Social Media in Disasters. Big Data Issues in Public Communication Field

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Abstract   With the growth and the changing nature of the (big) data, the role of social sciences researchers has been enhanced, producing an emerging assemblage of tools and techniques for managing and making sense of such data. Furthermore, a web content analysis (WCA) approach could become the basis for the use of techniques that enhance the relational context in which the production of messages and texts puts itself. In light of these premises, our contribution aims to explore the way in which new research strategies of WCA—in particular the adoption of a mixed-methoda perspective that moves back and forth qualitative and quantitative approach—could be useful in the analysis of social media use and functions in the process of disasters implementation. As disaster social media framework includes users such as communities, governments, individuals, organizations, and media outlets, the use of a broader range of techniques in scientific study of disaster social media effects could facilitate the creation of disaster social media tools in the public communication field.

1   Introduction

The article aims at highlighting the role of social big data in public communication field, toward a more sophisticated transfer of knowledge among the affected civil society and the actors devoted to manage the emergency responses, such as civil protection agencies as well as local and national administrators.

Although the paper has to be understood as a joint work of the authors, Francesco Marrazzo is the author of paragraph 1 and 3, Gabriella Punziano is the author of paragraph 2 and 4.

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In fact, social media is rapidly emerging as a potential resource of information capable to support natural disasters management because a more and more increasingly amount of people makes use of them during the evolving of disasters generating big geosocial data of different formats and quality that must be quickly processed (Athanasis et al. 2018).

The methodological challenge dwells in the rapid and comprehensive analysis of a variety and immense universe of data so much so that, over the years, many analyses have been produced on decisional supporting tools for natural disaster management that take into account the georeferenced information. However, online content goes far beyond this component. These data are dense and loaded with a semantic and communicative component that cannot be ignored. In order to improve the management of the disaster, the recovery of this component becomes more and more essential, as well as an integrated and multidisciplinary approach becomes more and more essential to be able to really generate meaning from the huge flow of social big data.

According to Pu and Kitsuregawa (2013), the potential benefits of Big Data for disaster management stay in the five C characteristics of social media data: collectively, connectedness, completeness, clarity, and collaboration. In the reported perspective, big social media data are imbued with relational, interactional, and action values that impact and could make use of the power imbedded therein in any phase of disaster management—prevention, preparedness, and response and recovery.

In a disaster situation, social media are used by the citizens in four primary ways: family and friend's communication; situation updates; situational/supplemental awareness; services access assistance. During disaster social media help to communicate, and after the disaster they help communities come together again and enhance capabilities to build better recovery efforts and distribution of assistance (Joseph et al. 2018). Social media, as a backchannel of communications (used both to receive and post messages), increase the social capacity of information generation and dissemination (Xiao et al. 2015). Their generated data in disaster management are real-time data that bring social media to be the fourth most popular source for retrieving emergency information (Lindsay 2016). The efficient integration, aggregation, and visualization of this huge information will assist emergency managers to optimize the situational awareness and could result in a better decision-making procedure.

Methodologically reasoning, in this optic, new strategies of analysis—more hybrid, capable to go jointly in depth and in extension, able to fight with new, multi-format, and big data—impose themselves among the contingent needs for research that aims to focus in the frame of media disaster communication analysis. It is in this precise situation that, among the analytical solutions and the approaches that can be pursued in this type of research, a particular variant of the *Web Content Analysis* is presented in the next paragraphs: *Mixed-Web Content Analysis*.

2   Big Data Issues: The Role of Web Content Analysis

With the growth and changing nature of the (big) data also the role of social sciences researchers has been enhanced. At the same time, it could be at the same time possible to assist to the assemblage of tools and techniques for managing and making sense of all this data—often with no more than simple software on a standard computer (Lewis et al. 2013), and to the merging of different knowledge and sciences domains (Savage 2012). This means that the future of research on social, political, and communication fields may depend on building intellectual and technical alliances with other ways of knowing. Only by this way, the overabundance of data should end up to be a fool's gold (Karpf 2012), becoming simply much more complicated to analyze (Tinati et al. 2014), even if computational techniques for large-scale data analysis that once required supercomputers now can be deployed on a desktop computer (Manovich 2012).

