

Hashtag Activity and Environmental Awareness: An Analytical Study of Global Warming and Climate Change Hashtags on X

Khouloud Albekri Abdalkader ¹, Mohamed Feddoul ²

Ramzi Djaballah³

¹ University of Batna 1, Batna, Algeria

khouloud.albekri-abdalkader@univ-batna.dz

² University of Batna 1, Batna, Algeria

mohamed.feddoul@univ-batna.dz

University of Batna1, Batna, Algeria

Ramzi.djaballah@univ-batna.dz

Received: 20/07/2024

Accepted: 10/10/2024

Published: 25/10/2024

Abstract

This study explores the role of hashtags as a communication tool in raising environmental awareness, specifically focusing on global warming and climate change discussions on X (formerly Twitter). By analyzing the activity and reach of popular hashtags related to these topics, such as #ClimateChange and #GlobalWarming, we examine their effectiveness in spreading information, engaging users, and mobilizing collective action. The study employs a mixed-methods approach, combining quantitative analysis of hashtag frequency, reach, and engagement metrics with qualitative analysis of user sentiment and content themes. To conduct the quantitative analysis, we rely on the TweetBinder website, which provides comprehensive data on hashtag performance, including metrics like total tweets, potential reach, and user engagement. Results indicate that hashtags significantly enhance visibility and foster global conversations on environmental issues, although their impact varies depending on factors such as the prominence of the hashtag, the timing of posts, and the

influence of key users. The findings underscore the potential of social media campaigns in environmental advocacy, suggesting strategies for optimizing hashtag use to maximize public engagement and drive meaningful climate action.

Introduction

In the digital age, social media has become a powerful tool for raising environmental awareness and fostering community engagement on issues such as global warming and climate change. Through hashtags, individuals and organizations alike can disseminate information and rally support for pressing environmental concerns. The use of hashtags like #GlobalWarming and #ClimateChange plays a crucial role in these efforts, helping to unify diverse voices and stimulate global dialogue on the impacts of these phenomena.

However, questions remain regarding the effectiveness of these hashtags in conveying environmental messages and engaging different segments of the public. Hashtags are communicative tools whose impact can vary depending on how they are used, the frequency of their use, and the people interacting with them. In this study, we aim to analyze the activity of hashtags related to global warming and climate change on X (formerly Twitter) to explore how they influence environmental awareness and public engagement.

By analyzing data from platforms such as TweetBinder, we seek to understand the dynamics of hashtag usage and its impact on raising awareness among various communities. Are there specific topics that capture the interest of particular users? Do these hashtags contribute to expanding the global conversation on climate change? We hope our findings will shed light on the role of hashtags in enhancing environmental awareness and provide strategies for optimizing their use in social media campaigns.

Related Work

Hashtags allow users to self-categorize their messages and to join a virtual conversation on a given topic. Users can search for tweets with a particular hashtag to learn about recent events on a topic of their choice.

Hashtags are also frequently used in scientific studies as they are easier to obtain and handle. (An et Weber 2016)

There have been various attempts to understand hashtag dynamics, with (Lehmann, et al. 2012)) describing different categories of collective attention. (Lin, et al. 2013) characterized the growth and persistence of hashtags along four dimensions: topicality (the number of times a hashtag is retweeted), prominence (the popularity of users mentioning the hashtag), interactivity (additional replies), and diversity (the number of unique retweet sources). Similarly, (Romero, Meeder et Kleinberg 2011) examined the mechanics of information diffusion on Twitter by analyzing the spread of hashtags, focusing on variations in diffusion features across different topics.

(Reilly et Vicari 2021) argue that hashtags allow users to share vital information and understand critical crisis events such as terrorist attacks. They also enable distant observers to express their sympathy and solidarity with the victims. Hashtags have empowered both elites and non-elites to share information that facilitates collective understanding during acute crises such as terrorist attacks, severe weather events, and wars. Emergency management organizations and professional journalists are no longer the sole sources for those seeking more information about the magnitude of these incidents and the support available to victims. Twitter hashtags, in particular, have increasingly enabled citizens to play "performative and constitutive roles" during these events by sharing eyewitness testimonies on the microblogging site (Tikka 2019) .

