SOCIAL MEDIA IN EARTHQUAKE-RELATED COMMUNICATION: SHAKE NETWORKS

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Introduction

Social media are playing an increasingly important role during and in the aftermath of natural disasters. Several case studies show how citizens and institutions are using them to spread or gather relevant information, share emotions or support recovery actions.

In 2013, Potts defined the role of social media during natural disasters as a 'largely untapped site of study' (Potts, 2014, p. 98). Although scholars are now engaging in a growing volume of research in this field, the literature still appears fragmented and overwhelmingly based on single case studies. Furthermore, research seems either to consider 'social media' as a whole, without heed to the characteristics of different platforms or to look only at individual platforms, with a disproportionate attention being paid to Twitter. In recent years, as social media have increasingly spread among ordinary users to the point of being defined as 'mainstream sites of relational maintenance' (Baym, 2010, p. 134), scholars have started to examine everyday practices that take place on social media platforms, gradually beginning to include Facebook (currently the most popular social media platform worldwide) in their analyses. In addition, research seems to focus either on top-down communication or on bottom-up processes.

In this book, we try to overcome this fragmentation by providing a comprehensive framework for analysing the role of social media during natural disasters and by taking into account a wide variety of platforms (with their particular affordances and constraints).

By crossing two different dimensions (top-down vs bottom-up processes and information sharing vs information gathering), we identify the four different scenarios that are summarised in the following table: top-down information sharing; citizen information gathering; institutional information gathering; bottom-up information sharing (Table I.1).

These scenarios can be summarised in two different but complementary ideal-typical patterns: the traditional model and the networked model. In looking at the traditional model, we can observe the ways in which institutions share disaster-related communication on social media (Chapter 1), while citizens act as audiences for such messages (Chapter 2), following the modes of communication familiar to us from

Table I.1: The Structure of the Book.

	Information Sharing	**Information Gathering**
Top-down	Institutional information sharing (Chapter 1)	Institutional information gathering (Chapter 4)
Bottom-up	Bottom-up information sharing; citizen engagement; digital volunteers (Chapter 3)	Citizens as audiences for institutional communication (Chapter 2)

traditional disaster communication. When considering the *networked* model, on the other hand, we observe the ways in which social media usage can enable innovative practices, ranging from bottom-up information sharing, citizen engagement and digital volunteering (Chapter 3), to enhancing situational awareness through social media, up to social sensing in the event of an earthquake (e.g. research relying on social media to provide estimates of the damage produced by a seismic event – Chapter 4). As we shall see in the following chapters, the traditional model is far more widespread than the networked one. From a quantitative point of view, institutions tend to use social media to spread rather than to gather, information; citizens, on the other hand, tend to rely on social media more to gather information rather than to share it. Nevertheless, we believe that such emerging (networked) practices, alongside their consistency with broader transformations we are witnessing in the digital world, can provide relevant insights into earthquake-related communication and contribute to disaster communication processes in a substantial way.

We do not believe that the networked pattern is, per se, more desirable than the traditional one; rather, we believe that these categories help gain a deeper understanding of the phenomenon, while a combination of patterns is needed for more effective communication during and following natural disasters. Moreover, the distinction between the two patterns should not be considered as binary, since different types of overlap occur in concrete communication situations. We do believe, however, that the two models are useful for analytical purposes.

In rejecting the position held by technological determinists, we do not believe that the networked model is a direct consequence of the rise of social media. Indeed, it originates in broader social transformations, described as the 'networked individualism operating system' (Rainie &

Wellman, 2012). It is further related to a shift in the conceptual frameworks that inform emergency management, effectively summarised in the sociology of disaster with reference to the shift from the *command and control* model to the *active survivor* model (Rodriguez, Quarantelli, & Dynes, 2007).

However, social media do enable communication and interaction practices that make visible a number of dynamics that have already been occurring in social life (particularly with regard to the active behaviour of citizens); indeed, the rise of these dynamics, and their growing visibility on social media, have led to a reconfiguration of the relations between the different actors involved and of their power and agency. As we shall discuss throughout the book, cultural considerations are important, along with technological concerns, if institutions are to embrace fully the networked logic. Indeed, the full integration of digital and social media in disaster communication and management highlights the need to overcome the command and control models mentioned above, as 'they do not easily adapt to the expanding data-generating and data-seeking activities by the public' (Alexander, 2014).

The book is divided into four chapters. After presenting the conceptual framework, we shall look at the four different scenarios. In each chapter, we provide a literature review at an international level and one or more case studies based on our own research project. While the conceptual frameworks build on a variety of research traditions (including research addressing a broad set of crises and disastrous events), the case studies focus on earthquake-related communication.

In considering institutions, we focus particularly on both local-level emergency management and on the communication processes of scientific institutions worldwide. We also investigate communicative practices, social media affordances and the barriers to a more extensive use of social media.