As it could be evident, technical, ethical, computational question, as well as the nature, the use and the re-use of the data, and so on, are the issues always recalled when we talk about big data (Amaturo and Aragona 2016; Lauro et al. 2017). In particular, the issues generated around big data could be summarized in the Skalski et al. (2017) statement:

> Big data often take the form of information produced by human behavior and collected and archived by the programs behind social media platforms, web sites, and mobile media applications (Lewis et al. 2013). We now have the ability to search, aggregate, and cross-reference large data sets from a variety of interactive platforms, giving researchers the ability to overcome traditional sampling and coding limitations (Boyd and Crawford 2012). However, by definition, big data implies that the data are too big and complicated to handle or even be fully conceived by humans—computer power must be employed to collate, massage, and analyze. Thus, big data are removed from human experience, so only gross summarizations of the outcomes of analyses can be comprehended, making the implications of findings on big data rather abstract and not always directly applicable to human experience (204).

Therefore, hybrid and mixed solutions (Amaturo and Punziano 2016) are needed because the structural features of new media can be more fully subjected to algorithmic and quantitative analysis (because of the forms and structures) (Amaturo and Punziano 2017), while the sociocultural contexts built up around those features need the careful attention of manual methods and the deepness of qualitative approaches (Marrazzo and Punziano 2018).

But another challenge is under our look, the fact that interactive media has replaced traditional media and modes of communication such as newspapers, magazines, old-school television, and even the traditional telephone. So, not only hybrid approaches but also hybrid objects and media insist on the possibility of content analyzed the expanding sea of hybrid data characterizing our era.

Among the approaches, methods, and techniques, *web content analysis* (WCA) allows scholars to expand the horizons of the possible questions that every research can arise in relation to communication and online participation analysis by offering the ability to jointly analyze both the content and the way it is used and re-used in any context in which it is realized (Auriemma et al. 2015). Hence, WCA could become

the basis for the use of techniques that boosts the relational context in which the production of messages and texts puts itself (Amaturo and Punziano 2013). WCA also perfects its way of existing, contemplating together techniques of analysis in extension (from the quantitative point of view) and techniques of analysis in depth (from the qualitative point of view) making itself a fundamental approach in the emerging stream of *Mixed Methods.*

In light of these premises, our contribution is going to explore the way in which new research strategies of *web content analysis* (Herring 2010)—in particular, the application of a mixed form that moves back and forth qualitative and quantitative approach—could be useful in the analysis of social media use and functions in the disaster implementation process.

3   Social Media in Disasters: A *Mixed Web Content Analysis* Approach

The *Mixed Web Content Analysis* (MWCA) could be used to understand the mechanisms generating mainly the influence on perception building and alternative public spheres generation when a disaster occurs. Starting from the analysis of already existing online textual big data coming from social media, by applying a mixed qualitative and quantitative perspective of *web content analysis*, every phase of disaster—prevention, preparedness, and response and recovery—could be managed in a more efficiently and timely way. In other words, thanks to MWCA, researchers could face the role and practical experiences of public (interest) communication (Rolando 2004) in disaster management, with particular reference to the linkage between top-down strategies and community's resilience strategies.

For example, the accompaniment to the disaster management for both policymakers and affected communities following this approach can be given by using a trivial example. The big data related to the increase of instantaneous communications on social platforms (the intent activity of flow data), can be considered a spy, an alarm bell, in order to understand that something is happening in a given zone (big data on platforms are also georeferenced data) which is influenced by this increase of data flow. This quantitatively marks the start of the process of a mixed analysis. The immediate analysis of the contents disseminated with this breadth and speed, from a qualitative, thematic, and content point of view, can be modeled to understand what is happening, what extent this event has, and where it is amplifying its effects. This would allow local administrators to direct aid by organizing the available forces rationally. Such a timely response would serve to manage panic for the community, as well as to increase security and a feeling of protection. The constant monitoring of flow and content data during the evolution of the disaster phases would allow an efficient and informed decision-making process and would limit the damages to the population involved, which in turn directs policies and actions through social communication, which it would also be produced without this monitoring-action

purpose. The extent of the use of social media in disasters through a *web content mix analysis* is quickly rendered in these few lines, although much further can be pushed.