Hashtags first emerged as key conversational markers during disasters. For example, the hashtag #qldfloods acted as a news stream for those affected by the Southeast Queensland floods of 2011, enabling them to share eyewitness accounts and provide advice to other flood-affected residents. In a study by Axel Bruns and colleagues at Queensland University of Technology, it was found that the hashtag became "a source for mainstream media" (A. B. Bruns 2012). Subsequent research has shown how citizens use hashtags to address information needs during such incidents and raise awareness, thus providing actionable data that enables emergency managers to build situational awareness and allocate resources to those in greatest need (A. M. Bruns 2016).

It is noteworthy that studies and research dealing with hashtags have provided relatively simple analyses regarding how they are used to categorize content and direct attention to specific topics. In the past, studies mainly focused on the prevalence of hashtags and how they influenced the spread of content across social platforms.

With the increasing importance and widespread use of hashtags, studies have evolved to include more complex aspects and deeper analyses. Researchers began to understand the linguistic and social patterns of hashtag use, including how they are created, how they spread within social networks, and the relationship between hashtags, information dissemination, and digital cultural transmission.

Today, studies on hashtags cover a wide range of topics, such as big data analysis to understand user behavior, studying the social and linguistic spread of hashtags, and analyzing cultural and political trends through hashtag usage. Technological tools and data analysis techniques have evolved to enable researchers to understand and analyze hashtags more thoroughly and deeply, leading to more complex and detailed studies in this field.

Among these studies is the one by (Cunha, et al. 2011) , inspired by linguistics, on how hashtags are created, used, and spread by members of information networks, aiming to understand the spread of hashtags on Twitter based on models for analyzing the spread of linguistic innovations in speech communities, i.e., groups of people who linguistically influence one another. Unlike traditional linguistic studies, this study looks at the evolution of terms in a live and rapidly evolving content stream that can be fully analyzed. Through experiments using large datasets from Twitter, the study was able to identify some interesting aspects—similar to those found in offline speech studies—which led researchers to believe that hashtags could be effective models for characterizing the spread of linguistic forms, including the presence of a "preferential attachment process," which makes many of the more common terms even more popular. The study also explored the relationship between the length of the hashtag and its frequency of use to understand successful hashtag formation patterns on Twitter and improve real-time search algorithms.

Meanwhile, the study by (Johnson, Hall-Phillips et Cho 2019) examined the role of hashtags in political consumerism through the lens of social influence theory and its relation to individuals' consumer practices. Using social network and content analysis, this study examined a sample of tweets and accompanying hashtags over four days, including the hashtag #BoycottNFL during nine days of the 2017 NFL season. The study found that the line between controversial political consumerism and lifestyle was blurred. Boycotting the NFL is a controversial form of political consumerism but is part of lifestyle political consumerism through the individual act of creating a tweet, which unintentionally becomes part of collective action. Furthermore, the analysis revealed that the accompanying hashtags reflected three types of political consumerism emotions (i.e., political, civil, and consumer-related), which changed the tone of the tweet and could alienate actors focused on community consumption practices. The study discussed the theoretical and practical implications.

Another study by (Sheldon, Herzfeldt et Rauschnabel 2019) focused on the characteristics of hashtags and the impact of individual cultural values on hashtag behavior. The results revealed four dimensions of hashtags, concluding that hashtags can be inspirational, structural, entertaining, and artistic. Second, the findings showed that hashtags are used to organize content independently of cultural values. However, inspirational hashtags are common among users with collective and uncertainty-avoiding cultural values and masculine cultural values. Additionally, collective and masculine values were also associated with artistic hashtags, while uncertainty avoidance was linked to entertaining hashtags. Moreover, the results showed that cultural values related to power distance were associated with a higher hashtag density.

In (Highfield 2018) study, the role of emojis in the social media world and how they integrate with hashtags was examined. The study compared two different methods of using emojis and hashtags on two different social platforms, Instagram and Twitter, highlighting how Instagram users utilize emojis as classification tags in their posts, allowing them to express their feelings and thoughts in a creative and innovative way. At the same time, the study reviewed how Twitter users use directed emojis as hashtags,

which are more focused and represent a specific subject or reference to a particular thing. These different methods show how social platforms provide different interactive experiences for their users. While Instagram users use emojis as a means of expression and creativity, Twitter users use emojis more as a guide to focus on specific topics or engage in specific conversations. The study demonstrated that social media, in general, plays an important role in enhancing communication between individuals and expressing ideas and emotions. Emojis and hashtags reflect this communication, facilitating the exchange of meanings, content, and the organization of topics of interest on social platforms. On Instagram, users can use emojis as classification tags, enhancing creative flexibility and allowing for multi-meaning expressions. These emojis can be used in post comments, stories, bios, and other parts of the platform, reflecting the structural freedom users enjoy in using emojis.

