Climate Change Narratives in TikTok Brazil: From Diagnosis to Despair

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Abstract

The objective of this exploratory study is to chart the discourses circulating on the TikTok social network concerning climate change in Brazil. It investigates the predominant narratives on Brazilian TikTok regarding climate change and the implications of these narratives. Using a methodology based on Basch et al. (2022) tailored for the Brazilian context, this study analyses 50 videos indicated as the most relevant by the platform using the hashtag #mudancaclimatica (#climatechange). Key aspects investigated include language patterns, the use of sources and strategies for addressing climate change. The videos were categorised based on various criteria, including their stance on the truth of climate change, the environmental issues highlighted, the social and ecological impacts mentioned, and the extreme weather events described. Given TikTok's immense popularity in Brazil, the prevalence of disinformation on digital platforms in the country, and the lack of awareness among Brazilians about climate change, this study aims to assess the potentially harmful effects of narrative circulation on the platform on understanding the issue. The findings indicate a relative consensus on the reality and severity of climate change. However, aspects pertaining to the complexity of the problem often receive less attention. Prominent in the analysed narratives are those with an alarmist tone, amplified by the platform's features. Moreover, the sources and channels behind these productions often lack clear identification, even when they are directly linked to scientific dissemination. This ambiguity could pose challenges in using these materials to counter climate denialism.

Keywords

climate change, TikTok, digital platforms, science communication, Brazil

Narrativas Sobre Mudanças Climáticas no TikTok Brasil: Entre o Diagnóstico e a Desesperança

Resumo

O objetivo deste estudo exploratório é realizar um mapeamento dos discursos em circulação na rede social TikTok ligados à temática das mudanças climáticas no Brasil. Investiga-se, portanto, que narrativas predominam no TikTok brasileiro quando se trata de mudanças climáticas e que sentidos essas narrativas engendram. A partir de metodologia baseada em Basch et al. (2022) com adaptações para o contexto brasileiro, 50 vídeos indicados como os mais relevantes pela plataforma a partir da hashtag #mudancaclimatica foram analisados. Investigamos

aspectos como linguagens utilizadas, uso de fontes e estratégias de enfrentamento às mudanças climáticas. Os vídeos foram classificados segundo diversos critérios, como seu posicionamento em relação à veracidade, ou não, das mudanças climáticas, os temas ambientais abordados, impactos sociais e ambientais citados e os eventos climáticos extremos referenciados. Em um contexto de grande popularidade do TikTok no Brasil, disseminação de desinformação em plataformas digitais no país e brasileiros pouco informados sobre as mudanças climáticas, a pesquisa busca compreender em que medida a circulação de narrativas na plataforma pode ser nociva à compreensão do problema. Concluímos que, por um lado, existe relativo consenso em relação à veracidade e gravidade das mudanças climáticas. Por outro, aspectos relacionados à complexidade da questão ficam em segundo plano. Narrativas em tom alarmista, reforçadas pelas *affordances* da plataforma, aparecem em proeminência. Além disso, fontes utilizadas e canais responsáveis pelas produções são pouco identificáveis, mesmo quando relacionados diretamente à divulgação científica, o que pode representar um problema para o uso desses materiais no enfrentamento ao negacionismo climático.

Palavras-chave

mudanças climáticas, TikTok, plataformas digitais, divulgação científica, Brasil

1. Introduction

While climate change had already been a prominent topic of discussion before the COVID-19 pandemic, the public health crisis seems to have hastened global awareness of the issues stemming from this phenomenon. Organisations like the United Nations (UN) underscore this correlation, cautioning that the next pandemic could manifest as drought (United Nations Convention to Combat Desertification, 2023). In Brazil, the perception that the climate emergency poses a serious threat with the potential to profoundly affect the lives of thousands of individuals has increased between 2020 and 2021. According to a survey commissioned by the Institute for Technology & Society, 96% of respondents in 2021 acknowledged the reality of global warming. Furthermore, eight out of 10 respondents considered it a major problem (Ipec Inteligência, 2022).

However, the same survey highlights a widespread lack of knowledge among the Brazilian population regarding the subject. Only two out of 10 respondents consider themselves well-informed about global warming. Despite consistent efforts by traditional media outlets to cover the issue, Nisbet (2009) notes that likely only a portion of the public — those already informed and engaged in the discussion — will be reached. The author emphasises that scientific facts alone are not persuasive; in a context where the audience is fragmented and disengaged with global warming, it becomes increasingly important to explore strategies for crafting and mobilising messages tailored to specific media and audiences (Nisbet, 2009).

