

SOCIAL MEDIA COVERAGE OF CLIMATE CHANGE IN POST COVID ERA (2020-2023): A STUDY OF X

JOURNAL OF COMMUNICATION PEDAGOGY
AND PRACTICE
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Abstract

The phenomenon of climate change is fast gaining attention among the peoples of the world, especially now that Covid-19 has been described by World Health Organisation as having no threat. Several nations and governments are taking actions and making plans to mitigate the effects of this phenomenon or see how they can circumvent the various ways climate change affects their people, particularly that the deadline of Sustainable Development Goals target draws near in 2030 and having environment at the heart of Goal 15. At different times, there had been discussions at governmental, organizational and group levels. At the individual level, the discussion is also common even among people with little or no familiarity, particularly on the social media. This study sought to know how Twitter, now X, a major social networking site, has been advancing the climate change discussion. A content analysis of trends of discussion on topics bordering on climate change on X was undertaken to examine how trendy these topics are. The period of January to June 2022 was chosen as the duration. It was found that X was used very heavily to spread information about climate change and that majority of the tweets centred on its effects on people around the world.

Keywords: Climate change, X hashtags, Covid 19, Social Media, Coverage

Introduction

Towards the realisation of the Sustainable Development goal on environment, climate change has become a major challenge facing society and a problematic issue to communicate: it has complex causes and consequences largely beyond people's biographical horizons – few will directly experience its consequences (Schäfer, 2012). The media have been identified as an especially important agent in the formation of common-sense knowledge about climate change (Carvalho, 2010; Moscovici, 2000), leading much research to examine the climate change dis-course in various mass media, mostly print newspapers and television (Moser, 2010). Yet, as stakeholders from scientists to policy-makers increasingly turn to social media to disseminate information about climate change and mobilise support for (in)action on climate change and members of the public increasingly use social media (Schäfer, 2012), the climate change discourse on social media becomes a

priority research area. While the existing body of research on the public understanding of science (PUS) offers well-established ways of studying traditional mass media as well as public and policy-makers' issue perceptions (via content analysis, surveys/experiments and case studies, respectively) (Suerdemet al., 2013), little agreement exists as to what methods can be employed to reliably study social media and what insights can be achieved. The absence of methodological guidelines can be attributed to the challenging, hybrid nature of social media as both 'media' (information sources) and data about people's behaviour. This hybrid nature means that its study can potentially provide unprecedented access to people's behaviour and the communicative space around an issue. The hybrid nature of social media also suggests that a mix of different but complementary theoretical frameworks may need to be harnessed to guide analysis. In particular, the notion of a personal public' (Schmidt, 2014) is fundamental to

understanding the role and use of social media such as X. Personal publics can be considered an ideal type of communicative space characterised by three main features. Information is selected and displayed according to criteria of personal relevance (rather than following journalistic news factors); information is addressed to an audience consisting of network ties and is made explicit (in contrast to being broadcast to an unknown mass audience), and information is often disseminated in a conversational rather than unidirectional way. In the context of social scientific research, X can offer information about the technological affordances of this platform, details about the social and textual relationships of its users and of user-generated content and insights into the shared rules and expectations within the community of users (Weller et al., 2014). Many discussions around coverage of climate change issues are actually happening online on many social media platforms. These are mainly to create

discussions around awareness, applications and players in the area. Meanwhile, lately, this discourse is now being taken to mainstream media and or their online versions. This is the crux of this study, which is to review the coverage of climate change issues on X.