On the other hand, on Twitter, hashtags are restricted to letters and numbers only and do not support the use of emojis as classification tags. Twitter's approach to employing emojis in hashtags involves its own intervention, as the platform attaches hashtags to emojis automatically through commercial partnerships, rather than by users. This limits users' ability to express creativity or subversion through emojis.

These practices differ across platforms, highlighting competing tensions regarding what users can or want to do on social platforms and how these platforms meet the diverse demands and needs of users.

These studies demonstrate the evolution of research on hashtags, from the initial focus on their spread and linguistic and social impact to exploring multiple dimensions of their use and relationship with cultural and political values. The studies vary in their analyses and methods of using hashtags across different platforms, showcasing the complexity of user interaction with expressive emojis and hashtags on social media platforms.

Methodology

The study falls under the category of quantitative descriptive field studies. According to John Creswell, quantitative studies are defined as: "a means for testing objective theories by examining the relationship among

variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures. The final written report has a set structure consisting of an introduction, literature and theory, methods, results, and discussion. Those who support this form of inquiry have assumptions about testing theories deductively, building in protections against bias, controlling for alternative explanations, and being able to generalize and replicate the findings." (Creswell 2014).

Our study falls within this type of research due to its alignment with the functional paradigm, which has a positivist orientation (a philosophical perspective). Although philosophical ideas remain largely hidden in research, they still influence research practice and need to be acknowledged. They help explain why one chooses a quantitative, qualitative, or mixed-method approach to study. Philosophical perspectives are the general worldview and the nature of research that the researcher holds. This study adopts positivist ideas, which represent the traditional form of research, and these assumptions are more valid in quantitative research and reject qualitative research. This theoretical perspective is sometimes called the scientific method or natural sciences research. It is also referred to as objective research and experimental science. These objective ideas stem from writings by authors in the 19th century, such as Comte, Mill, Durkheim, Newton, and Locke.

Based on the nature and type of our descriptive quantitative study, the appropriate methodology for it is the "descriptive survey method", through this method, we aim to describe how environmental crises are addressed through the hashtags in the study sample, which in turn helps to raise environmental awareness through this approach.

This method is defined as "the collection of information about people, situations, behaviors, beliefs, properties, and conditions, which represents phenomena occurring in societies or social systems in general." (Kothari 2004) .

We did not rely on any of the conventional sampling methods due to our use of Tweet Binder, a platform for analyzing big data on Twitter (now X). We only focused on two well-known hashtags that have been widely

used to raise environmental awareness and address climate-related crises in recent years and are still in use today. A specific package was purchased from the site, which then extracted an appropriate sample based on the selected package and available options. The analysis was conducted over the period from September 2023 to November 2023.

Results

Table 1 Frequencies and percentages of gender interactions with the hashtags.

Gender	#GlobalWarming		#ClimateChange		Total	
	F	%	F	%	F	%
Male	744	76.15%	501	47.90%	1245	61.542%
Female	233	23.85%	545	52.10%	778	38.458%
Total	977	100%	1046	100%	2023	100%

For the hashtag GlobalWarming :

The proportion of males was 76.15% compared to 23.85% for females. Males may be more interested in the topic of climate change than females due to social and cultural factors. For example, professions related to climate change are more common among males, such as engineers who play a significant role in developing solutions for climate change, including new technologies for renewable energy generation, energy efficiency techniques, and climate change mitigation technologies. According to the Energy Engineers Council, 90% of engineers in the United States are male. (t. A. Engineers 2023) Similarly, according to the American Association for the Advancement of Science, 72% of scientists in the United States are male (AAAS 2022). For environmental professionals, according to the American Society of Civil Engineers, 78% of environmental professionals in the United States are male (A. S. Engineers 2023). Globally, only 30% of technology specialists are women, and according to a study by Deloitte Global, only 23% of women work in the IT and computing sector in the United States. The proportion of female graduates in STEM (Science, Technology, Engineering, and Mathematics) fields is about 19%, and

women leave the technology industry at a 45% higher rate than men (snajjela 2022).

