Babeș-Bolyai University Cluj-Napoca

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Doctoral School of Political and Communication Sciences

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DOCTORAL THESIS

Natural disasters reflected in social media.

Multimodal analysis of Instagram content:

#australianwildfires, #earthquaketurkey, #alluvioneemiliaromagna

Summary

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Introduction

At a time when the link between representations of disasters and the effects on the public are influenced by human reactions, this research investigates the role of photography and social media in influencing public perceptions of natural disasters. Focusing on the semiotic and narrative properties of images shared on platforms such as Instagram, the study explores narrative construction in crisis situations and how digital visual narratives shape societal reactions to disasters.

Through a multidisciplinary approach combining data analysis, semiotic approaches and visual studies, the research examines the evolution of photography as part of visual culture, the dynamics of social media as a platform for communicating risk situations and the relevance of natural disasters in a global context.

Analysis of Instagram narratives related to three recent natural disasters - the Australian bushfires (2019-2020), the Turkish earthquake (2023) and the floods in Emilia-Romagna, Italy (2023), incorporates a combination of quantitative and qualitative methods, including natural language processing and machine learning, to investigate the interplay between images and text, identify who are the people affected by the disasters, the public people involved in relief efforts and what are the central emerging themes.

1. The visual message

The first chapter outlines how visual culture, semiotics and aesthetics influence viewers' interpretation of and interaction with visual representations. The advent of digital technology has transformed not only the process of producing and disseminating photographs, but also their perception and analysis. Cultural narratives are embedded in photographs, and their semiotic influence is embedded in visual culture, shaping the interpretation of messages. Building on the theoretical and analytical foundations proposed by Gillian Rose (2001), this chapter clarifies the ways in which images act as agents of communication and interpretation in society. The ubiquity

of photography in diverse socio-cultural contexts positions it as an essential medium of mass culture, facilitating the creation and consumption of visual narratives.

Studies on visual culture demonstrate that images play an active role in communication, influencing identity formation and social differentiation. They are not mere mirrors of reality, but rather influence our understanding of the world around us. The concept of realism in photography is the subject of ongoing discussion - photographs offer perspectives of reality, but the subjective decisions taken by photographers demonstrate that photographs are not just about capturing moments, but also about creating them.

Thus, the characteristics of an image, shaped by the rules of composition and the principles of visual communication, convey distinct messages. Subject placement, chromatics and lighting of elements in an image have the ability to evoke emotion, imply connections and convey symbolic meaning. Semiotics provides a theoretical framework for understanding the meaning-making process in visual representations, while social semiotics extends this framework to encompass the social and cultural ramifications associated with meaning-making.

2. Visual narratives and digital discourse: exploring communication dynamics on Instagram

Social media platforms have become important spaces for public communication, information sharing and community building in the digital age. Instagram is a platform that stands out as a medium oriented towards visual communication, which goes beyond the simple act of sharing photos. It has developed into a system where visual elements, textual content and social interactions intersect. The objective of this chapter is to analyse specific elements of social networks and their role as communication platforms in modern digital society.

The analysis begins by examining social media as a means of communication, followed by a clarification of the various dynamics that characterize and distinguish these platforms, with a focus on the functionalities and role of the Instagram platform in creating narratives, communicating risk situations, and engaging/responding to community needs.

Complementarily, the notion of the hashtag as a tool for navigating and understanding the digital environment is explored. Hashtags serve as a means of classifying content and as a symbol of collective unity, representing how digital communities come together around events, ideas or various movements and currents.

Beyond the conceptual clarifications and functionalist perspective, the chapter also aims to analyze content on Instagram from a multimodal perspective, recognizing the simultaneous presence of various modes of communication in social media and their combined impact on meaning-making processes. The field of semantic analysis encompasses many natural language processing (*NLP*) techniques, such as sentiment analysis and named entity recognition (*NER*) analysis. These are analytical tools that identify and classify unstructured textual information generated by social media posts and help to identify emotional nuances associated with the content and identify key information such as places, people or organizations mentioned in descriptions. The integration of automated and manual analytic methods leverages the scalability of automated systems, while preserving the interpretability offered by manual analysis, especially in terms of identifying cultural and contextual nuances often ignored by purely automated solutions.

The review of the existing theoretical and analytical framework continues with the distinction between manual and automated visual analysis, as well as elements on trope identification and the construction of visual narratives.