This article seeks to analyse the discourses surrounding climate change on the social network TikTok, whose popularity has increased notably in Brazil (Ecwid, 2023). In essence, our objective is to address the following question: what are the predominant narratives about climate change on Brazilian TikTok, and what interpretations do these narratives foster? To accomplish this, we scrutinised elements such as language patterns, use of sources, and approaches to addressing climate change. We aimed to

provide a brief overview of the symbolic debates associated with the issue. We collected 50 videos using the hashtag #mudancaclimatica, as suggested by the platform's search algorithms. These videos were then categorised based on several criteria, including their position on whether climate change is true or not, the environmental concerns highlighted, the social and environmental impacts mentioned, and the extreme weather events described, among other factors. The methodology employed in this study drew inspiration from an article authored by Basch et al. (2022), with necessary adaptations made to suit the Brazilian context, as outlined in the methodological procedures section.

Launched in 2016 by the Chinese company ByteDance, TikTok is a platform designed for sharing short videos. It gained popularity in Brazil in 2019 and swiftly rose to become one of the most accessed digital social networks in the country — currently trailing only behind YouTube, Instagram, and Facebook (Comscore Brasil, 2023). As of 2023, Brazil had approximately 84,100,000 active TikTok users, trailing behind only Indonesia (113,000,000 users) and the United States (116,500,000 users; DataReportal, 2023). Despite its reputation for content centred around humour, music, and dance, the platform has evolved into a forum for discussions spanning beyond mere entertainment. Its popularity, particularly among younger demographics, has catalysed the proliferation of debates on "serious" topics, such as mental health (McCashin & Murphy, 2023) and politics (Herrman, 2020), on the platform.

The absence of knowledge about the causes, consequences, and debates about the climate emergency, a complex issue intertwining various dimensions beyond the environmental realm, encompassing health, economics, and politics, takes on heightened concern within today's informational landscape. In recent years, Brazil has garnered attention for the proliferation of misinformation across various digital platforms (d'Andréa & Henn, 2021; Oliveira et al., 2021). However, there is still little research specifically addressing communication and the climate emergency in the country. Nevertheless, notable initiatives are emerging, focusing on investigating the production and public perception of environmental journalism and its discourse regarding climate change (Aguiar & Schaun, 2019; Horn & Del Vecchio De Lima, 2019; Loose, 2016; 2021; Loose & Girardi, 2017; Rodas & Di Giulio, 2017; Winch, 2017). These include coverage of climate catastrophes (Bueno, 2017) and reports on issues directly or indirectly related to the climate emergency, such as fires (Pinto & Zanetti, 2021), drought (Farias, 2022), and deforestation (De Campos et al., 2021). Additionally, there are investigations into public communication (Quinteros, 2023) and scientific communication concerning the subject (Colatusso, 2022).

Therefore, by focusing on the narratives surrounding climate change on TikTok in Brazil, we hope to contribute to the debate regarding the significance and challenges of digital communication in shaping public perception of the issue.

2. Public Arenas and Science Communication on Digital Platforms

With the advent of digital content-sharing platforms, the potential for engagement in the communication of scientific subjects within these digital spaces has been

underscored (O'Neill & Boykoff, 2011). However, alongside this potential, there are numerous challenges to the dissemination of scientific information and communication within the public arena of the Internet (Patel et al., 2020; Sloane et al., 2015; Wicke & Taddicken, 2020).

Ines Lörcher and Monika Taddicken (2017) contend that the formation of public arenas on the Internet facilitates the involvement of a diverse array of public players engaging in online communication, spanning a wide spectrum of topics and opinions related to science, including sceptics. Alongside the rise of scepticism (Engels et al., 2013), science communication has been marked by the confrontation with denialist movements (Reichstadt, 2020), anti-science movements (Biddle, 2018; Szabados, 2019), anti-intellectualism (Merkley, 2020), and science-related populism (Mede & Schäfer, 2020).

By encouraging novel forms of public engagement (Dahlgren, 2005; Papacharissi, 2002), these seemingly decentralised environments, blending characteristics of interpersonal communication and mass media, have reconfigured the landscape of public debate on subjects pertaining to science, health, and the environment within the digital realm (Boykoff & Yulsman, 2013; Bucchi & Saracino, 2016). According to Schmidt (2013), contemporary public arenas can be conceptualised as distinct configurations of agents, encompassing both communicators and the public, who disseminate information according to specific rules for presenting arguments, which may sometimes be contentious. This reshaping of arenas is crucial for comprehending how individuals outside the scientific community have learned to create new categories, hypotheses, and theories, explore causes and test therapies (Cefaï, 2017), thereby challenging the very concept of expertise (Collins & Evans, 2002). Researchers like Van Zoonen (2012) argue that the proliferation of these alternative epistemologies can be interpreted as the popularisation of "I-pistemologies", wherein individuals construct their knowledge based on personal experiences.

