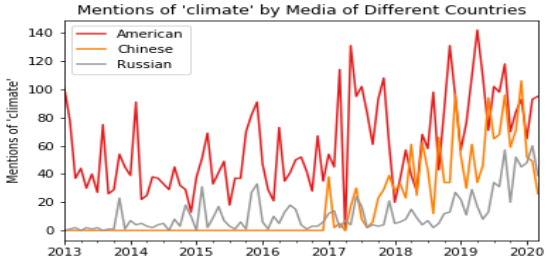


Figure 1. Mentions of 'climate' over time by news outlets of different countries

We then attempted to gain some insight into the policy content of climate reporting by plotting the frequencies of a number of other keywords against time.

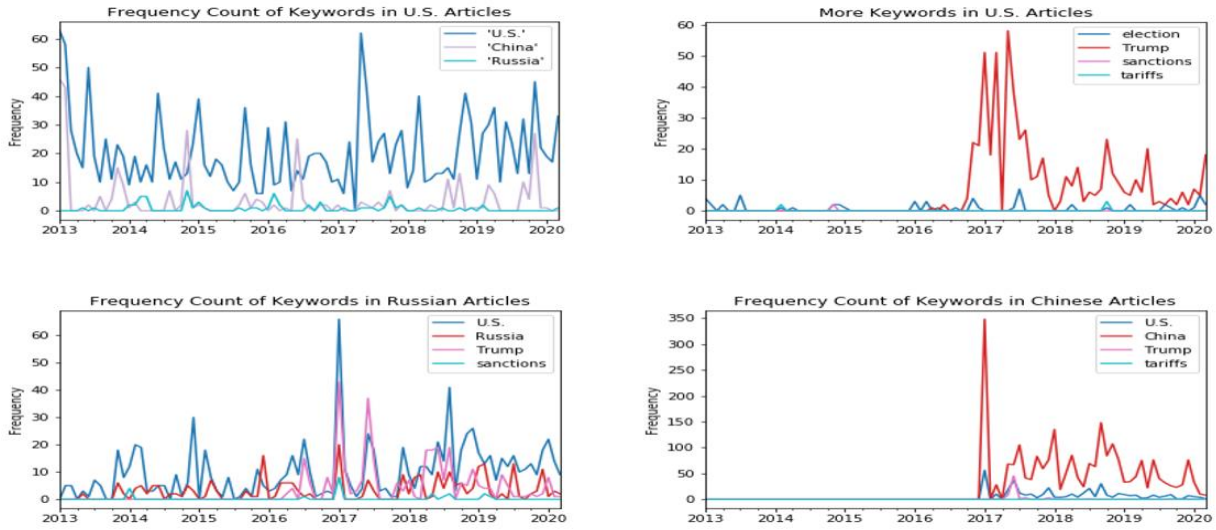


Figure 2. Mentions of keywords over time by news outlets of different countries

U.S. and Chinese news articles on climate change were dominated by mentions of their own respective countries, whereas Russian articles seem to have strongly associated climate issues with the United States. Surprisingly, there was no obvious linkage between climate change and other foreign policy issues, e.g., sanctions and trade tariffs.

We were intrigued by the surge in mentions of some keywords in 2017. It is fairly clear why the words 'U.S.' and 'Trump' appeared so frequently halfway into the year: this was when the Trump administration announced its withdrawal from the 2015 Paris Agreement. It is slightly less obvious as to why Chinese news outlets were so liberal in their use of the word 'China' in January 2017. We believe this had to do with President Xi's speech to the World Economic Forum, which cast China as a new leader in climate mitigation. The 2017 surge in mentions of 'U.S.' by Russian outlets roughly coincided with a sharp increase in their mentioning of 'Trump', indicating that they were intent on discussing climate change less as a U.S. issue and more as an issue relating to President Trump's threats of withdrawing from the Paris Agreement. Russian media has an observed tendency to bolster their coverage of President Trump when he is under attack from political rivals within the United States, or from the international community regarding his foreign policy.[xvii]