3. Natural disasters and social media narratives

Narratives related to natural disasters in social media are diverse and complex, encompassing not only the immediate consequences of these events, but also the lasting social, political and cultural ramifications. From the perspective of social networks, natural disasters are undergoing transformations, moving from being news viewed from a distance to personal experiences shared by millions of individuals in an intimate and immediate way.

Social networks such as Twitter and Instagram function as tools for spreading important information, participating in humanitarian assistance, providing emotional support and identifying people who have been injured. Research has shown that social networks have the capacity to support direct testimonies of affected people, allowing for more timely involvement of authorities.

An examination of disasters and their representation in the media and social media provides insights into social frameworks, uncovering the political and cultural principles that shape community responses to disasters. The increasing intensity of natural disasters highlights the importance of implementing effective communication with affected people.

Public social media data from multiple perspectives - spatial, temporal, content - helps to identify the most affected areas, share information in a timely manner, classify content and share

information between relevant parties. Artificial intelligence and satellite imagery or official information are revolutionising disaster identification and analysis on social networks.

The section on risk communication and civic journalism aims, among other things, to explore how users report on important events, highlighting the public's involvement in the news landscape. Civic journalism, strongly influenced by social media, highlights the transformation of ways of reporting, consuming and understanding newsworthy events. The analysis then turns to the communication of newsworthy situations on social media, examining how platforms such as Instagram play an important role in the rapid spread of information.

4. Natural disasters reflected in social media. Multimodal analysis of Instagram content

The fourth chapter focuses on the visual narratives configured on the Instagram platform during three distinct natural disasters in recent years: vegetation fires in Australia (2019-2020), earthquake in Turkey (2023) and floods in the Italian Emilia-Romagna region (2023).

The three disasters chosen for study occurred in geographically diverse areas, providing a wide range of cultural, social and environmental contexts. This diversity and the fact that the disasters are of different types and magnitudes contributes to the analysis of how different communities respond to and communicate about disasters on social networks, identifying how the nature of the disaster influences online narratives, public reactions and, in particular, visual representations. It also provides insights into how cultural factors influence online discourse during crises.

The selected disasters received varying degrees of media coverage and public attention globally. Studying events with different levels of awareness allows exploration of how media influence and public attention shape social media narratives.

Practical considerations of data availability and accessibility significantly influenced the selection of the Australian fires, the Turkish earthquake and the Italian Emilia-Romagna floods as focal points for this research. These events attracted attention on social platforms, resulting in a considerable volume of user-generated content. The abundance of publicly accessible data for these disasters facilitates meticulous examination of the dynamics of online communication, allowing insights into how individuals and communities express themselves visually and semantically in the face of crises.

By combining multimodal analysis, this research aimed to identify patterns, trends and socio-cultural nuances embedded in Instagram narratives during natural disasters, ultimately contributing to the general discourse on crisis communication and the role of social networks in shaping public perception.

In order to conduct a detailed exploration of the specifics of the textual and visual content distributed on the Instagram platform for the three selected events, 1000 random posts containing the hashtags *#australianwildfires, #earthquaketurkey* and *#alluvioneemiliaromagna* were extracted.

The following research questions guided the study:

RQ1 - What are the main categories of users creating content associated with the natural disasters analysed?

RQ2 - What are the characteristics of the texts of Instagram posts associated with natural disasters from a linguistic and thematic perspective?

RQ3 - How is the narrative discourse specific to natural disasters constructed through visual communication elements and compositional techniques?

To answer the research questions, the paper proposed a mixed approach, involving both quantitative and qualitative analysis.

Quantitative analysis involves examining user engagement metrics and content characteristics. Sentiment analysis is based on the text accompanying posts (en. caption) and divides them into three categories: positive, negative and neutral. Attention is also paid to identifying users who generate a lot of content, the most frequently used hashtags but also, hashtags common to all three datasets.

A *CNN* model was trained to recognize composition rules such as the rule of thirds, framing of the subject in the center of the image, presence of patterns and guidelines. It is used to decode visual techniques encountered in images. Classifying images according to content and placing them in a context - indoor, outdoor, night, day, presence of animals, presence of people, etc. - helps enrich our understanding of how individuals choose to visually represent natural disasters on the Instagram platform.

The qualitative dimension of the study involves detailed analysis of the images and the text associated with the images. One of the dimensions explored in this study relates to the integration of visual tropes into images depicting natural disasters on Instagram. These play an important role

in shaping the discourse around events. The visual composition of images is not just a representation of reality, but often involves the strategic deployment of tropes that evoke specific emotions, convey symbolic meanings and contribute to the overall narrative. Recognizing and interpreting these tropes contributes to understanding how individuals use visual language to communicate complex emotions and responses in times of crisis.