In alignment with these scholars, it is possible to argue that digital social media platforms have evolved into conducive environments for communication exchanges mediated by affectivity (Papacharissi, 2015). While this phenomenon is part of a broader process of media reconfiguration (Baym, 2008), the amalgamation of facts and opinions, politics and emotions is notably prominent on these platforms, fostering the mobilisation, connection, and identification of affective audiences (Papacharissi, 2015) on the web. Amplified by unique features of such environments, such as speed, the nearly limitless flow of information, and multiple connections (van Dijck, 2013), this mediation by affectivity becomes particularly conspicuous during public discussions of extreme situations.

While this dynamic did not originate with digital platforms, it is crucial to acknowledge a significant distinction: prior to their emergence, communication of scientific subjects largely involved maintaining a distance between the public and communicators, with science communicators playing a leading role. As highlighted by Massarani et al. (2005), the predominant model of science communication until the early 21st century was the deficit model, wherein the public was viewed as a "group of science illiterates" (p. 63). The emergence of new actors, particularly following the widespread adoption of digital social networking platforms, has bridged the gap between scientific discourse and everyday life.

With increased opportunities for diverse forms of interaction with the public and less formal communication, narratives on scientific topics on the web blend established formats from other media, such as television (Miranda & Guilherme, 2023), with formats unique to each platform.

Driven by strategies geared toward maximising user engagement to gather data and target advertising content, digital platforms encourage and perpetuate emotional exchanges (Papacharissi, 2015). While these dynamics can foster a sense of community and enhance the public's social imagination, potentially strengthening connections between science communicators and their audience, they also facilitate the dissemination of inquiries regarding the role of science — particularly during critical situations.

Natural disasters, decentralised cyberattacks, or public health epidemics reflect the anxieties and insecurities stemming from the ambiguities surrounding scientific practice (Evangelista & Garcia, 2019). The case of climate change epitomises a quintessentially contemporary phenomenon: while the outcomes and advancements of science increasingly permeate all facets of our daily lives (Tucherman & Ribeiro, 2006), science itself operates within the shifting sands of the risk society (Giddens, 1991), navigating complex webs that pose challenges in formulating measures that can actually mitigate the problem. Meanwhile, scientists, activists, journalists, politicians, and the "lay" public, among other stakeholders, are devising different strategies to construct and contest meanings surrounding climate change on digital platforms within a matter of seconds.

3. Social Networking Platforms and Climate Change: Research Horizons

While still emerging in Brazil, the debate on how climate change is addressed on digital social media platforms has garnered increasing attention within international academic circles. In a systematic review of the topic, Pearce et al. (2018) conclude, among other findings, that a predominant focus of published research is on conversations disseminated on the Twitter platform. This preference is attributed, in part, to Twitter's Application Programming Interface being one of the most accessible for academic research, particularly for quantitative studies. However, the authors argue that this excessive emphasis limits more comprehensive examinations of the collective imaginaries surrounding climate change and its impacts on social life. Pearce et al. (2018) also observe a correlation between social media posts and local experiences of temperature anomalies. Nonetheless, they note that the predominant sources and framing of the issue are largely mainstream.

In other words, despite the existence of polarised perspectives and echo chambers surrounding climate change — a phenomenon strongly influenced by political disputes, as argued by Falkenberg et al. (2022) — legitimised views regarding the existence and severity of the issue hold sway. Meanwhile, as noted by Schäfer (2012), the presence of specialised scientists and scientific institutions on digital platforms does not guarantee their prominent involvement in discussions concerning climate change and climate policies. As the effects of phenomena like extreme temperatures become increasingly apparent

on a daily basis, more individuals engage in discussions, underscoring the everyday nature of conversations on digital platforms (Papacharissi, 2015). However, according to Schäfer (2012), this fragmentation of the discourse may be associated with inadequately informed discussions, leading to minimal discernible impact on public perceptions of climate change.

Parry et al. (2022) highlight, in a survey of 16–25-year-olds residing in Madrid, that the proliferation of discussions on the subject has led to a rise in climate anxiety (Hickman et al., 2021), resulting in some experiencing eco-paralysis (Albrecht, 2011). Feelings of guilt, anxiety, helplessness, and hopelessness were associated with exposure to information about climate change on digital social networks. According to the interviewees, more propositional and positive approaches, focussing on possible strategies — even if represented by small individual actions — for mitigating climate change were deemed more useful. Additionally, the young individuals surveyed emphasised the importance of acquiring skills to critically analyse available information, seeking to learn how to use it in decision-making processes. Furthermore, it was concluded that a significant factor in alleviating the distress induced by news about climate change would be to reinforce the notion that these young people possess agency. Supporting Pearce et al.'s (2018) observations, Parry et al. (2022) contend that there is a need for more research encompassing predominantly visual digital social media platforms, which are currently overlooked in studies on the subject. Besides, drawing from interviews with young individuals, Segado-Boj et al. (2019) assert that the most influential emotions driving individuals to share news about climate change on digital social networks are fear and anger — coincidentally, emotions closely associated with climate anxiety.