In the construction of our conceptual framework, we rely on several fields of study, which have traditionally been operating, as it were, in isolation from each other, without regard to the variety of conceptual patterns and empirical results offered by other perspectives. We mainly refer to the sociology of disaster, crisis informatics, crisis communication and science communication. Moreover, we appeal for a deeper dialogue between these fields and communication (and Internet) studies, as we believe this might contribute to a better understanding of communication dynamics in the context of social media disaster communication,

particularly with regard to active audiences and the communicative practices enabled by digital and social media.

This book is the result of a three-year research project involving both social scientists and seismologists. All of the findings have been thoroughly discussed by participants in the research project within what has become a far-reaching interdisciplinary environment.

Chapter 1

Top-down Information Dissemination during Natural Disasters ☆

The topic of the top-down dissemination of emergency information through social media is controversial, as we shall try to demonstrate in this chapter. On the one hand, we need to consider how institutions perceive and use social media as part of their tool box, given that, in emergency situations, the official and verified information they provide is crucial for finding coping strategies. Given the conversational nature of social media (Lenhart, 2007), on the other hand, the institutional attempt to provide citizens with timely and official information risks denying the horizontal structure of online communication networks by implicitly proposing a linear communication model.

Moreover, institutions are endowed with specific competencies and knowledge which can be potentially hard to communicate, particularly in a historical moment when their reputation is under threat.

Although we are aware that the complex overlapping between top-down and bottom-up communication practices cannot be reduced to binary classification, we shall, for the moment, leave aside this complexity simply for explanatory purposes.

In this chapter, we will analyse institutional communication practices during and in the aftermath of natural disasters, trying to address the more general issue of institutions' top-down information dissemination strategies. More specifically, we will refer to the established tradition of studies devoted to the crafting of effective warning messages in order to highlight one of the fundamental dimensions of institutional communication. We will then turn to the analysis of institutions' communicative practices in emergency situation, with a special focus on social media usage practices. In order to problematise top-down information dissemination

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☆ This book is the joint effort of the two authors, who have jointly designed its structure, discussed its content, and performed the related empirical research. However, Francesca Comunello has written Chapter 3 and 4, and Simone Mulargia Chapter 1 (paragraphs from 1.1 to 1.6) and 2. Case Study 3 and 4, in Chapter 1, were written by PieroPolidoro

practices, we will refer to literature regarding barriers to social media adoption, also considering local-level institutions, framing the discussion about institutional communication practices into the broader debate concerning scientific institutions' communication strategies. In the concluding part of this chapter, we shall present and discuss four case studies. The first and the second deal with the analysis of Italian institutions' social media usage practices at the local level and will offer some insights into the way institutions consider and use social media for disseminating information during and in the aftermath of an earthquake. The last two case studies will analyse web communication strategies, and the use of infographics by different geophysical agencies, considered as good example of institutions that deal with both emergency and scientific information.

1.1.   Disseminating Effective Warning Messages

Although this chapter focuses on the use of social media by institutions, we cannot ignore the fact that institutional communication is more generally often considered in terms of warning messages.

In the light of the uncertainty generated by the sudden disruption of daily routine caused by emergencies, we expect institutions to provide expert guidance, along with the material and symbolic tools citizens can use to confront an unexpected situation. This special role can operate on at least two levels. First, by providing precise advice to the affected population regarding effective protective measures to be taken; second, by assuming a central role in the public debate (which involves both citizens and the media system).

When we look at the relationship between institutions and the affected population, the well-established tradition of studies on the crafting of effective warning messages has already implicitly framed institutions' 'role as a communicative actor'. More specifically, institutions have to give guidance to the affected population by communicating the most effective protective measures (Mileti & Sorensen, 1990).

More generally, an institutional communicative strategy has to help citizens overcome their initial bewilderment and a certain feeling of scepticism (Drabek & Stephenson, 1971) towards messages received and interpreted in an adverse situation. In this context, an effective warning message is one that tends to help people save precious time by positively influencing their behaviour and thereby reducing the time needed to put into place protective measures.

According to Quarantelli (1991), a warning message must refer specifically to the threat; be targeted, as it must identify its recipients

ex ante, using an appropriate language and style; be non-ambiguous in describing precisely the behaviour to be put in place; be redundant, as people tend to verify a specific message by turning to different channels. Relying on a system theory approach, Mileti (1975) proposes a model that brings together the specifics of the warning message and people's capability of putting into place the best protective measures. In a recent contribution, Sutton and colleagues summarise the characteristics of an effective warning message in terms of content and style: a warning message has to provide exact guidance in order to maximise health and safety protection; it has to be precise in terms of time and location; it must contain a detailed and exhaustive description of the hazard and its consequences; it has to identify clearly the source of the information given (Sutton, Spiro, Johnson, et al., 2014, p. 769). As to style, Sutton and colleagues draw heavily from the aforementioned academic tradition in concluding that an effective warning message has to be clear, specific, accurate, certain and consistent (Sutton, Spiro, Johnson, et al., 2014, p. 769).

From these preliminary considerations, we can conclude that we have to move beyond the instrumental conception of communication, even in the context of emergencies. Communication is not something that can be used by institutions; it represents a constituent part of an institution's mission within a broad context of bringing together institutions, citizens and the media system.