Research Objective

To investigate the level of coverage X users have given climate change issues since the end of the Covid-19 pandemic

Literature Review

Communication plays a crucial role in forming social representations. In this context and in line with previous studies, social representations are conceptualised as user-generated semantic networks at the aggregate level (Veltri, 2013a, 2013b). SRT can thus be employed to map the semantic spectrum of issues discussed in relation to climate change on X. Here, we move from user-generated content analysis to selection of online news. A recent shift from traditional 'push media' to emerging 'pull media' has implications for how the public

consumes science news and information (Torres-Toukoumidis, Angel, Sofia, Santiago, Castro, 2023). By virtue of increased control and choice over media content afforded by the Internet, understanding the media ecology of tweets means better understanding sources of content that users re-publish through their X accounts. On X, information sharing can be conceptualised in two stages or degrees: (1) selecting and posting from a range of different sources and publishing a tweet (first degree of sharing), and (2) retweeting a tweet (second degree of sharing), thus triggering conversations and information diffusion. While there is an increasing body of research on ‘retweeting’ (e.g. Bogdanovet al., 2013) and even some literature in the more specific case of climate change news ((Weber 2016; Motel 2014), the first degree of sharing has received little attention. The closest existing study on this issue is a recent study on the emailing of articles from The New York Times (NYT) (Berger and Milkman,

2012). The authors found a strong link between positive affect and ‘virality’ (sharing an article via email). Based on psychological theories they concluded that this relation is universally valid. However, this study was limited to the particular configuration of analysing information shared from one source (The NYT) via email, a social network not necessarily used in the same way as social media (see the critique of Hansen et al.,2018). The NYT carried out the other existing study on motivations and sharing behaviour (actual choices). In this study, we analysed the first degree of sharing in the context of climate change–related tweeting activity focusing on two aspects: first, we carried out a content analysis of the most frequently posted web links in tweets to understand what kind of content users select and publish on X. Second, we rated the content of these web links on a two-dimensional emotional scale to test whether it correlated with how frequently a web link was shared. Hence, the content analysis represents a

classification of sources of the first degree of sharing and thus an exploration of the ‘media ecology’ around the tweets on or related to climate change. Previous studies have stressed the importance of emotions in determining the sharing of online news in general (Berger and Milkman, 2012) and in the case of climate change tweets as well (Hansen et al., 2018). We test the importance of emotional value in the first degree of sharing (what people post on X rather than tweets shared on X)

Climate change on social media. There is a nascent body of research on climate change discourse in social media, which has focused on X. This focus comes as no surprise given the widely shared agreement that studying X in particular is necessary for multiple reasons, from the fact that it is simply too important now to ignore with its global reach and growing number of users and posts to it being able to provide a window on various aspects of society (Weller et al., 2014). This body of research has studied how the emotion and affective

valence of a tweet may influence its ‘virality’ in terms of the probability of a retweet (Hansen et al., 2018), use of web links in climate change-related tweets and sources behind those web links (e.g. mass media, personal websites) and tweet content (topics) (Torres-Toukoumidis, Angel, Sofia, Santiago, Castro. (2023) or structure (who links to whom/who talks to whom) and tweet content (topics) (Pearce et al., 2014). To give an overview of these findings, after analysing two samples of tweets – tweets about the Copenhagen Climate Change Conference (COP) and a random sample – Hansen et al. (2018) found that sentiment differentially influenced retweet probability of tweets containing news web links and non-news tweets. Negative sentiment promoted retweeting in news-driven tweets from both samples, and positive sentiment promoted retweet probability of non-news tweets. From this analysis, Hansen et al. (2018) gained insights about the similarities of news-tweeting and the logic of traditional

news media: the emergence of negative content as a strong promoter of retweeting in news-driven tweets resonates with the classic theory of selection and diffusion in traditional news media according to which negative affect is a key contributor to propagation. Next, Segerberg and Bennett (2023) analysed random samples of tweets from two hashtag streams associated with two climate change protest marches that were among a number of protests leading up to COP. Their analysis of web links showed that alternative media websites (as opposed to, for example, mass media websites) accounted for the greatest share of web links in both streams. The analysis of tweets' content showed that tweets mostly described the marches but were less likely to share logistical information, leading the authors to gain insights into the orchestration of the marches. Finally, Pearce et al. (2014) analysed tweets about the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment AR5 WG1 report, published in September 2013,

in which they identified 'science', 'geographical discussions' and 'societal concerns' (e.g. geo-engineering) as the most prominent topics.