The correlation between a text's capacity to evoke specific emotions and its likelihood of being shared was also examined by Veltri and Atanasova (2017) in a quantitative study focusing on Twitter. In addition to underscoring the significance of traditional media as a source for such content, the authors emphasise the multidimensionality of discourses surrounding climate change. Another study involving Twitter, conducted by León et al. (2022), explored social engagement pertaining to climate change through images shared on the platform. The authors highlight four guidelines aimed at enhancing interaction with users on Twitter, all related to concepts of "meaningfulness and personification" (León et al., 2022, p. 721).

Research linking climate change denialism to political polarisation has garnered increasing attention in recent years. Williams et al. (2015) assert that, even on Twitter, it is possible to verify the existence of echo chambers associated with activist groups and sceptics regarding the consequences of global warming. More recently, Falkenberg et al. (2022) presented the findings of a study conducted on Twitter from 2014 to 2021, analysing the discussions surrounding UN climate conferences during that period. According to the authors, ideological polarisation significantly escalated from COP26 onwards in 2021, driven by intensified activity among right-wing supporters critical of climate change. The study also reveals that accusations of hypocrisy have emerged as a recurring theme in climate discussions on Twitter since 2019.

In the Ibero-Latin American context, Balbé and Carvalho (2016) presented a survey of Facebook groups focused on the subject. Unlike other studies that have identified the significance of traditional media in sharing information about climate change (Kirilenko & Stepchenkova, 2014; Pearce et al., 2018; Veltri & Atanasova, 2017), the authors concluded that in the Portuguese- or Spanish-speaking groups analysed content published directly on Facebook predominated. However, in a subsequent study focusing on Twitter, the authors encountered a different scenario. In their attempt to identify the key participants in the debate surrounding the "21st UN Climate Conference", COP21, Balbé and Carvalho (2017) highlight the significant role of traditional media as a source of information on that platform. Nevertheless, the authors also note that politicians and ordinary citizens were predominant in generating content on the subject.

Also worth mentioning is the dossier Mudanças Climáticas e Engajamento Digital: Tendências, Hábitos e Dinâmicas nas Plataformas Digitais (Climate Change and Digital Engagement: Trends, Habits, and Dynamics on Digital Platforms) published by *Revista Ciências Humanas* in 2022. Among the seven articles featured, four directly tackle issues related to denialism and fake news concerning global warming, indicating that the issue identified by Falkenberg et al. (2022) has been the focus of more frequent investigations in the country. We would like to particularly highlight the work of Junqueira (2022), who examines the controversies surrounding the hashtag #yes2meat, which has gained popularity as a rebuttal to dietary recommendations for planetary health put forth by scientists. The author scrutinises current discourses surrounding the hashtag on the TikTok platform and, drawing on Treem and Leonardi (2013), delves deeper into the affordances[1] of editing and association. The research reveals a significant use of mixing, cutting, and editing of images and texts "for the production and dissemination of content related to the clash of data from multiple sources, with different levels of credibility" (Junqueira, 2022, p. 45), without fostering incentives for dialogue or debate. The author contends that while TikTok's affordances expand the public space for the emergence of diverse voices, the absence of theoretical and scientific grounding in the videos that garner more visibility through these affordances favours the circulation of climate change-related disinformation (Junqueira, 2022).

In addition to the study above, another research focusing on TikTok, conducted by Basch et al. (2022), offers pertinent insights for this article. After analysing 100 English-language videos under the hashtag #climatechange, the authors concluded that only eight of the videos included information from reliable sources.

4. Methodological Procedures

This study involved a total of 50 Portuguese-language videos related to climate change, sourced from TikTok and available until March 31, 2023. The short video[2] platform

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[1] Affordance refers to an object's inherent qualities, properties, and attributes, enabling the subject to identify its purposes and functionalities intuitively, based on previous experiences or not, without requiring prior guidance or explicit instructions.

[2] In 2024, productions are limited to 10 minutes, although TikTok has become popular for even shorter videos of up to 60 seconds (https://www.tiktok.com/creators/creator-portal/pt-br/product-updates-pt-br/novidades-colecoes-e-videos-de-10-minutos/; accessed in February 2024).

provides various features such as viewing, liking, commenting, sharing, producing, and republishing videos. Users can also follow and interact with others through functionalities like private messaging and creating duets by editing clips. One of the reasons behind TikTok's popularity is its recommendation system, which suggests videos based on user data such as interests, previously created and consumed content, and similar user preferences. This algorithmic approach aims to present videos that are more likely to engage the audience, potentially leading to addictive usage patterns (Brennan, 2020). Additionally, the platform offers the ability to search for videos using categories and keywords, which was used in this research.