1.2.   Institutions' Communicative Practices in Emergency Situations

Literature has devoted attention to the behaviour and strategies of institutional communication when using social media during emergencies; this probably has also been helped by the relative ease of mapping the presence of institutions on social media. Compared to the complexity of informal actors contributing to social media conversations, the role played by institutions seems to be more structured and their social media presence (or absence) easier to map and analyse.

Several research projects have provided classifications about how institutions use social media in emergency situations. These exploratory studies focus on mapping institutions' communicative practices as observed in emergency situations, and, taken together, offer us an extensive picture of what has been done with social media from the institutional standpoint.

In 2011, Bruce Lindsay, in a research report prepared for members and committees of the American Congress, highlighted that most of the

institutions involved in using social media in an emergency passively spread information rather than establishing a two-way communication process with the audience. According to Lindsay, institutions use social media to share information directly related to the specific emergency, as in the case of the US Army Twitter account providing updates during the Fort Hood shootings in 2009 or to promote readiness and preparedness (Lindsay, 2011).

In a study inspired by the 'Uses and Gratification' approach (Katz, Blumler, & Gurevich, 1974), Houston et al. derive a social media usage framework from a consistent literature review, highlighting the principal social media usage patterns and related needs. Not surprisingly, the principal social media users identified in the study are: (1) individuals, (2) communities, (3) organisations, (4) governments and (5) news media (Houston et al., 2015, p. 7). The work by Houston et al. (2015) also offers a detailed list of social media uses derived from a review of the literature. Social media are used to provide and receive disaster preparedness information; provide and receive disaster warnings; signal and detect disasters; send and receive requests for help or assistance; inform others about one's own condition and location and learn about a disaster-affected individual's condition and location; document and learn what is happening in the disaster; deliver and consume news coverage of the disaster; provide and receive disaster response information; identify and list ways to assist in the disaster response; raise and develop awareness of an event; donate and receive donations; identify and list ways to help or volunteer; provide and receive disaster mental/behavioural health support; express emotions, concerns, well wishes; memorialise victims; provide and receive information about (and discuss) disaster response, recovery and rebuilding; tell and hear stories about the disaster; discuss socio-political and scientific causes and implications of and responsibility for events; (re)connect community members; implement traditional crisis communication activities (Houston et al., 2015). The framework provided by Houston and colleagues contains a full spectrum of social media usage practices already observed in literature, in which the two-way communication process is fully displayed, even if the actual social media usage by institutions seems to be still characterised by a top-down approach.

Another classification of social media use in emergency situations is provided by Takahashi et al. through the analysis of more than 10,000 tweets in November 2013 related to typhoon landfall and passage in the Philippines. The study highlights some recurring social media usage practices, such as reporting on the situation (second-hand reporting), expressing well wishes and memorialising and coordinating relief efforts,

together with some secondary Tweet usage, such as discussing causes, (re)connecting community members, criticising the government, request-ing help and providing mental counselling (Takahashi, Tandoc, & Carmichael, 2015). The institutional communication practices observed in the study tend to confirm that institutions rely heavily on a top-down approach to social media: they share their information, but, for instance, do not use social media to facilitate their rescue and relief operations (Takahashi et al., 2015).

In view of the above, content is not the only key factor in characteris-ing the social media usage strategies of institutions rather it is a more nuanced mixture of content and interaction style with citizens, as the comparison between the Twitter accounts of the London Metropolitan Police and the Greater Manchester Police during the riots in August 2011 carried out by Denef et al. demonstrate (Denef, Bayerl, & Kaptein, 2013). While the London Metropolitan Police Twitter commu-nication style was characterised by an instrumental approach, Greater Manchester Police opted for an expressive approach (Denef et al., 2013). We can see, in this contrast between an institution trying to maintain its prerogative as the official source of top-down information (if not direc-tives) and the conversational style adopted by the Greater Manchester Police, that social media usage by institutions is the moment of truth for a long-awaited change in the culture of institutions.

A systematic analysis of the different elements characterising an insti-tution's presence on social media is provided by Sutton and colleagues in a study focused on Twitter's official government accounts during the Waldo Canyon wildfire in Colorado Springs in June−July 2012. In order to investigate which characteristics of the communication strategy adopted by different accounts would increase the likelihood of receiving retweets by citizens, researchers analysed institutional tweets in terms of content, style and public attention (Sutton, Spiro, Johnson, et al., 2014). The thematic analysis carried out in order to classify different types of tweets provides us with an extensive spectrum of the activities actually put in place by different institutions' accounts. More specifically, the following types of tweet have been identified: (1) off-topic, (2) advisory, (3) closures, (4) correction, (5) evacuation, (6) hazard impact and (7) information (Sutton, Spiro, Johnson, et al., 2014, p. 775). Tweets have been also analysed in terms of style, highlighting their functions (distinguishing between declarative, imperative, exclamatory and interrogative tweets), the presence (and function) of words or sentences written in capital letters, and what has been addressed as conversational microstructure elements (mentions, retweets, hashtags and tweets