For the hashtag ClimateChange:

The proportion of female interaction was slightly higher than that of males, at 52.10% compared to 47.90%. This contrasts with the previous hashtag despite both hashtags addressing climate crises and environmental protection. This slight difference suggests that males interact with these types of hashtags more frequently, as their proportion was close to half, while females' interaction was only slightly above 20% in the previous hashtag. The slightly higher female interaction with this hashtag compared to males may be due to males being more likely to share tweets focusing on technical or scientific topics related to climate change, while females might be more inclined to share tweets on personal or social topics. Additionally, women are increasingly exposed to news and content about climate change through media. For example, a study by the Geena Davis Institute on Gender in Media in 2023 found that women represent 38% of speakers about climate change in the media, compared to 50.8% of women in the United States. Women are also more likely to appear in news stories focusing on the human impacts of climate change, such as displacement and natural disasters, but less likely to appear in stories focusing on climate change solutions, such as renewable energy or environmental policies (Media 2022). This demonstrates that women's participation differs from men's in terms of the nature and type of interaction due to varying interests.

Table 2 Frequencies and Percentages of Interaction Types within the Hashtags

Type of interaction	#GlobalWarming		#ClimateChange		Total	
	F	%	F	%	F	%
Text Tweets	41	%2.18	15	%0.95	56	1.62%
Replies	71	%3.77	92	%5.85	163	4.718%
Retweets	723	%38.44	717	%45.55	1440	41.679%
Images and Links	340	%18.07	440	%27.95	780	22.576%
Likes	706	%37.54	310	%19.70	1016	29.407%
Total	1881	%100	1574	%100	3455	%100

Retweets were the most commonly used interaction method among participants within the sample hashtags of the study, followed by likes on tweets, then images and links, and finally replies to tweets, with text posts being the least used.

These results indicate that retweeting is a simple and easy method for interacting with tweets. Users can retweet a tweet with just one click, making it a quick and effective way to engage with others on a specific topic. Additionally, retweeting is an effective way to disseminate information and raise awareness about issues. When a user retweets a tweet, they share it with their followers, which can increase its reach to a larger audience and signal their agreement or disagreement with the content, potentially sparking discussions about the topic.

The results are closely related to agenda-setting theory, as users tend to retweet tweets that they find important or interesting, viewing it as an effective way to spread information and raise awareness about significant issues. By retweeting, users broadcast these tweets to their followers, which can further expand the reach of these topics and help in spreading awareness.

Table 3 Emotion Statistics Frequencies and Percentages for the Hashtags

Emotion Statistics		#GlobalWarming		#ClimateChange		Total	
		F	%	F	%	F	%
Tweets	Negative	282	%27.76	172	%15.52	454	21.37%
	Neutral	644	%63.38	775	%69.95	1419	66.81%
	Positive	90	%8.86	161	%14.53	251	11.82%
	Total	1016	%100	1108	%100	2124	100%

Images and Links	Negative	48	%14.68	37	%9.92	85	12.14 %
	Neutral	36	%11.01	267	%71.58	303	43.29 %
	Positive	243	%74.31	69	%18.50	312	44.57 %
	Total	327	%100	373	%100	700	100 %
Retweets	Negative	228	%31.58	134	%19.01	362	25.37 %
	Neutral	420	%58.17	486	%68.94	906	63.49 %
	Positive	74	%10.25	85	%12.05	159	11.14 %
	Total	722	%100	705	%100	1427	100 %
Contributors	Negative	361	%31.56	318	%21.66	679	25.99 %
	Neutral	644	%56.29	995	%67.78	1639	62.75 %
	Positive	139	%12.15	155	%10.56	294	11.26 %
	Total	1144	%100	1468	%100	2612	100 %

The results between the two hashtags were quite similar, with neutrality prevailing in the sentiment patterns across various interactions. However, there was a notable difference in the category of images and links, where the hashtag related to global warming showed a significantly higher percentage of positive sentiments, with 74.31%, making it the highest positive sentiment across all interaction types within the study's sample. This result indicates that users are more likely to express positive feelings through images and links concerning environmental issues. This makes sense, given that global warming is a significant topic of concern, and users may use images and links to express hope for a better future or to show

their support for efforts to address the crisis. The difference between the two hashtags can be explained by the nature of their use. #GlobalWarming is more commonly used by scientists or activists focusing on the scientific aspects of climate change, whereas #ClimateChange is more often used by the general public or NGOs focusing on the social and political aspects of climate change.