The productions were categorised using the platform's organic search function for the hashtag #mudancaclimatica, as it best represented the topic we aimed to explore. Extensive data cleaning was necessary due to the fact that the TikTok search results included videos related to various interpretations of "change," such as relocation or lifestyle changes. Only videos directly related to environmental concerns were selected for analysis. As a precaution, alternative searches were initially conducted using the hashtag #mudancaclimatica within inverted commas ("#mudancaclimatica") and the hashtag #mudançaclimática. However, the results were largely similar, both in terms of the presented videos and the need for data cleaning. Therefore, we decided to proceed with the simple hashtag #mudancaclimatica.

TikTok videos are distinguished by their short duration and the need to promptly captivate the audience, who can effortlessly transition to the next video with a mere swipe of their fingers. The platform is also renowned for providing easy-to-use tools for replicating videos, which frequently incorporate music, voiceovers, dancing, and humour. One of TikTok's key distinguishing features is its powerful algorithm for customised identification of user behaviour through natural language processing and computer vision technology and its high capacity for capturing and retaining users' attention (Stokel-Walker, 2020, 2022).

The classification of the videos was guided by the categories proposed by Basch et al. (2022) in a similar study conducted with TikTok in English. However, certain adaptations were made to highlight specific characteristics of the videos and to adapt the analysis to the Brazilian context. While the original table comprises 29 categories aimed at examining aspects such as the portrayal of climate change (whether it is presented as something real) and the environmental and societal impacts of the phenomenon[3], our study divided the categories into five overarching analytical macro-categories. These include: "the type of content presented," "topics related to climate change," "socio-environmental impacts addressed," "mention of extreme events", and "responsibility for climate change." Table 1 shows the categories within each macro-category. To streamline the classification, two subcategories commonly associated with events in the Northern Hemisphere, "tornadoes" and "hurricanes," were amalgamated. Additionally, the term "cyclones" was included in this subcategory to encompass events more prevalent in Brazil. Furthermore, three additional subcategories were introduced to analyse specific aspects: "qualifies as journalistic content," "deforestation and mining," and "rainfall, lightning, and flooding".

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[3] The full spreadsheet is available at https://link.springer.com/article/10.1007/s10900-021-01031-x/tables/1.

REGARDING THE TYPE OF CONTENT PRESENTED	Presents climate change as true
	Presents a credible source (public health professionals, environmentalists or relevant organisations)
	Misinterprets climate patterns
	Contains misinformation
	Presents climate change as false
	Induces climate-related anxiety/frustration
	Qualifies as journalistic content
CLIMATE CHANGE-RELATED TOPIC	Land and sea pollution/rubbish/plastics
	Carbon dioxide/fossil fuels
	Escalation in greenhouse gas emissions
	Deforestation and mining
	Health inequalities
	Future generations
	Environmental justice (addresses disparities between the global South and North, social inequities, consumption capacity, and/or the correlation between human selfishness, capitalism, and climate change)
SOCIO-ENVIRONMENTAL IMPACTS COVERED	Impacts on human populations (migration, poverty, and homelessness)
	Impacts on human health
	Impacts on wildlife
	Impacts on crops and plant life in general
	Impacts on changing global temperature levels
	Impacts on ocean levels and water temperatures
	Impacts on melting polar ice caps
EXTREME EVENTS CITED	Drought/heatwave/frost/severe cold
	Tornadoes, hurricanes, and cyclones
	Forest fires
	Rainfall, lightning, and flooding
ACCOUNTABILITY FOR CLIMATE CHANGE	Individual recommendations: reducing carbon footprint and environmental impact/conscious consumption
	Macro-political recommendations: voting for other leaders or parties, lobbying for specific laws or the regulation of certain activities
	Political criticism of countries and government leaders
	Criticising specific brands, companies or industries
	Praises politicians or government leaders
	Praises brands/companies

Table 1. *Categorisation used to classify the videos analysed*

One reviewer (Author 1) viewed all 50 videos and noted whether or not each of these content characteristics was present in that video. A second reviewer (Author 2) observed 10 randomly selected videos (a 20% sample) to determine inter-rater reliability. Basch et al.'s study (2022) conducted validation similarly, with the only distinction being that the second reviewer's sample was 10% of the collected material. Microsoft Excel was used for all data entry, organisation, and analysis.

5. Findings

In total, the 50 videos amassed nearly 20,000,000 views by March 31, 2023, garnering almost 2,500,000 likes, over 70,000 comments, and 130,000 shares. The categorisation based on the impacts of climate change allowed for the formulation of hypotheses regarding the most engaging types of content — either in terms of gaining prominence on TikTok or due to the authors' deliberate focus on these issues.

Out of the total analysed, 15 videos underscored the impacts on populations, such as the need for migration and hunger. At the same time, 13 highlighted the planet's overall temperature levels. Nine emphasised the impacts on animals, particularly with emotionally impactful images (such as bears isolated on ice sheets, marine animals entangled in plastic, and large mammals succumbing to drought, among others). Despite Brazil's extensive coastline, impacts associated with rising sea levels and melting polar ice caps received less attention compared to other examples, with only two and seven videos, respectively. This may be due to these issues being less tangible and more long-term, making them harder to observe than animals in deteriorating habitats directly.