containing links) (Sutton, Spiro, Johnson, et al., 2014, p. 767). The third key feature identified by researchers, public attention, refers to the connection between numbers of followers of a specific account and the likelihood of receiving a retweet. In general terms, the study contains several indications about specific tweets' characteristics which increase the likelihood of receiving a retweet, thereby offering interesting insights into effective communication strategies that can potentially be exploited by institutions. More specifically, on-topic tweets produce more retweets than off-topic ones (regardless of content), while advisory tweets and those containing information about the hazard impact are more likely to be retweeted than those containing information about protective measures (Sutton, Spiro, Johnson, et al., 2014, p. 783). Some other findings appear somewhat controversial or contradict the general idea that the dialogic approach is what is really missing in institutional communication strategy. In particular, the fact that sentences with imperatives augment the effectiveness of the tweets (in terms of retweets) and that the presence of links does not increase the number of retweets (Sutton, Spiro, Johnson, et al., 2014). However, the number of followers of an institutional account is vital in augmenting the serial transmission of messages (i.e. the retweet), thus suggesting that institutions' communication strategies have to focus (also) on networking activities (generally achieved through dialogue with citizens and stakeholders) in order to bolster their communicative effectiveness. In the context of the Boston marathon bombing in 2013, Sutton and colleagues analysed terse messages (e.g. text messages and tweets) written by responding organisations and highlighted some differences from the study mentioned above. They found that an important role was played by local actors, and a meaningful prevalence (in terms of ability to grab an audience's attention) of messages were oriented towards a more specific terrorism communication. This emphasises the even greater importance of the social context of the emergency situation over content and style in influencing the information spread by terse messages (Sutton, Spiro, Fitzhugh, et al., 2014).

In a recent study based on a quali-quantitative approach, Reuters et al. investigate social media usage practices by European institutions, both at a personal (looking at the socio-demographic characteristics of social staff members) and on an organisational level. As to the former, the age and sex of emergency staff influence their social media use; women are more likely to use social media than men and younger staff members than older colleagues (Reuter, Ludwig, Kaufhold, & Spielhofer, 2016). On the organisational level, European institutions use

social media to: (1) provide warnings, advice and guidance to citizens on how to cope with or prevent emergencies or disasters; (2) disseminate hints and advice on how to behave during an emergency, as well as coordinating the help of volunteers and (3) share summary information or reports with citizens after the emergency and coordinate clean-up activities (Reuter et al., 2016, p. 103).

Although disseminating top-down information is the prevalent communication strategy adopted by institutions, some exceptions have already been observed in literature, as in the case of the Jefferson County Type III Incident Management Team (IMT). During the 2013 Colorado Flash Floods, the team offered an example of an integrated social media strategy, where each platform is dedicated to a specific role (i.e. Twitter as a timely notification system; Facebook as a platform used in order to promote community engagement; and the Blog as the information infrastructure of the communicative strategy), and the institution tries to respond to people's expectations by joining the conversation without hesitation (Denis, Palen, & Anderson, 2014). The idea that different platforms are used for different communication strategies by different organisations is gaining ground in research and also owes to the contribution of studies trying to widen the range of the phenomena studied, as in the case of Hughes et al.'s study of the social media communication strategies observed during the Hurricane Sandy landfall on October 2012. By including coastal counties affected by the hurricane within a 100-mile radius, the study takes in a total of 26 counties in five US states where the researchers observed the social media strategies of (when present) 568 fire departments and 272 police departments. By analysing the online presence of these institutions and looking into their websites, a subscriber-based notification service (Nixle), and Twitter and Facebook accounts, a complex scenario emerges where differences appear alongside some recurring practices. In terms of contents, '[t]he most frequently occurring categories are information about *closures*, *reference* to other official sources of information, *safety* instructions, and *weather* updates' (Hughes, Peterson, & Palen, 2014, p. 4). In respect of the different platforms, Facebook appears to be more connected with conversational practices which can result in meaningful interactions with the public (though hard to manage in terms of organisational effort). In more general terms, the study offers a clear picture of a fast-changing communication environment, where a majority of institutions were not yet present on social media platforms, yet some were able to put in place a number of advanced communication strategies.

1.3.   Limitations and Barriers to Social Media Adoption

Although we are focusing in this chapter on top-down information strategies, which can be considered the first level in the implementation of social media potentiality, we have already shown that the full picture of institutions using social media is characterised by evident fragmentation. While some institutions are already fully exploiting the possibilities of social media, other institutions are experiencing some difficulties in keeping up with the fast pace of technological development. This, as Hughes and Tapia show, is not just a technological problem, since 'despite recognized potential, emergency responders encountered socio-technical difficulties' (Hughes & Tapia, 2015, p. 685). For this reason, if we are to shed light on the use of social media by institutions, we need to pay particular attention to the limitations and barriers to social media adoption.