Finally, we tried to determine if there was any relationship between coverage of climate change and issues of the domestic economy. To this end, we fitted simple linear regression models predicting the count of some keywords using various economic and price indicators. We report some statistically significant and near-significant results below:

```
lm_from_df(rus_tab, 'wti', 'climate')
```

```
climate = 25.301 + -0.207(wti)
P-value: 0.002
R-squared: 0.107
Standard error: 0.0
```

```
lm_from_df(usa_tab, 'snp', 'climate')
```

```
climate = -17.865 + 0.034(snp)
P-value: 0.0
R-squared: 0.24
Standard error: 0.0
```

```
lm_from_df(chn_tab, 'cci', 'climate')
```

```
climate = 1104.017 + -10.948(cci)
P-value: 0.017
R-squared: 0.065
Standard error: 4.0
```

```
lm_from_df(chn_tab, 'sse', 'logged_u.s.')
```

```
logged_u.s. = -0.308 + 0.0(sse)
P-value: 0.071
R-squared: 0.038
Standard error: 0.0
```

Figure 3. Results of regressions involving word counts and economic/price indices

We found remarkable the extent to which Russian and U.S. climate reporting could be predicted, respectively, by the WTI spot price and the S&P 500 Composite Index. The results pertaining to China, while statistically less powerful, are quite substantively meaningful: Chinese news outlets are less inclined to mention the word 'climate' when confidence in the government is high, but apparently *more* inclined to associate climate issues with the United States when the Shanghai Stock Exchange (a proxy for economic growth, which is measured in quarterly intervals only) shows positive growth.[7]

In addition to checking the intersection of specific issues and climate change, we wanted to see what stories' most common words could tell us over a condensed interval of six months. Chinese outlets mentioned China often, as well as words such as development and UN; the Russian outlets frequently mentioned Greta Thunberg; the American outlets mentioned corona, health, deal and politics (PBS) but also whales, sea and water (NPR). Al-Jazeera, similarly to NPR, mentioned coronavirus, health and pandemic while the BBC used more positive words like hope and future. These initial results began to confirm some of our hypothesis; namely that China wants to posit itself as a climate leader, however the other themes were not as clear cut and needed more context both in terms of sentiment and the changes over time. To do so we zoomed in on monthly word frequency and compared to sentiment over time. This provided greater insight, the most interesting of which we present below.

Themes:

Both Vader and TextBlob assessed that the majority of the climate change-related articles in our control groups were more positive than negative. Figure 4 depicts the proportion of positive to negative articles within each outlet as calculated by each tool.