Overall, the videos depict various extreme climatic events that have occurred worldwide — there are at least 22 videos featuring images or references to at least one of these events. The most frequently cited events are droughts and extreme heat or cold waves across the globe (16 videos), followed by forest fires (14 videos), rainfall, lightning, or flooding (13 videos), and tornadoes, hurricanes, and cyclones (four videos).

Examining the issues related to the topic also unveiled significant gaps, notably the absence of a direct link between the environment and health in the presented videos. Despite the manifold threats to public health posed by climate change, such as epidemics and compromised water quality, only one video briefly touches upon issues concerning health disparities among populations of diverse socio-economic classes and regions. Similarly, within another macro-category referencing the impact of climate change on human health — only five videos presented arguments along these lines.

References to pollution were more prevalent. This category included references in the videos to land and water pollution, rubbish and the accumulation of plastic. In total, 17 videos addressed this issue, with particular emphasis on images depicting the sea polluted by plastics. In an effort to align the analysis more closely with the Brazilian context and the prominent themes in the country's environmental discourse, topics related to deforestation (13 videos) and mining (two videos) were added to this macro category. Environmental justice issues were addressed in 11 videos, with most focusing on consumption patterns and advocating for environmentally friendly lifestyles among those who have the means. Other videos delved into the capitalist lifestyle and human selfishness and greed, attributing them significant responsibility for the exploitation of the planet and the global climate crisis.

This finding is closely related to the macro-category of accountability. Among the videos analysed, 11 directly criticised governments for their role in climate change, with most of these criticisms directed at the policies of the Bolsonaro administration. This indicates that Brazil's intense political polarisation in recent years (and the resulting

increase in politicisation surrounding climate change) significantly influenced the content observed in the study. Additionally, within the same category, 14 videos placed blame on large companies and industries (five of them also targeting government policies and rulers). Notably, attacks on agribusiness were prominent, with several videos citing it as the primary polluter and generator of waste (an issue that aligns with criticisms levelled against Jair Bolsonaro's administration and further underscores the politicisation of the climate change discourse). Only three videos among those analysed expressed praise for the actions of politicians, countries, or authorities in any capacity (with one of them being a self-praise by then-President Jair Bolsonaro). Interestingly, none of the videos praised or positively mentioned the actions of companies or industries related to addressing the issue of climate change.

Regarding proposals for tackling the problem, 10 videos offered recommendations for adopting less polluting lifestyles and reducing carbon footprints — particularly emphasising conscious consumption and boycotting polluting companies. Conversely, 10 videos made political recommendations, highlighting the need for political changes to address the climate crisis. These videos often ridiculed calls to adopt "greener" lifestyles without addressing the stances of global leaders and large companies.

Nonetheless, the suggestions tended to be vague, with only four videos proposing concrete actions. Two advocated for the election of socialist politicians to champion environmental causes. The other two encouraged the public to engage in organised civil society initiatives (Amazonia de Pé, which opposes the encroachment on indigenous lands, and the Face of Pollution initiative, advocating for greener attitudes in daily life). Interestingly, only two videos simultaneously offered political and individual recommendations and were classified in both categories.

5.1 WEAVING RELATIONSHIPS FROM CLIMATE CHANGE

When examining the entire sample, we inquired about the sources mentioned in the collected videos. The analysis revealed that despite the smaller sample size compared to the study by Basch et al. (2022), which examined 100 productions, the number of videos citing some form of "reputable source", such as professionals and institutions associated with environmental research and public health policies, was relatively higher. Among the 50 productions surveyed on this empirical study, nine cited information attributed to such sources, whereas Basch et al. (2022) found only eight instances among 100 videos. The UN and the Intergovernmental Panel on Climate Change were the most frequently cited sources, each appearing in three videos. In addition to these, references were made to research conducted by São Paulo State University, representing the sole Brazilian source mentioned in the videos, focusing on the impacts of climate change in the country. Rounding out the list were mentions of warnings issued by two scientists: Peter Kalmus, a researcher at the US Space Agency who was arrested during a protest in April 2022, and Carl Sagan, the renowned science communicator who passed away in 1996. However, it is worth noting that only the videos featuring the scientists' warnings

present the sources in their own voices. In the other productions, references to sources like "the latest report" from the Intergovernmental Panel on Climate Change — IPCC — or the UN are made generically. Furthermore, there is no in-depth analysis of the sources, such as providing links or other forms of validation.