This fragmented picture results from a fragmentation that characterises institutions themselves, although observers often implicitly consider them to be a whole. In a study conducted in New York City and in Los Angeles County, Latonero and Shklovski highlighted the specific functions of some emergency managers, acting as social media evangelists in their organisations, often struggling to promote social media acceptance in their institutions (2011). In this context, a lack of organisational support emerged as a major barrier to a complete integration of social media in institutions' routines. The lack of support from high-level management has been also found to be a barrier in a qualitative study conducted with 25 'Public Information Officers' in the state of Colorado by Hughes and Palen (2012). The study also highlighted an increased pressure on officers responsible for social media, both from citizens and the media system (Hughes & Palen, 2012). Public information officers interviewed by Hughes and Palen are generally experiencing a change in their social status, especially in terms of a shift in social expectations regarding their job, as:

> […] the perception of the PIO role is shifting from that of a gatekeeper to a translator. A gatekeeper is one who manages or constrains the flow of knowledge or information […]. A translator, on the other hand, is one who takes information and transforms it into another format so that it can be better understood by others. (Hughes & Palen, 2012, pp. 13−14)

Summarising the main findings of their work, Hughes and Palen indicate that the most important barriers to a full implementation of social

media are a lack of staff, technological limitations, lack of personnel (meaning lack of skilled personnel) and broader organisational restrictions (Hughes & Palen, 2012).

Some of the difficulties highlighted are even more acute when it comes to institutions on a local level, as demonstrated by Starr Roxanne Hiltz, Linda Plotnick, Andrea Tapia, and colleagues in different research projects. In an exploratory study aimed at analysing social media use by US emergency managers, Hiltz et al. summarise several barriers to a full adoption of social media, such as the lack of personnel, the lack of training, a lack of policies and guidelines, and a more general concern about the trustworthiness of information derived from social media conversations (Hiltz, Kushma, & Plotnick, 2014). Generally speaking, there is a complex mixture of technological and organisational limitations in a context where social media seem to challenge the willingness of institutions to change. When not explicitly forbidden by some internal procedures, social media usage is almost limited to top-down information dissemination, while information gathering activities struggle for complete acceptance (Hiltz et al., 2014). Even where a generally positive attitude is expressed by emergency managers towards social media and towards new software capable of helping in manage and organise data collected from online conversations, this kind of enthusiasm is destined to be frustrated both explicitly, by official agency prohibitions (Hiltz et al., 2014), and implicitly, as institutions are still far from that cultural change needed to fully exploit social media potentiality.

In a more recent contribution, which can be seen as a quantitative follow-up to the aforementioned qualitative study, Plotnick et al. discuss the results of a survey administered to US emergency managers at the county level. The study tends to confirm the general trend highlighted by the previous research. In terms of the actual use of social media by institutions, it emerges that top-down information sharing is the most prominent, while information gathering from social media conversation is practically absent. In particular, social media are used to: (1) communicate public alerting or reassurance to the public; (2) carry out public relations activities; (3) monitor special events; (4) increase situational awareness; (5) provide specific information to the public; (6) counter rumours; (7) share information with other organisations and (8) share information on behalf of partners (Plotnick, Hiltz, Kushma, & Tapia, 2015, p. 7). When it comes to barriers to social media usage, respondents again highlight a complex mix of material and immaterial factors that clashes with a generally positive attitude towards social media. More specifically, the barriers most mentioned are (in order of importance): (1) lack of staff (quantity);

(2) lack of guidance/policy documents; (3) lack of staff (skills); (4) lack of training opportunities; (5) lack of experience with social media and (6) lack of support from senior management (Plotnick et al., 2015, p. 5).

In light of these findings, we can rely on Hiltz et al. (2014) who, in summarising the general attitude of institutions towards social media and their actual communication practices, refer to Merge and Bretschneider's three-stage social media adoption process (2013). Considering both North American and European contexts, institutions have, in terms of top-down information dissemination through social media – with some negative and positive exceptions that are respectively at first stage (early experimentation without systematic approach) and at third stage (institutionalisation and consolidation) – reached the second stage, which is characterised by an increased awareness about social media potentiality and a lack of standardisation in social media use.

1.4. Communicating Scientific Information within the Digital Media Environment

The reflection about the crafting of effective warning messages is useful in order to comprehend the theoretical framework within which institutional communication takes place. Nevertheless, referring to that theoretical framework is not sufficient to acquire a full picture of current phenomena. Crafting an effective warning message can be, in fact, understood as a specific communicative practice, put in place by specific institutions. More specifically, institutions in charge for managing emergency situations are the ones likely to be responsible for producing and disseminating warning messages coherently with emergency management procedures. When it comes to considering earthquake-related communication practices, some acquisitions from the reflection about warning messages are difficult to apply, also due to the unforecastability of seismic events.[1]

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[1]Burkett and colleagues (2014) have highlighted recent development in earthquake early warning system (i.e. ShakeAlert), and the related special need for educating people to promptly react to warning messages. Although the United States Geological Survey (USGS) has declared the intention to start using ShakeAlert for limited public notifications in 2018 (for more info https://www.shakealert.org), the time frame between notification to users and the arrival of the actual shake is strongly related to geophysical specificity of the affected territory (in this case, the west coast of the United States) and could be hard (when not useless) to apply in other country.