According to Bruns et al. (2012), the use of a broader range of techniques in the scientific study of disaster social media effects could facilitate the creation of disaster social media tools in public (interest) communication field. The implementation of research design on disaster social media aimed to facilitate the creation of social media tools should take into account some critical administrative questions (Lindsay 2016), as well as the relevance of sense-giving strategies in disaster management held by government agencies (Marx et al. 2018) and the informal trust in their relationships with citizens (Mehta et al. 2017).

3.1 Social Media in Disasters: A Literature Review

Communication has even been considered a core component of disaster planning, response, and recovery (Rodríguez et al. 2007). Since the creation of the Disaster Communication Intervention Framework (DCIF) model, social media have made their entry in the disaster management field (Houston 2012), covering different functions in the various phases characterizing a disaster (see Table 1).

Disaster social media framework includes users such as communities, government, individuals, organizations, and media outlets (Houston et al. 2015). During disasters, social media can influence traditional news media more so than the other way around (Valenzuela et al. 2017).

In the same way, social media characteristics are said to provide so many advantages over traditional media for disaster communication, that some government agencies have been interested in their use for disaster management since 2008 (Lindsay 2016).

According to Mehta et al. (2017), emergency management agencies (EMAs) can be distinguished among three social media models in disaster management, based on online trust: intelligence gathering; quasi-journalistic verification; crowdsourcing.

For Marx et al. (2018), EMAs should have the conception of themselves to be a publisher of crisis information during extreme events. As EMAs are often organized as local and nationwide branches, they can take, for the amplification mechanics, publishing strategies of media organizations as a paragon for information distribution. For the same scholars, it is possible to identify three different sense-giving strategies of media organizations (and local news media outlets): popularity arbitrage; bound amplification; open amplification (Marx et al. 2018).

Analyzing the different role played by official information—on the mainstream media or provided by government agencies—and the user-generated content in the Net—on the social media—in building perceptions and in generating alternative public spheres in communities hit by different kinds of disasters and facing high risks means conducting a systematic reflection on two sides. The former is more methodological and implies the changes that occurred in the formation of public opinion spheres and individual perceptions, influenced commonly by the media but

Table 1 Functions of disaster social media

Disaster social media use	Disaster phase
Provide and receive disaster preparedness information	Pre-event
Provide and receive disaster warnings	Pre-event
Signal and detect disasters	Pre-event → Event
Send and receive requests for help or assistance	Event
Inform others about one's own condition and location and learn about a disaster-affected individual's condition and location	Event
Document and learn what is happening in the disaster	Event → Post-event
Deliver and consume news coverage of the disaster	Event →Post-event
Provide and receive disaster response information; identify and list ways to assist in the disaster response	Event →Post-event
Raise and develop the awareness of an event; donate and receive donations; identify and list ways to help or volunteer	Event → Post-event
Provide and receive disaster mental/behavioral health support	Event → Post-event
Express emotions, concerns, well-wishes; memorialize victims	Event → Post-event
Provide and receive information about (and discuss) disaster response, recovery, and rebuilding; tell and hear stories about the disaster	Event → Post-event
Discuss socio-political and scientific causes and implications of and responsibility for events	Post-event
(Re)connect community members	Post-event
Implement traditional crisis communication activities	Pre-event →Post-event

Source: Houston (2012)

also guided by a new kind of information, that could be recognized in the online social data.

The latter goes in depth in the implications in terms of crisis communication and the relative impact on social, economical, and political structures of local post-disaster communities. Top-down processes of reconstruction and risk management (Alexander 2014), on one hand, and bottom-up strategies to resist in a broken-link community (Dufty 2012); on the other hand, come together in defining new and very complex scenarios in a post-disaster community.