We should also address the role of journalism in the videos analysed. Channels from news outlets appeared only three times in the sample, specifically from G1, iG, and UOL. This observation, combined with the lack of references to "reputable sources", seems to paint a different picture from the review published by Pearce et al. (2018), which suggested that the dominant sources and framing of climate change are predominantly mainstream. This outcome could be attributed to both the limited investment of traditional media and scientific institutions on the platform and the popularity of influencers and other types of users in these spaces. Additionally, it may be influenced by the platform's predominantly youthful audience — over 60% of users are under 34 years old (DataReportal, 2023).

However, the dynamics of TikTok itself, characterised by the rapid consumption of videos suggested in sequence by the platform's algorithms (Stokel-Walker, 2020), facilitate the appropriation of mainstream content for the construction of unique discourses. It is no coincidence that another 15 videos in the sample feature references to mainstream media, often used to illustrate the overall state of the planet or specific environmental catastrophes. Only three of these are reproductions of excerpts from newspapers or TV programmes. The rest are always re-signified with comments, emojis and subtitles. Most of the time, these references are used to legitimise and underscore the urgency of the climate emergency, even if the original articles do not explicitly make this connection. Therefore, these sources hold enough legitimacy to at least serve as a foundation for presenting a comprehensive picture of the crisis.

Similarly, when examining the content of the videos to identify information about the creators of the respective channels, two significant observations can be made: firstly, there is a prevalence of young individuals as the creators of the productions — out of the 24 videos featuring a speaker addressing the camera directly, almost all of them are in their 20s and 30s. The second observation, which complements the first, is the near-total absence of efforts towards scientific legitimisation concerning the creators of the videos. Given the short duration of the productions, it is understandable that presenting a comprehensive CV with each entry on the social network would not be practical. Nonetheless, there is no indication of the authors' "academic" or "institutional" credentials anywhere, whether in the subtitles, captions or even in the video descriptions[4]. The exception was a video from the channel Sua Mente É uma Revolução, in which the author attempts to interview former President Jair Bolsonaro and introduces himself as a student of international relations and climate change (although in this case, he is in an external environment

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[4] When examining the profiles responsible for the videos, an analysis that falls beyond the scope of this article, we observed that certain individuals consistently create content on science communication related to environmental issues. However, despite this, information about their involvement with the subject (such as their roles as researchers) is challenging to access. This topic will be revisited in future research.

and is not depicted as a presenter speaking to the camera; [https://www.tiktok.com/@ suamenteeumarevolucao/video/7054247184866233605]), and a video from the channel Pura Física, where the subtitles and description mention that the presenter is a teacher (in this instance, an individual slightly older and from a field not directly related to the discussion; [https://www.tiktok.com/@purafisica/video/6875401236154191110]).

While they typically do not disclose their identities, browsing their channels on the platform reveals that many of these young individuals are frequent creators of videos centred on scientific topics, particularly those related to the environment. In fact, one of the channels even labels itself as an environmental activist. Four of these creators appear multiple times in the studied sample (@andre...francis with four videos, @biafumelli, @camilibrio, and @hanakhalil, each with two videos) and adopt an explanatory format that strongly resembles science communication practices. Regarding language, even in videos where creators adopt a more didactic approach, the prevailing tone is informal, with few technical terms used. From these findings, it is possible to infer that initiatives aimed at disseminating science on these platforms largely stem from the personal endeavours of young students across various fields. There appears to be minimal institutional backing for these initiatives.

Building on Junqueira's study (2022), it becomes evident that TikTok's algorithm tends to prioritise videos based on editing techniques such as mixing and cutting rather than their theoretical or scientific foundation. This observation, coupled with the diverse backgrounds of the video creators, ranging from students to religious individuals, does not necessarily suggest that poorly qualified debates will have little impact on public perceptions of climate change, as highlighted in Schäfer's research (2012).

However, one aspect of this dynamic is reflected in the relationship between the analysed videos and the feelings of climate anxiety/frustration. Echoing the findings of Parry et al. (2022) on the perceptions of young people regarding the consumption of climate change-related content on digital platforms, at least 20 videos in the analysis contribute to such feelings in some way. This perception arises from various elements, such as the use of fast-paced soundtracks, dark colour schemes, and apocalyptic narratives, which contribute little to constructive debate on the issue. In these productions, the environmental crisis is depicted as a dire situation with little hope for meaningful action.

There are no actionable proposals in these videos, only a strong emphasis on the practically irreversible damage already inflicted. Six videos exhibit connections to religious discourse, either by referencing the apocalypse (https://www.tiktok.com/@mrf-fonseca/video/7196807378401119493) and the purported arrival of the planet Nibiru[5] and the end of the world or by framing the effects of climate change as a form of "karma" for humanity (https://www.tiktok.com/@greenchanges/video/6995017658378898694). For instance, several videos recycle the same images of the protest led by climate

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[5] An old conspiracy theory circulating on the internet surrounding an unidentified celestial body, commonly referred to as Nibiru or Planet X, posits that it will collide with Earth. The impact has already been predicted for the early 2000s, for 2012, and for 2017. This narrative is reminiscent of Zecharia Sitchin's book The 12th Planet, published in 1976, which discusses a planet with an elliptical orbit that enters the Inner Solar System every 3,600 years.

scientist Peter Kalmus in April 2022. In the highlighted excerpts, the authors express their frustration at society's failure to heed their warnings about the climate crisis and emphasise the imminent destruction of the planet, along with the dire consequences for future generations.