Considering emergency situations caused by natural or man-made disasters, particular institutions are at stake, playing a key role within the communicative ecosystem: the scientific institutions, as in the case of US USGS, Japanese Meteorological Agency (JMA) and Italian Geophysical Agency [Istituto Nazionale di Geofisica e Vulcanologia (INGV)]. Consistently with these observations, it occurs to expand the set of our theoretical tools, confronting with the main theme of communication of scientific knowledge, with a specific focus on the role of social media.

Communicating about a natural phenomenon as an earthquake, especially in the aftermath of it, means providing the public with a message able to capture citizens' attention, as highlighted in the literature about citizens' informational needs during and in the aftermath of a natural disaster, not only for its scientific meanings. Under this respect, institutions as USGS, JMA and INGV can be considered as hybrid communicative subjects — as they represent a mix of traditional institutions, dealing with emergency management and being in charge of monitoring and communicating seismic events — and scientific institutions, devoted to studying and disseminating scientific information about earthquakes.

These hybrid communicative subjects act in a communicative environment characterised by the growing centrality of digital media. Broadly speaking, digitalisation has contributed to foster disintermediation processes, providing material and symbolic tools to allow institutions to engage in forms of auto-representations (Parisi & Rega, 2010). More specifically, if institutions strongly relied on journalist's mediation function, they are nowadays able to autonomously produce content and directly address publics. In the field of science communication, we therefore witness scientists literary coming out of laboratories to address the public debate on scientific issues. On the other hand, due to the proliferation of digital media, citizens are potentially able to come into direct contact with scientific information, in a renewed communicative environment where the distinction between content producers and content consumer is blurring.

This scenario calls for a specific reflection on the relationship between science and society, also due to the fact that there is no consensus about the general evaluation of the consequences of disintermediation processes. More specifically, following the so-called deficit model, citizens and other non-scientific actors cannot achieve a sufficient scientific knowledge as they miss some fundamental theoretical tools and are destined to remain victims of forms of scientific popularisations proposed by the media system that tend to trivialise science (Scamuzzi & Tipaldo,

2015). On the other hand, there is a more optimistic approach which tends to positively evaluate citizens' participation in the scientific debate, also considering them as part of the process that leads to improvements in knowledge, as long as a new confidence pact is made between science and society (Bucchi & Trench, 2008; Scamuzzi & Tipaldo, 2015).

As people are experiencing an increase in their possibility to come into direct contact with specialised content, or at least with content not meant to be understood by the so-called 'laypeople' (with no specific scientific education), literature is paying growing attention to public understanding of science. Under this respect, Scharrer and colleagues highlight the presence of a so-called easiness effect that would bring people to underestimate their level of dependency from experts and the complexity of themes when encountered within texts aiming at popularising science (Scharrer, Britt, Stadtler, & Bromme, 2013; Scharrer, Stadtler, & Bromme, 2014).

If the popularisation of science can be considered in positive terms, as an attempt to overcome science tendency to autoreferentiality, the easiness effect would lead to a deterioration of the public debate (where people are convinced to know more and do not recognise experts' role). In order to avoid such an effect, Scharrer and colleagues suggest that texts should contain references to the complexity of dealt themes (2016). This strategy to bypass the easiness effect risks to lose its effectiveness as laypeople show a controversial attitude towards experts' discordance. More specifically, as highlighted by Fleck (1935), while the esoteric community (the experts) is characterised by doubts and is able to deal with ambiguity, the exoteric community (non-experts) tends to avoid doubts, preferring a black-or-white approach to knowledge. Under this respect, laypeople tend to consider scientific information in terms of truth, non-controversial facts, while scientists daily deal with methodological doubts and uncertainty.

Recently, Dieckmann et al. summarised laypeople's attitude towards experts' disagreement. More specifically, less educated and non-expert (in terms of auto-assessment about a specific content) subjects tend to attribute disagreement to experts' incompetence rather than the intrinsic complexity of the theme. While some subjects with average level of education attribute disagreement to financial or ideological struggles within the scientific community, only a minority of subject (more educated and expert in relation to the specific content) think that disagreement derives from the irreducible complexity of the theme (2017).

The relationship between science and society is complicated by the fact that people have personal representations of what science is (independently from science) and, moreover, tend to distinguish between science and scientific institutions. According to Achterberg and colleagues (2015), we would be in presence of a science confidence gap that resonates with Norris' concept of democratic confidence gap (2011). More specifically, according to this hypothesis, people believe in science but do not trust scientific institutions, as they believe in democracy but do not trust actual politicians. Considering such a scenario, two fundamentals explanatory hypothesis are discussed. First, if the confidence gap is related to contemporary society's tendency to self-reflexivity, educated people should have high trust in scientific method and distrust in scientific institutions as part of a more general tendency to contest power and authorities. Second, if confidence gap is related to high level of anomie among marginal social groups, less educated and underpaid people should be the protagonist of the processes that lead to question scientific institutions, as part of the social system that is contributing to their marginality. They should also positively consider the abstract concept of science as a potential liberation myth (Achterberg et al., 2015). Achterberg and colleagues' findings suggest that only the second hypothesis is confirmed, thus contributing to explain why growing sectors of society (without a specific scientific education) are currently promoting (mainly through digital media) alternative scientific knowledge.