So, it becomes important to consider three key factors: official information coming from mainstream media (disseminated online and on social media too); public communication (spread online and on social media too); opinion and emotion along local population involved in the post-disaster communities (expressed online and on social media too).

3.2 Social Media Data in Disaster Management: The Role of the Mixed Web Content Analysis

In disaster media management, social media data are increasingly being used for enhancing situational awareness and assisting disaster management. The reasons are different: social media data can characterize a (natural) disaster across space and over time, and thus are applicable to provide useful information on disaster situations. People have strong geographical awareness during (natural) disasters and are interested in communicating situational updates; news media and local authorities are opinion leaders and play a dominant role in the communication network (Wang et al. 2016).

In public risk communications, the initial focus on developing and executing best practices for outward communications is now giving way to discussions about augmenting response efforts with the inclusion of data from the public (Palen and Hughes 2017).

According to scholars, "it is almost impossible to make sense of the large amount of socially-generated data for applications to emergency management without adequate tools to filter, analyse, and visualize the data" (Palen and Anderson 2016); "information systems research can support emergency management agencies in using social media data for efficient crisis management by enhancing awareness of the benefits of social media analytics and helping to overcome organisational and technological challenges" (Stiegltiz et al. 2018).

Content analysis can help scholars and EMAs to understand how online participants communicate among and between the different crisis convergence behaviors, and which would be the best communication practices to assist crisis response efforts (Subba and Bui 2017).

As the new big data core issue in crisis and disaster management is to extract from the mass of incoming information what is important for situational awareness during emergencies, an empirical, MWCA-oriented, contribution for the implementation of public (interest) communication tools for disasters and emergencies management could be very useful.

Using this approach, it is possible to frame the disaster management not only as a question of what communicate but also of who communicate, with which intent, and in what direction, in order to assess the general sentiment of: (i) who experiences the disaster—and of course produces user-generated online content to describe and inform other people in the same situation, and also to express himself, increasingly online and on social platforms; (ii) who is storytelling the disaster—media mainstreams *in primis* for their natural function not only on the official but also on social and interactive platforms; (iii)who is called to manage with the disaster—such as local and national authorities, governors, agencies devoted to intervene, and so on, that, as well as the two previous categories, use social and minus social platforms.

All these flows of data are immersed in the general flows of data produced by, on, and for the occurred disaster, and need to be assessed, framed, and processed to become useful knowledge.

4 Conclusion and Final Remarks: Social Media in Disaster Tools

Inserting these argumentations in the framework of the MWCA, our intention was to look at employ Web 2.0 and 3.0 technologies for future collaborative decision-making (Zielinski et al. 2013)—including the use of social media—without giving up taking into account that the contents are not readily accessible and interpretable, since online texts, data, and images, are unstructured, noisy, and multilingual.

The principal result could be enclosed in a warning automated system that is able to continuously monitor the situation, the mood and the possible directions of information distortion, such as fake news, false alarms, and so on (Starbird 2017), and that could be useful for the decision-makers as well as for the inhabitants or for the official media.

In doing that, data science—that could be conceived as inclusive spaces of domino—joint to MWCA should overcome the limits experienced by the single disciplines in giving responses to all the questions arisen in media communication disasters. This is true both when social scientists are called to work on the computational side than when they are called to fight with the interpretation of the results recalling their specific expertise on the dominos side. Only the perfect mix among the two sides, the related disciplines and their main approaches, could give to the research also the function of public utility, especially in the situation in which it is needed a real-time understanding of phenomena, such as in a disaster situation.

The most solid reflection that comes from the union of big data to social media content data concerns the union of the analytics in the study of the former and the mining elaborations of the latter. The new tools to be produced in this area must take charge of the knowledge of communication experts, as well as of the ones generated by the professionals in disaster management or the ones produced from below, locally, in a social manner, capable of moving effective resolutions, in real time and closely related to opinions, moods, and contingent needs of the populations experiencing the disaster as well as of the governors who must be ready to manage the emergency situation.

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