Table 4 Frequencies and percentages of the language used in interactions within the hashtags

language	#GlobalWarming		#ClimateChange		Total	
	F	%	F	%	F	%
English	1051	90.76%	1084	94.76%	2135	92.75%
French	11	0.95%	5	0.44%	16	0.69%
Spanish	4	0.35%	0	0	4	0.17%
Italian	16	1.38%	18	1.57%	34	1.48%
Hindi	35	3.02%	2	0.17%	37	1.61%
Unknown languages	41	3.54%	35	3.06%	76	3.30%
Total	1158	100%	1144	100%	2302	100%

It is clear that the English language is widely used in all hashtags, as these hashtags originated in the United States of America, making English the original language for these hashtags. It cannot be denied that English enjoys vast popularity worldwide. It ranks first globally, with about 25% of the world's population speaking it, and the number of speakers exceeds 1.8 billion people. It is the official language of many countries, and its speakers come from all around the world. (Alarabiya 2023)

There are small percentages of unknown or 'other' languages, which may indicate the use of unspecified or less-known linguistic codes in the current context. Users might be using their local languages in hashtags, especially if the hashtag focuses on a particular topic or audience. This shows that hashtags have become a platform for expressing cultural and national identity, where users can use their local languages or linguistic codes to communicate with each other, even if these languages or codes are not understood by the general public. Additionally, users may make

mistakes in writing the language, leading to the appearance of unknown languages.

Table 5 illustrates the hashtags associated with the hashtag #GlobalWarming

#	The number of tweets
#CLIMATECHANGE	394
#COVID19	348
#DIGITALINDIA	278
#CLIMATECRISIS	265
#SHEEPL	156
#PSYOPS	90
#ELNINO	72
#CLIMATEEMERGENCY	23
#COP28	5

Based on the previous table, it can be observed that:

- **#CLIMATECHANGE:** is the most used and linked to the main hashtag with 394 tweets, due to the similarity and overlap of topics addressed within them, specifically related to the environment. This hashtag is used to share news and developments related to climate change in general and also to express emotions about climate change, such as concern or anger.
- **#COVID19:** with 348 tweets, this hashtag was used to link climate change to the COVID-19 pandemic and to express the opinion that climate change makes the world more vulnerable to infectious diseases.
- **#DIGITALINDIA:** in fourth place with 278 tweets, this hashtag was used to link climate change to digital transformation, with the belief that digital transformation can help address climate change.
- **#CLIMATECRISIS:** used to express that climate change is a crisis and to call for urgent action to address it, with 265 tweets.
- **#SHEEPL:** used to express skepticism about the reality of climate change, with the belief that it is a conspiracy, with 156 tweets.

- **#PSYOPS**: this hashtag was used to express doubt about scientific research on climate change, claiming that it is a hoax, with 90 tweets.
- **#ELNINO**: used to discuss the impact of climate change on El Niño, making it more severe, with 72 tweets.
- **#CLIMATEEMERGENCY**: used to express that climate change is an emergency and urgent actions are needed to address it.
- **#COP28**: used to discuss the 28th Conference of the Parties on climate change.

Overall, it can be said that the hashtags associated with #GlobalWarming provide a comprehensive picture of how people are engaging with climate change issues on Twitter, reflecting a wide range of opinions and feelings on this important topic. They can be categorized into three main groups:

- Hashtags related to climate change in general, such as #CLIMATECHANGE, #CLIMATECRISIS, and #ELNINO, addressing topics like the impact of climate change on the environment, society, and the economy.
- Hashtags related to the impact of climate change on other issues, such as #COVID19 and #DIGITALINDIA, covering topics like the relationship between climate change and infectious diseases or the relationship between climate change and digital transformation.
- Hashtags related to skepticism or opposition to climate change, such as #SHEEPLE and #PSYOPS, addressing topics like doubt about the reality of climate change or the belief that climate change is a conspiracy."