Theoretical framework

First, the overall content of tweets can be analysed through the lens of social representations theory (SRT). In SRT (Moscovici, 2000), the aim is to identify representations of a given scientific or technological issue, their adoption by social groups and their role in the formation of common-sense knowledge. SRT posits that (1) there are competing definitions of issues in the public sphere referred to as social representations (Gaskell et al., 1998); (2) definitions are a matter of framing that aims to impact opinion/attitude formation and legislation; and (3) the framing battle 'is being waged in the arena of language, as much as that of science' (Ogden, 2001: 340).

Methodology

There is an on-going debate about how standard content analysis should be adapted to web content (Tao, Rongjiang & Xu, 2024); but notwithstanding the controversies, this article adopts content analysis. Only user generated content in tweets processes are considered. The study tracked seven randomly selected days of tweets between 1 January and 30 April 2023, collecting tweets containing the keywords and hashtags 'climate change' and 'global warming'. Duplicates were eliminated via parsing using tweets' ID tags, the unique number identifying each tweet. A random week generation technique was adopted to select the seven days for data collection. The unit of analysis was the tweet, which had a major impact on sampling due to the large computing power needed to process a very large number of tweets. The following strategy was adopted: two tests were carried out, monitoring one week in January and another week in April, and the tests

produced an average of 8300 tweets per day about climate change. It is important to clarify that we refer mainly to tweets in English; therefore, this is not an estimate of tweets about climate change in total. The corpus was restricted to English-language tweets in order to be analysed using the lemmatisation and automatic coding. Data collection was limited to a week in order to stay within the computational limit of the software used, in particular in the case of T-LAB and LIWC2007.3 The source of data was the public application program interface (API) of X using a free (for non-commercial use) version of the proprietary service of tracking public tweets based on the DMI-CAT platform (Borra and Rieder, 2014).

Findings

Data gathered with the online content analysis were analysed and presented as follows. It is discovered that many of the search words were written mostly in PHP and runs in a webserver (LAMP) environment. Using the search terms

‘climate change’ or ‘global warming’, 60,122 tweets in total were collected during the 7 days of tracking. The tracking algorithm includes the following information: content of the post, web link in the tweet, username and number of followers.