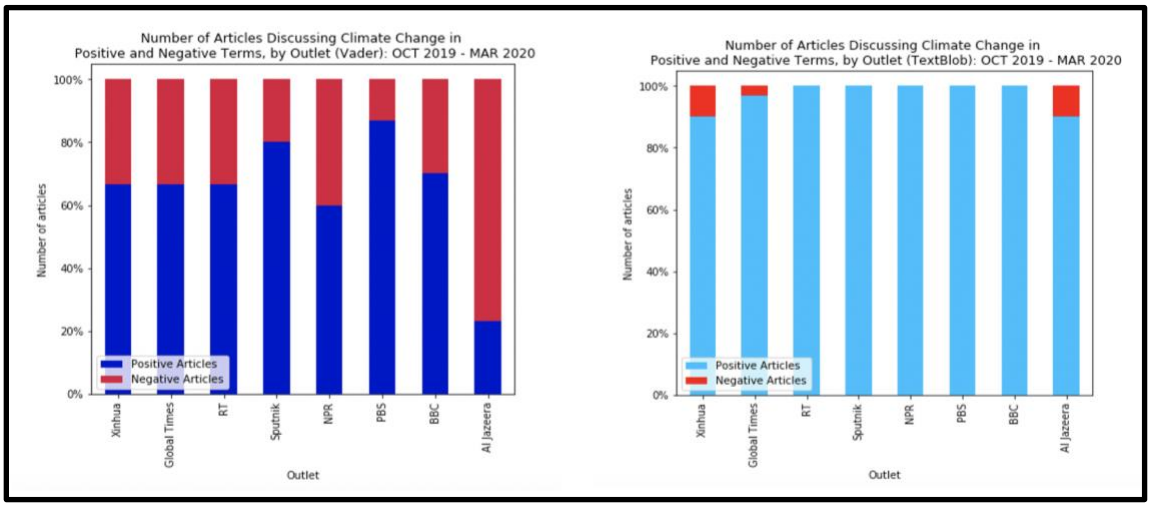
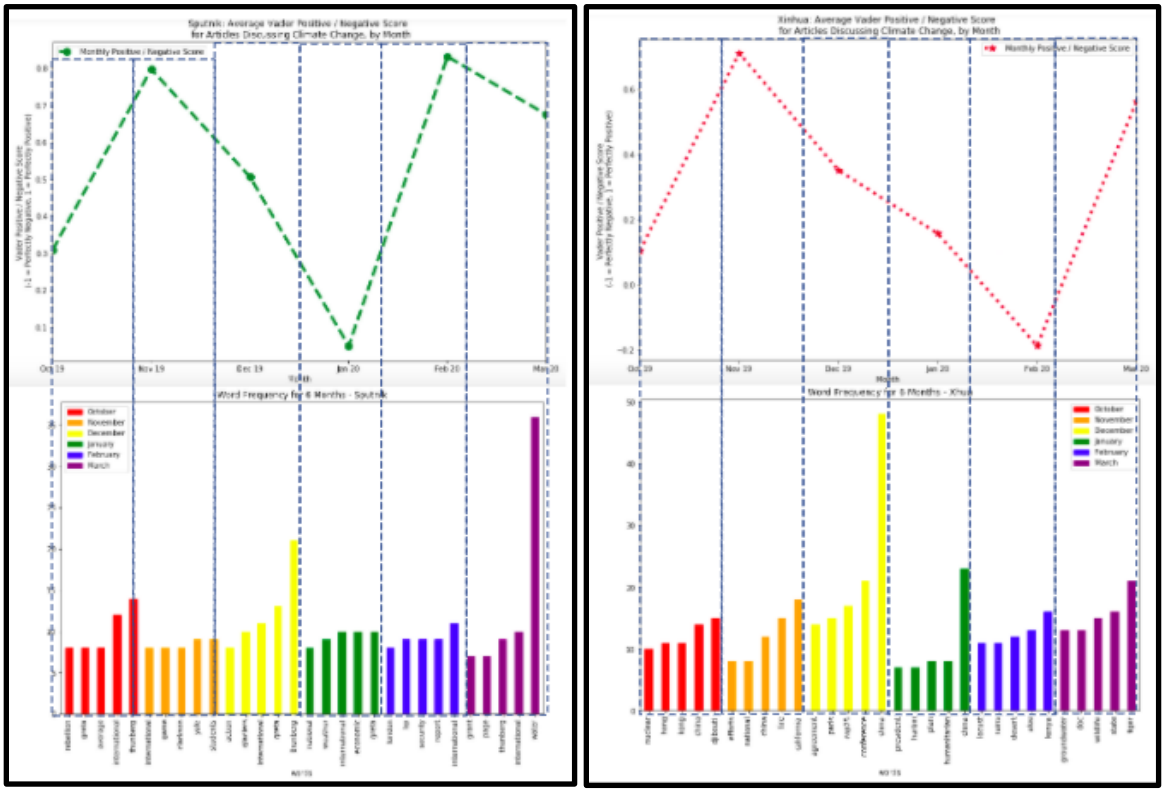


Figure 4: Depiction of the proportion of positive and negative stories in each outlet

[7] We tested beforehand for possible transformations of data using Box-Cox normal plots, and found it prudent to use a log-level model to predict the count of 'U.S.' in Chinese news articles.

These findings caused us to regard TextBlob as an unreliable tool and to subsequently discard it in the rest of our analyses. Meanwhile, Vader's assessments indicated that an article about climate change appearing in Al-Jazeera during the six month time frame of our study was more likely to be negative than positive. *NPR* and *BBC* respectively had the next highest proportion of negative articles, followed by a tie between *Xinhua*, *Global Times*, and *RT*. These results did not comport with what we expected to find: we anticipated that, as it is so often depicted in American news outlets, the topic of climate change would tend towards the apocalyptic in media reporting regardless of national origin. An immediate explanation for this disparity is that while Vader appeared to be more reliable than TextBlob, it still was not able to suss out the sarcastic from the positive or the negative from the neutral when reading the articles in our database.