Table 6 illustrates the hashtags associated with the hashtag #ClimateChange

#	The number of tweets
#COP28	546
#PUTIN	354
#SAVESOIL	258

#CLIMATEACTION	246
#CLIMATECRISIS	279
#GLOBALWARMING	236
#COP28UAE	102
#CO2	67
#CLIMATEACTIONNOW	21

This table illustrates the hashtags associated with the hashtag #ClimateChange and the number of related tweets:

- #COP28: This hashtag was used to discuss the 28th Conference of the Parties on Climate Change, which will be held in 2024 in the United Arab Emirates, advocating for urgent actions to address climate change during the conference.
- #PUTIN: This hashtag talks about Russian President Vladimir Putin, expressing anger at Putin's actions that contribute to exacerbating climate change, such as the weapons used in the Ukraine war and his threat of using nuclear weapons.
- #SAVESOIL: This hashtag refers to the importance of preserving soil and the impact of climate change on soil. #CLIMATEACTION: This hashtag is used to call for actions to address climate change and to express support for efforts to tackle climate change.
- #CLIMATECRISIS: This hashtag was previously mentioned among the hashtags related to global warming.
- #GLOBALWARMING: This hashtag is used to discuss the phenomenon of global warming, which is a primary cause of climate change.
- #COP28UAE: Related to the climate change conference that will be held in the United Arab Emirates.
- #CO2: Used to talk about carbon dioxide, one of the main greenhouse - gases responsible for climate change.
- #CLIMATEACTIONNOW: This hashtag is used to call for urgent actions to address climate change and express concern over the rapidly changing climate.

All of the mentioned hashtags reflect the concern and interaction with climate change issues, expressing worry about the environmental and climatic challenges the world is facing and the need for effective and urgent actions.

Discussion

The findings of this study provide critical insights into the role of hashtags in shaping environmental awareness and engagement around climate change topics on social media. The analysis indicates that hashtags such as #GlobalWarming and #ClimateChange significantly enhance visibility and foster global conversations on environmental issues.

One of the notable findings is the prevalence of retweets as a primary form of interaction among users. This highlights the effectiveness of retweeting as a mechanism for spreading awareness, as users can quickly share content with their followers, amplifying the reach of important environmental messages. The implications of this are profound; as users engage with and disseminate information through retweets, they contribute to a collective awareness that can mobilize action and influence public discourse on climate change.

Furthermore, the demographic analysis of interactions reveals gender disparities in engagement with climate-related hashtags. The higher percentage of male users interacting with #GlobalWarming compared to female users suggests potential barriers or differences in interest that warrant further investigation. Understanding these dynamics can help tailor communication strategies to engage a more diverse audience and address the needs of underrepresented groups in environmental advocacy.

The emotional analysis of tweets indicates a predominance of neutral sentiments, yet there is also a significant representation of positive sentiments, especially associated with images and links. This finding suggests that while many users may engage with climate content in a neutral manner, there is a substantial portion that expresses hope and support through visual content. This can serve as a valuable insight for environmental organizations looking to craft messages that resonate emotionally with their audiences.

Overall, this study emphasizes the importance of strategic hashtag use in social media campaigns aimed at environmental advocacy. By understanding the patterns of engagement and sentiment associated with specific hashtags, stakeholders can optimize their outreach efforts and foster a more informed and active public discourse on climate change.

Conclusion

In conclusion, this study highlights the significant role that hashtags play in raising environmental awareness and fostering global discussions on climate change issues. The analysis of hashtag activity on platforms like X (formerly Twitter) reveals that hashtags such as #GlobalWarming and #ClimateChange not only enhance visibility but also serve as catalysts for engagement, mobilizing users to share information and express diverse sentiments. The findings demonstrate that while certain hashtags have a broader reach and a stronger impact on public engagement, their effectiveness depends on factors such as timing, the influence of key users, and the type of interaction (retweets, likes, etc.).

Furthermore, the study shows that hashtags have evolved from mere organizational tools to powerful communication mechanisms that influence public discourse on critical environmental issues. Hashtags allow for the creation of virtual communities where users from diverse backgrounds can express their concerns, share solutions, and advocate for climate action. However, the impact of these hashtags also reflects the complex relationship between social media usage, public perception, and political or social agendas.

Overall, this study underscores the importance of strategic hashtag use in environmental advocacy, offering insights for organizations and activists seeking to maximize their impact on social media. By leveraging the power of hashtags effectively, stakeholders can continue to drive meaningful conversations and promote collective action in the fight against climate change.

Références

AAAS. 2022. <https://www.aaas.org/>.