Distribution of Data

Table 1: Table Showing the Tweets Analysed

Tweet	Frequency
60,122	100%

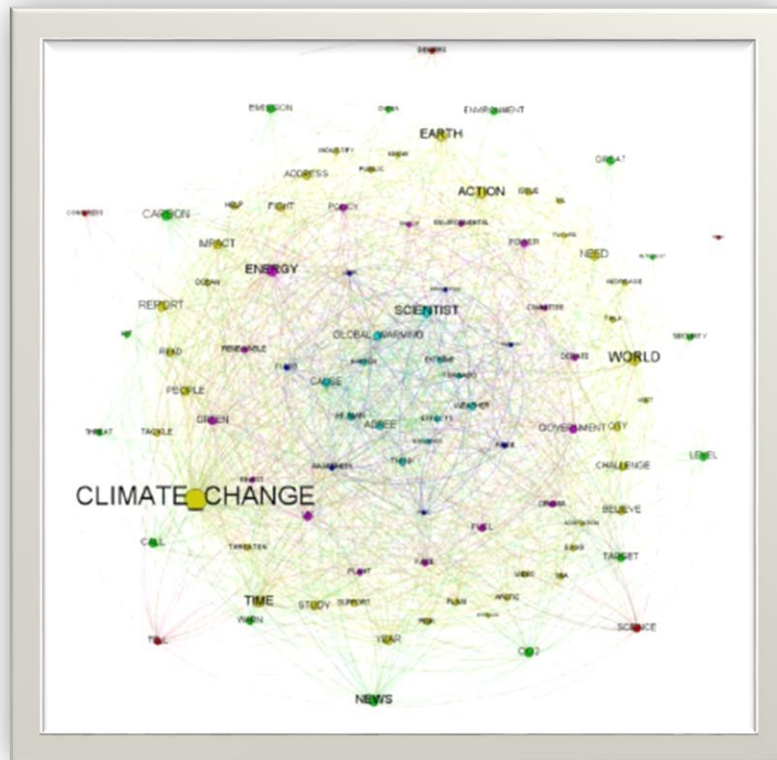
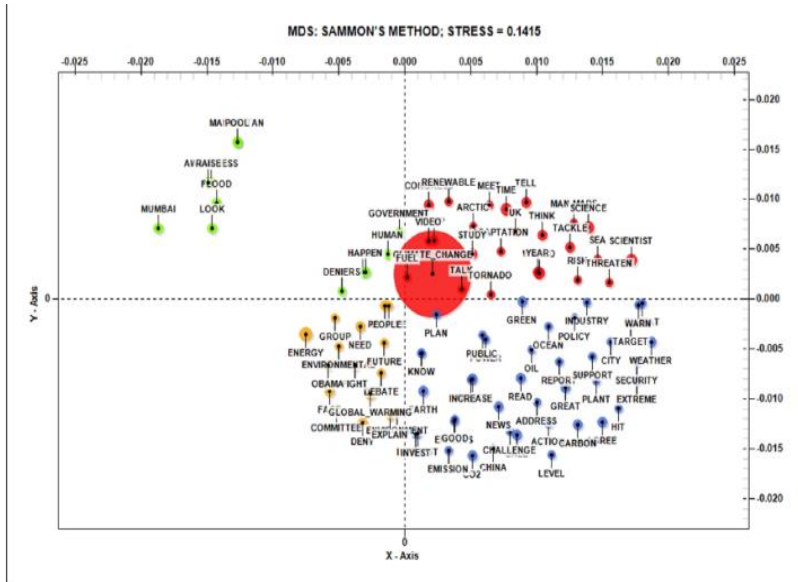
Latent semantic analysis

The algorithmic grouping of keywords in tweets in semantic domains according to the procedure described in the ‘Methodology’ section revealed four thematic areas (Figure 1). The first corresponds to the top left corner of the

MDS graph indicating the theme of **call for action** about climate change with an emphasis on its consequences. The latter themes are predominant in the second thematic space corresponding to the top right corner of Figure 1. In this case, climate change is associated with **consequences** and, in particular, rising sea levels and extreme weather.

The third theme in the bottom right corner of the MDS representation refers to the policy dimension of climate change, referring to regulations, discussions by committees and political actors (e.g. the President of the United States). The fourth thematic space includes local (geographically specified) news associated with climate change such as the news that Mumbai will be under threat.

Diagrams 1 & 2: Diagrams Showing the Distribution and Tweet Formats and Origins of Tweets



Information Sharing and Media Ecology

Table 2: Table Showing Sources of Tweets

Sources	Percentage
Media organisations	67
NGOs	9
Non Professional Blogs	8
Others	5

The majority of web links in tweets about climate change were from professional news organisations such as newspapers or public broadcasting companies (67%), followed by non-professional blogs (8%) and non-governmental organisations (NGOs) (9% including environmental NGOs and others). Links from other social media represent only 5% of the overall amount of web links in tweets.

Regarding content type, majority (74%) of web links pointed at news articles reporting anything related to climate change. This is followed by news articles that discussed a specific news on scientific study, related to

climate change (14%). The third type of content were links to videos related to climate change, and this amounts to 4%.

This means in essence that news articles take an eminent position in the number of tweets on climate change observed over the period of the study.

Videos that were observed and analysed were from the following sources: professional news sources (40% of the videos), social media (25%) and non-professional blogs (18%). In all, 78% of the analysed web links were ‘descriptive’ news articles about climate change and the remaining 22% had an ‘affirmative’/‘call for action’ frame.