Although disinformation and misinformation are well-established topics in the field of social sciences, even before the advent and development of social media (Shibutani, 1966), some authors consider social media as a communicative environment that is hosting (and also contributing to spread) alternative narrations and knowledge (Bronner, 2013). The general role played by such a communicative environment is quite controversial. As we will see in our analysis of institutions' information gathering practices (Chapter 4), social media use can result in an impoverishment of the public debate, due to echo chambers effect (Bessi et al., 2015) and filter bubbles (Pariser, 2011) but can also play a role in diversifying people's information provision. In more general terms, we should avoid any determinist approach to the topic, considering that some of the most relevant changes in science communication have occurred due to broad social phenomena not directly related to social media, as in the case of the specialisation of science (Knight, 2006).

1.5.   Case Study 1. A Qualitative Study of Italian Local-level Institutions' Social Media Usage Practices

In this section, we present findings from two separate analyses into social media communication practices performed in emergency situations in Italian local institutions: first, an exploratory, qualitative study, and second, a quantitative approach from a survey given nationally to local-level institutions. Our examination of the literature above has already highlighted the importance of local-level institutions. The centrality of the local level is even more the case when we consider the Italian civil protection system, based as it is upon municipalities. More specifically, the Mayor is, by law, the first civil protection authority; the Civil Protection Department (state level) is formally activated by the mayor, if the emergency reaches beyond regional boundaries.

Moreover, the fragmentation in the social media practices of institutions we mentioned above is all the more pronounced at the local level, where several variables (including the size of a municipality, its geographical location and the type of emergency confronted) contribute to a diversification in the behaviour and attitude of institutions towards social media.

The overall research design we are presenting here is inspired by the work by Hiltz, Kushma, Plotnick, and Tapia (i.e. Hiltz, Kushma, & Plotnick, 2014; Plotnick et al., 2015), who concentrated on local-level emergency managers in the USA (at a county level). As discussed, the authors concluded that the main barriers for social media usage in disseminating and gathering information were shortage of staff (quantity), the lack of formal social media policies, lack of staff (skills) and a low estimation of the trustworthiness of user-generated content. The authors therefore confirm that local-level agencies in the USA 'are not yet ready to embrace SM and use it to its fullest potential' (Plotnick et al., 2015, p. 10). As is consistent with our main concern in this chapter, we are concentrating on social media use in disseminating information, following the top-down approach, and on barriers to these activities.

The Italian context has already experienced the distance between the social media practices of institutions and people's expectations about what constitutes an effective institutional social media strategy. After several natural disaster situations that have hit Italy in recent years, citizens complained, for example, about the lack, or inadequacy, of institutional communication on social media; at the same time, they showed great interest in finding reliable and verified information (Comunello, Parisi, Lauciani, Magnoni, & Casarotti, 2016). Even when they are

present, Italian institutions struggle to obtain a central position of influence in terms of social media power compared with (Twitter) stars or media outlet accounts (Comunello, 2014; Comunello et al., 2016). Nevertheless, when asked about their preferred sources for getting emergency information, Italian citizens prioritised the local level, also underlining the role of the mayor (Lombardi, 2005, pp. 94–99).

Due to the complexity of the Italian civil protection system, we decided firstly to carry out semi-structured interviews with four experts from the communication office at the Department of Civil Protection in order to get a comprehensive picture of the Italian civil protection system and its communication processes. This strategy also followed the studies mentioned previously from which we found inspiration.

Taking on board the advice of experts, we decided to focus on a single Italian region, chosen because of its average position in terms of social media emergency communication indicators. Our expert advisers also helped us select two social media managers working for Italian municipalities (outside the selected region), whose social media emergency communication practices were considered best practice at a national level. For the region selected, we decided to concentrate our attention both on municipalities and provinces, even though a recent institutional reform has eliminated provinces. Prefectures, institutions representing the government at the local level, are responsible for emergency management at the provincial level when the extent of an emergency has overwhelmed the ability of a municipality to respond.

In order to engage our respondents, we wrote a formal letter to every mayor of the provincial capital of the municipality in the selected region and to every prefect in the same region. Mayors and prefects were asked to nominate a delegate (involved at any level in emergency management and/or communication) for a face-to-face interview. Overall, we conducted 16 semi-structured interviews, which lasted between 30 and 60 minutes.

In line with the literature to which we have referred, and consistent with our research focus, we asked the following research questions:

1. What social media platforms are used, and for what purposes, by local-level emergency managers? What are the prevailing usage patterns?
2. How are these platforms perceived by managers and operators?
3. What are the main barriers to broader social media adoption for disseminating or gathering emergency-related information?
4. What desiderata are expressed by managers and operators with regard to platform features or organisational issues?