- Alarabiya. *After English.. this is the most common language in the world!* 2023.
<https://www.alarabiya.net/last-page/2023/06/10/%D9%84%D9%8A%D8%B3%D8%AA-%D8%A7%D9%84%D8%A7%D9%86%D8%AC%D9%84%D9%8A%D8%B2%D9%8A%D8%A9-%D9%87%D8%B0%D9%87-%D8%A3%D9%83%D8%AB%D8%B1-%D9%84%D8%BA%D8%A9-%D9%85%D8%AD%D9%83%D9%8A%D8%A9-%D9%81%D9%8A-%D8%A7%D9%84%D8>.
- An, Jisun, et Ingmar Weber. «#greysanatomy versus #yankees:Demographics and Hashtag Use on Twitter.» *the Tenth International AAAI Conference on Web and Social Media*. 2016. 523-526.
- Bruns, A., Burgess, J., Crawford, K., & Shaw, F. «#qldfloods and @QPSMedia: Crisis Communication on Twitter in the 2011 South East Queensland Floods.» *ARC Centre of Excellence for Creative Industries and Innovation.*, 2012.
- Bruns, A., Moon, B., Paul, A., & Münch, F. «Towards a typology of hashtag publics: A large-scale comparative study of user engagement across trending topics.» *Communication Research and Practice*, 2016: 20-46.
- Creswell, John W. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. United States of America: SAGE Publications, 2014.
- Cunha, Evandro, Virgilio Almeida, Gabriel Magno, Marcos André Gonçalves, Giovanni Comarela, et Fabrício Benevenuto. «Analyzing the Dynamic Evolution of Hashtags on Twitter: a Language-Based Approach.» *Proceedings of the Workshop on Language in Social Media*. Portland, Oregon, 2011. 58-65.
- Engineers, American Society of Civil. *American Society of Civil Engineers*. 2023.
<https://www.asce.org/>.
- Engineers, the Association of Energy. *the Association of Energy Engineers*. 2023.
<https://www.aeecenter.org/>.
- Highfield, Tim. «Emoji hashtags // hashtag emoji: Of platforms, visual affect, and discursive flexibility.» *First Monday*, 2018.
- Johnson, Olivia, Adrienne Hall-Phillips, et Hyojung Cho. «Are You Connected Through Consumption? The Role of Hashtags in Political Consumption.» *Social Media + Society*, 25 11 2019.
- kothari, c. r. *Research Methodology: Methods and Techniques*. new delhi: New Age International Publishers, 2004.
- Lehmann, Janette, Bruno Gonçalves, José J Ramasco, et Ciro Cattuto. «Dynamical Classes of Collective Attention in Twitter.» *WWW*, 2012.
- Lin, Yu-Ru, Drew Margolin, Brian Keegan, Andrea Baronchelli, et David Lazer. «#Bigbirds Never Die: Understanding Social Dynamics of Emergent Hashtags.» *the Seventh International AAAI Conference on Weblogs and Social Media*. 2013. 370-379.

- Media, Geena Davis Institute on Gender in. *Gender Bias in Media Coverage of Climate Change*". 2022. <https://seejane.org/>.
- Reilly, Paul, et Stefania Vicari. «Organizational Hashtags During Times of Crisis: Analyzing the Broadcasting and Gatekeeping Dynamics of #PorteOuverte During the November 2015 Paris Terror Attacks.» *Social Media + Society*, 2021: 1-13.
- Romero, Daniel M., Brendan Meeder, et Jon Kleinberg. «Differences in the Mechanics of Information Diffusion Across Topics: Idioms, Political Hashtags, and Complex Contagion on Twitter.» *the International World Wide Web Conference WWW*. Hyderabad, India., 2011.
- Sheldon, Pavica, Erna Herzfeldt, et Philipp A. Rauschnabel. «Culture and social media: the relationship between cultural values and hashtagging styles.» *Behaviour & Information Technology* , 11 05 2019: 758-770.
- snajjela, mohammed. *What if women ran the internet*. 22 July 2022. <https://www.aljazeera.net/women/2022/7/22/%D9%85%D8%A7%D8%B0%D8%A7-%D9%84%D9%88-%D8%A3%D8%AF%D8%A7%D8%B1%D8%AA-%D8%A7%D9%84%D9%86%D8%B3%D8%A7%D8%A1-%D8%B4%D8%A8%D9%83%D8%A9-%D8%A7%D9%84%D8%A5%D9%86%D8%AA%D8%B1%D9%86%D8%AA%D8%9F>.
- Tikka, M. «Ritualisation of crisis communication: Crowdenabled enabled responses to the Stockholm terror attack on Twitter.» *Nordicom Review*, 2019: 105-120.
- سناجلة, محمد. *ماذا لو أدارت النساء شبكة الإنترنت؟*. 22 07 2022. <https://www.aljazeera.net/>.