Analysis of variance (ANOVA) was performed on both media source categories and content type regarding the number of shares received by web links, but no significant effect was found – perhaps this is due to the very low number of shares for several of the categories. The last step was to explore the relationship between the number of shares that a web link received

and their score in terms of emotional valence (negative–positive) and arousal (bland–intense) measures using the SAM non-verbal scale. A statistically significant positive and mild correlation was found only for arousal and number of shares, $r(766) = .14, p$

Discussion of findings

Findings from the different analyses offer an intriguing picture of the representations of climate change in the social medium X. Analysing the semantic dimensions of tweets, we have identified a sophisticated discourse that includes multiple issues and angles. The four thematic clusters that emerged are related to calls for action and awareness of climate change, its consequences and causes, and the policy debate about climate change and energy.

Of particular interest is the cluster about consensus and the causal relationships between the causes and effects of climate change. The emphasis on tweets' content related to climate change 'causation issue' revealed by the LIWC analysis supports the

idea of a social grounding process that is not fixed. The media ecology analysis reveals a dependence upon professional sources of information such as newspapers and public broadcasting. In this case, X users relied on traditional sources more than anything else and there is little ecological diversity of sources from the World Wide Web. Hence, findings related to the degree of sophistication of the discourse may simply reflect the traditional media discourse.

However, on X, traditional sources were selected with remarkable sophistication, with users behaving rather like 'curators'. The explanation for this sophistication might be that we have tapped into a 'topical influence backbone' (Torres-Toukoumidis, Angel, Sofia, Santiago, Castro, 2023), a sub-network of X users who are followers of science and technology–related news.

In any case, the lack of diversity of sources is notable and in sharp contrast with common expectations about the diversity of communication channels online. Regarding information sharing behaviour, a modest

positive correlation was found between the number of shares and emotional arousal levels of the web links' content. Given that the large majority of tweets were classified as neutral, the weak relationship is to be expected. The result, however, is in line with previous findings that content with high, arousing emotional value, independently from its valence, has a greater chance of being shared online (Hansen et al.,2018). The emotional tweets we uncovered were mainly characterised by anger and sadness, as suggested by the LIWC classification.

Finally, we must draw attention to some limitations of this study. The generalisability of this study is limited by two restrictions affecting its research design. First, it was limited to tweets in the English language, and second, monitoring covered a relatively short time period (although 7days has been fairly standard in similar studies). Both limitations stem from the lack of necessary computing power to process and analyse a very large number of

tweets. For example, tracking climate change over 1year might have resulted in over 20million tweets in English alone, and there is no way to predict how large this number might be if other languages were included.

Conclusion

This study proposed theoretical and methodological approaches for the study of an issue of major societal significance: climate change on the social media platform X. The study combines different levels of analysis related to tweets. It combines a set of analytic techniques related to the content of tweets including semantic clustering, semantic networks, psychological process classification, sentiment analysis and content analysis. X offers a large amount of information that allows researchers simultaneously to study the content of tweets and interactions with tweets' content. Users publish their content and comment and share (retweet) other users' tweets. Audiences on X are often composed of articulated social ties, and

therefore, social networks are also crucial for understanding the content that is discussed or commented on.

More generally, this study exemplifies the analytical stepping stones to a promising approach in public opinion and public understanding research based on social representation theory.

In summary, both the analysis of semantic networks and the psychological process text classification yielded interesting results and are well suited to analyse social media data. There are still substantial limitations in this kind of analysis. The first is that semantic information about narrative structures are discarded by the use of co-occurrences-based text mining techniques. Narrative structures underlying discourses related to the topic under investigation are an important factor on how social representations are organised. While the identification of themes and subthemes can be reliably obtained by automatic procedures and applied to a multi-language corpus of a large size, higher order

structures of meaning such as narratives and arguments/claims are much harder to automatically extract. Social media constitute an increasingly vast pool of potential data for analysing public opinion dynamics regarding PUS. It is important that social scientists take the opportunity to use these data; currently, the corporate sector leads in this field. There is a need for a theoretically informed, methodologically robust and critical – as well as ethical – use of online data. We hope this article can trigger more discussion and research to fulfil this need.

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