We decided to examine the variation in each outlet's Vader assessments alongside the most common words in each outlet by month to corroborate this suspicion. Doing this helped clarify why some outlets' climate change articles were construed as positive; furthermore, it helped us to identify linkages between key terms' frequency and the direction that sentiment tended to vary when these terms were present. Figures 5 and 6 provide an illustration of this contextualization process for *Sputnik* and *Xinhua*, which produced the most interesting relationships between word frequency and sentiment change over time for Russian and Chinese outlets.[8]



Figures 5 & 6: Variations in Outlet Sentiment by Month, Overlaid by Top 5 Words by Month for *Sputnik* and *Xinhua*

[8] All of the context figures we generated can be viewed in Annex A.

We inferred from Figure 5 that the average positivity score for *Sputnik*'s articles was generally lower in months where Greta Thunberg was one of the most frequently used words in those articles. Additionally, Greta's name tends to be invoked much more typically than the other frequent words; the average frequent word used in *Sputnik* in the month of December 2019 was used 12 times, while "Greta" was used more than 20 times. The fact that Greta Thunberg was so singly focused out and was usually related to a decreased emotional content led us to conclude that Russian coverage of climate change to be positive when it is generically focused on climate-related issues, but is also prone to bouts of sensationalism by highlighting the role of celebrity activists--and when it does this, it does it with negative connotations.

Figure 6 tells a different story for China. The *Xinhua* sentiment trendline is notable in how much it steeply declines in positivity over time; concomitantly, the frequency of the word "China" is much higher in more negative-scoring months, and appears in these instances alongside words suggesting international collaboration ("agreement," "paris," and "cop25," for example). When the frequency of the word "China" goes down, so too do the international collaboration words: these are replaced with words more clearly associated with the effects of climate change, such as "forest," "wildfire," and "groundwater," and the positivity score starts to trend back up. The inference we draw from these observations is that when China talks about itself frequently in relation to climate change, it is doing so with an eye on posturing itself as a world leader capable of solving an international and dire crisis.

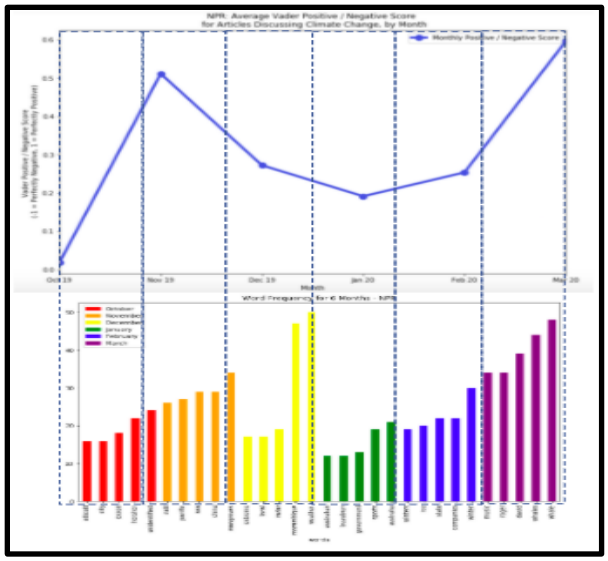


Figure 7: Outlet Sentiment by Month, Overlaid by Top 5 Words by Month for *NPR*

By comparison, Figure 7 shows *NPR*'s sentiment variation overlaid with its most frequent words by month. The most interesting observation to glean from this information is that there are distinctly different outcomes between months which discuss the harsh effects of climate change on the one hand and the months which talk about possible solutions on the other. *NPR*'s highest sentiment occurs in November 2019, and the most frequent words for that month all derive from stories that explore novel ways of mitigating climate change's effects. Similarly, sentiment spikes again in March

2020, in conjunction with frequent mentions of whales and music and their application to machine learning to fight climate change. The sentiment of *NPR* drops most often when another country is mentioned as a frequent word (e.g., Mozambique, Australia), and usually this is in connection to an extreme weather event in the specified country. The one country this does not hold true for in our data is China.

VII. Discussion

We find mixed evidence supporting our initial hypotheses. H1, which predicted that countries' climate framing would be consistent with their international climate agenda, generally held up to our findings: The surge in Chinese climate reporting since 2016, plus the coincidence of China's frequent self-mentions alongside mentions of other countries in a comparatively negative tone of voice, suggests a country that wants to demonstrate global leadership. Russia's climate change messaging was generic, but punctuated by occasional noticeable emphasis on celebrity advocates like Greta Thunberg--advocates sure to rile up particular segments of the international *RT* and *Sputnik* viewing base who resent youthful globalist celebrities. The United States' outlets were also generic, focusing on celebrities protesting against climate change, mentioning big companies such as Exxon, and air pollution.