Two videos published by the user @favtodoroki include a call to action, albeit vague ("we have to do something"). Nevertheless, this call is overshadowed by exaggerated conclusions drawn from climate change studies. These videos were the only ones classified in the category assessing a misinterpretation of climate patterns presented. The author suggests that a 1.5 °C increase in Earth's temperature spells the end of the human race and asserts that we have only three years to reverse this situation. In these and the other videos that contribute to feelings of climate anxiety/frustration, we observed several comments expressing hopelessness, which were not formally assessed within the scope of our study.

Although further research is necessary, the association between climate change-related content and feelings of climate anxiety/frustration on digital platforms appears to reflect (and potentially reinforce) an existing connection. In a study examining the production of fear in journalistic narratives on climate change, Balbé and Loose (2020) suggest that the issue's impacts are often depicted through a lens of fear in journalism. However, the authors note that "there is no clear evidence that its use can actually generate a massive confrontation" (Balbé & Loose, 2020, pp. 50–51). In other words, while instilling fear may facilitate the dissemination of information regarding the severity of climate change, this awareness does not necessarily translate into actions aimed at mitigating and/or adapting to the reality imposed by the crisis.

Despite numerous studies highlighting the connection between disinformation and climate change (Falkenberg et al., 2022; Pinto & Zanetti, 2021), only three videos in the sample were categorised as disinformation, which entails a deliberate attempt to manipulate the public. In two instances, data regarding the climate crisis were used to suggest that the end of the world is imminent due to the supposed arrival of the planet Nibiru. In another video, then-President Bolsonaro engages in science-related populism (Mede & Schäfer, 2020) by stating, during the 2022 presidential election debate, that global warming is a fabrication designed to vilify agribusiness. Interestingly, this is the sole video that portrays climate change as false. Out of the total, 44 videos depict climate change as a genuine phenomenon. The remaining five address various aspects related to the climate crisis, such as specific impacts on the Earth's gravitational field, without explicitly linking them to climate change as a whole.

6. Final Considerations

While there is consensus on the severity of climate change, our exploratory study has revealed a tendency to prioritise simplified narratives over the complex aspects of the issue, such as climate justice, public health, and environmental racism. This observation aligns with the nature of TikTok, where short-form content prevails, and certain emotional

states, like climate anxiety, may be favoured by the recommendation algorithm. However, further research is needed to establish a definitive link, as our current analysis is insufficient for drawing direct conclusions. Similarly, we underscore the challenges posed by the opacity of TikTok's algorithms and the platform's inherent limitations, which complicate the theoretical and methodological framework for research. Given that information consumption on TikTok is predominantly driven by recommendations rather than active information seeking, it is imperative to broaden the scope of analysis using alternative methodologies such as ethnographic and reception research.

Given the content's simplistic nature and the significant influence of individual actions on shaping social interactions on platforms (d'Andréa, 2020), it becomes pertinent to inquire: why do these videos not provide additional sources to facilitate a deeper understanding of the issue? Is this due to a limitation imposed by the platform, such as restricted access to external links, or is it influenced by algorithmic conditioning based on the consumption patterns of other videos within the platform?

Similar questions arise when considering both the use of credible sources and the identification of video creators. Proportionally, the use of reliable sources was more expressive compared to the findings of the survey conducted by Basch et al. (2022). However, these sources were referenced vaguely. Regarding the profiles, even those identified as channels for science communication, very few provided clear identification. It cannot be discounted that the lack of identification may be intentional — after all, in an environment characterised by informality, institutional credentials may be perceived as a deterrent. However, within a landscape marked by climate denialism (Santini & Barros, 2022), it is crucial to question whether these strategies might undermine the credibility of scientifically accurate content in the battle against disinformation.

In conclusion, the absence of references to formal scientific knowledge steers the discourse towards a certain commonality, where opinions are equated with scientific data. Discussions, where they occur, often centre on acknowledging the crisis, its extreme events, and some local impacts, with minimal reflection on collective or political action measures. Another area for exploration thus pertains to the effects of consuming such content on diverse audiences' perceptions of the climate change issue — particularly videos that evoke feelings of climate anxiety.

Despite the limited sample size and the scope of the analysed aspects, we hope to have provided insights that will spark future research into the numerous gaps surrounding the dissemination of scientific content on digital social media platforms.

Translation: Anabela Delgado

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