Conclusions

This research, at the intersection of visual analysis, semiotics and digital media studies, explored how images and associated texts act as communication tools that influence societal responses to crisis situations. The analysis of content posted on Instagram for three major natural disasters sought to understand thematic content, narrative construction and emotional dimensions in the context of visual content-oriented digital platforms.

Multimodal analysis recognises that meaning is not created in isolation, but results from the interaction between image and text. On Instagram, this interaction can amplify emotional impact, provide context, and shape audience engagement in ways that neither text nor images alone can.

It was found that for the *#australianwildfires* dataset the main themes were human-animal relationships, environmental impacts of bushfires and community resilience. The use of wildlife photos and efforts to help wildlife generated emotional engagement from users and helped to trigger charitable actions. Celebrities and public figures mentioned in the descriptions help amplify messages and rescue efforts.

For the *#earthquaketurkey* dataset the main themes were resilience, solidarity, human spirit and community aid. Celebrities and athletes amplified messages of support and calls for charitable action, and NGOs and public institutions used Instagram to provide information and coordinate various victim relief activities. The most recurring images highlighted earthquake destruction, community efforts and rescue operations.

In the case of the Emilia-Romagna floods, the emergency services have been strongly singled out for their dedication and heroism, and people in the political class have been criticised. The most common images depicted rescue and reconstruction efforts, with community groups and volunteers making significant contributions.

Descriptions on Instagram demonstrated a wide range of emotions and emerging themes such as the human cost of natural disasters, community resilience, the causes of natural disasters, and health or humanitarian crises associated with them. They also illustrated the role of the platform in amplifying personal and collective narratives.

Narrative construction within the posts analysed was influenced by visual rhetoric and compositional techniques, developed to enhance narrative impact through chromaticism, composition, symbolism and the use of narrative tropes designed to evoke emotional responses and contextualise the scale of disasters. While most of the images were made in a straightforward manner in which the subject matter is often centered, the use of visual and textual elements on Instagram offer compelling ways to communicate complex narratives about disasters to a global audience.

One of the innovations of this thesis was the methodological approach that aims to structure unstructured Instagram data. Using natural language processing and automated image analysis techniques, large amounts of textual and visual data were classified and analyzed, transforming raw social media content into structured datasets that provided insights into narrative trends, collective responses to disasters, and the role of Instagram in natural disasters.

The research identified various key actors and sources, such as visual content creators, public figures, NGOs, public institutions and media outlets, each of which played distinct roles in disseminating and structuring disaster-related narratives. By analysing content characteristics and user engagement metrics, it was identified how their contributions vary.

Therefore, we believe that the thesis has answered the research questions, and the findings highlight and detail the role of social media and content conveyed in crisis communication and the potential for future research to further explore these dynamics.

Although this research provides valuable insights into the use of Instagram in communicating about natural disasters of different types, there are limitations to the analysis conducted.

The data for this study was not extracted during or immediately after disasters. As a result, the dataset may not capture the dynamics of the social platform in real time . The content may evolve rapidly and the most important posts distributed during the disasters may not be found in the analysed sample. The tool used for data collection allowed starting from a specific main

hashtag identifiable in all posts, but did not allow adjusting the time interval of posts or changing other parameters. Thus, the posts extracted are random.

The research focused on Instagram posts with specific hashtags, which may not encompass the entire discourse about those natural disasters. Narratives not associated with selected hashtags could provide additional context and insights.

Building on these findings, future analyses can delve deeper into the specifics of digital communication in crisis situations. One such direction would be to track disaster narratives on Instagram over extended periods of time, providing a dynamic view of how narratives and public sentiments shift from the immediate aftermath of a disaster to the long-term recovery and reconstruction phases.

While this thesis focused on Instagram, comparative studies involving other social media platforms, such as *Twitter (X), Facebook* or *TikTok*, may reveal differences and similarities in how visual and textual narratives are constructed and disseminated, helping to identify platform-specific characteristics.

With the rapid advancement of artificial intelligence and machine learning, future research may use more advanced analytical techniques to analyze datasets with greater precision.

On the visual side, future research directions may focus on the role of technologies such as drones, 360-degree cameras and augmented reality in capturing images of natural disasters, offering new ways to document and experience natural disasters.

In conclusion, we believe this thesis has deconstructed how Instagram can serve as a platform for shaping public narratives and responses to natural disasters through its unique combination of visual and textual storytelling.