There was little evidence to support H2: Mentions of 'U.S.' and 'Trump' in Russian and Chinese news articles have actually been on the decline since 2017. China consistently shows evidence of using climate change as a way of promoting its agenda of asserting global leadership, but Russia used language that could be reasonably construed to be targeted at wedge issues in approximately one-third of the cases we examined. The U.S. tends to talk about climate change predominantly in terms relating to domestic audiences' preferences, with emphasis on celebrities, extreme weather events (such as Mozambique's cyclone or Australia's wildfires), and whales. The only state which shows any indication of reporting on climate change in a way designed to advance an agenda against American interests is Russia--but it does this in an oblique way, designed more to foment societal division within the U.S. than to actively promote Russian policy initiatives.

VIII. Conclusion

Our research's initial findings provide some interesting insights into how state-sponsored media is tethered to a given country's foreign policy agenda. China is the most prominent example of this, as its coverage of climate change seems to neatly align with its demonstrated intention to assert leadership through involvement in the developing world and harnesses international climate negotiations as platforms to execute such moves.

Other countries are not as overt: Russia does not create a direct channel to confront America over the Arctic. However, its use of liberal tropes such as Greta Thunberg and Yale students can play upon a particular audience's perception of climate change as a leftist, woke issue; this is similar to its approach to U.S. elections, where it seeks to target and exacerbate conflicting value systems within American society. We make this inference based on Russia's demonstrated past behavior while also

acknowledging that its behaviors in one topic area (U.S. domestic politics) might not directly overlay with its behaviors in another.

American outlets' use of celebrities could be viewed in a similar vein, but as the target audience of these outlets is different (i.e., a domestic audience instead of an international one), this is highly unlikely; these stories likely were reported because of the public's genuine interest in the prominent personalities involved in them. The variety of U.S. outlets' themes lends further credence to this deduction.

Our control group outlets of *BBC* and *Al-Jazeera* did not seem to have the same approach as the other outlets. *BBC* had more climate-related words, such as "targets," "gas," "carbon," and "future." The only mention of other countries was in the context of the two significantly big news events of the time: Venice's floods and Australia's fires. Al-Jazerra words were less indicative of a certain narrative but did focus on coronavirus.

Further research is certainly needed to further clarify the relationships we have uncovered here. More refined language processing tools could allow us to further expand the time horizon of our word count and sentiment analysis, for example. Yet, even with the limitations of our project we believe our research could allow policy makers and academics to use state media as a valuable methodology for understanding climate change security between nation-states. We believe that this is a novel approach to an urgent international issue, and that our initial foray into research methods represents a valuable contribution to the field.

[i] Julian TszKin Chan and Weifang Zhong, "The 'Value' of Propaganda: Machine Predictions of Rare Events Based on Text Data," *Yale Journal of International Affairs*, 5 March 2020, available at http://yalejournal.org/article_post/the-value-of-propaganda-machine-predictions-of-rare-events-based-on-text-data/.

[ii] See Foreign Policy Research Institute, "Introduction of the Foreign Influence Election 2000 Project," November 2019, available at https://www.fpri.org/fie/what-is-fie-2020/.

[iii] Jim Rutenberg, "RT, Sputnik and Russia's New Theory of War," *The New York Times Magazine*, 13 September 2017, available at https://www.nytimes.com/2017/09/13/magazine/rt-sputnik-and-russias-new-theory-of-war.html.

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[v] See Rutenberg; Dan M. Kahan et al, "'They Saw a Protest': Cognitive Illiberalism and the Speech-Conduct Distinction," Stanford Law Review , Vol. 64 (2011): 8; Dan M. Kahan et al, "Cultural Cognition of the Risks and Benefits of Nanotechnology," *Nature Nanotechnology*, Vol. 4, No.2, (2009):87.

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[xiv] Ibid.

[xv] Rebecca, Riso, "Sentiment Analysis: Beyond Words," *Towards Data Science*, 27 March 2019, available at https://towardsdatascience.com/sentiment-analysis-beyond-words-6ca17a6c1b54.

[xvi] Ibid.

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