Before addressing the specific findings from the exploratory study, we shall focus here on a general trend emerging from analysing the interview responses. Leaving aside specific issues, it seems that two distinct narratives emerged in terms of social media usage by institutions and their attitude towards social media. We defined the first style of narration as practical-professional, produced by those respondents who showed high levels of social media usage and thought of them in practical and concrete situations. The language used by those interviewees often used technical or jargon expressions, thereby illustrating high levels of confidence with the broader social media professional community. Within this narrative, we also found significant complaints about the fact that they were, as the de facto social media managers for their institutions, not officially recognised in their profession. The second style of narration was, on the other hand, characterised by constant reminders of the institutional dimension and showed a controversial attitude towards social media. Although they were considered indispensable for updating institutional communication strategies, they were perceived as too far from an implicit command and control (Rodríguez et al., 2007) attitude that, in the minds of emergency managers, have to characterise institutional communication.

A generally positive attitude towards future implementations of social media tools also emerged; however, an in-depth analysis of this positive attitude led to controversial conclusions. On the one hand, it showed that several interviewees were positively oriented towards future developments in institutional communication strategies; on the other hand, it was used rhetorically to justify the status quo.

1.5.1.   *The Use of Different Communication Channels*

Interviewees referred to different communication channels as forming part of their institution's communication strategy. Considering that, in most cases, neither social media policies nor guidelines were present, communication strategies were elaborated by personal initiative, confirming the picture of the evangelist as driver of innovation in the institutional environment (Latonero & Shklovski, 2011). The channel most referred to was the website, followed by Facebook, Twitter, email and text messages. Less than the half the respondents named WhatsApp, Instagram and certified email.

1.5.2.   *Disseminating Top-down Information at the Local Level*

As is consistent with the literature we have already discussed, Italian local-level institutions use social media almost exclusively to disseminate top-down information, rather than gathering information from the public. Local-level institutions involved in the study showed an overall good ability to manage traditional communication tools. Sometimes, traditional communication channels were the only ones used; at other times, some kind of integration between traditional channels and digital channels emerged. Administrations almost exclusively using traditional channels justified this choice by addressing their effectiveness in relation to the specific context and the population. They referred to brochures, fly-sheets and posters used to highlight the most prominent risks to the territory and to inform people about the local-civil protection plan. Some respondents also spoke of a problematic relationship with the local media, which they considered far too concerned with scandals or gossip, and unwilling to collaborate with institutions.

With digital media, a central role was played by the institutional website (mentioned by all the institutions involved), followed by Facebook. While some institutions created a Facebook page, others used the mayor's personal profile as a means of official communication. These two controversial strategies in using Facebook are emblematic of the overlap between institutional communication and personal/political communication, which is a specific characteristic of the Italian context (Faccioli, 2016). Moreover, a variety of uses emerged in relation to the same tool, as there were some Facebook pages that were updated and broadly used as an emergency communication tool, while others appeared to be almost totally neglected and incapable of generating citizens' engagement. The institutions we selected as examples of best practice in Italy showed an advanced level of social media use in disseminating top-down information and a more general tendency to merge traditional and digital channels and tools effectively. A respondent from this institution spoke of the design of a brochure distributed among the population to inform about social media usage in emergency situations. On the subject of this awareness campaign, the same respondent mentioned that, in a more recent emergency situation, the Facebook account managed by his institution achieved 50% of organic reach among the population, despite a significant share of older citizens.

Institutions with advanced communication strategies were also fully aware of the specific features of different communication channels in terms of message content, style and communicative dynamics. In these

areas, the professionalisation of institutional communication management that has been advocated (Scanlon, 2007) seems to have been achieved. One municipality involved in the study, for instance, has already accepted and fully developed a set of hashtags used to organise Twitter conversation and immediately signal different levels of emergency. In another municipality, during a specific weather emergency, the emergency manager spoke about having identified and directly contacted the most influential mothers in the town in order to spread information about school closures more rapidly. Despite these examples, which testify to high levels of understanding and use of the potentiality of social media in emergency situations, we note that they often represent the personal initiative of highly motivated emergency managers.

1.5.3. *How Social Media Are Perceived at the Local Level*

The attitude of interviewees towards social media is controversial. Overall, they expressed a positive attitude towards these new communication tools, but several distinctions emerged. In particular, emergency managers showing an institutional attitude towards social media often pointed out the mismatch between the dialogical nature of social media and the linear essence of institutional communication. They were also concerned, sometimes paternalistically, with the trustworthiness of information shared through social media, often recalling the risk of the spread of hoaxes. On the other hand, social media managers who expressed a practical-professional attitude towards social media described how a re-organisation of their work routines had allowed them to detect and confront immediately misinformation and disinformation.

Overall, social media were appreciated for their immediacy and seen as a way of furthering institutional communication strategies. In some cases, there was a sense of inevitability about social media: regardless of any evaluation of social media usefulness, they seemed to be considered a tax which had to be paid to keep up with the changing times.

There were three main factors mentioned in respect of the perceived disadvantages of social media. The first of these is a contradiction between the dialogical nature of social media conversations and the specific role of institutions, often highlighted by those emergency managers typified by an institutional attitude towards social media. More specifically, there was a particular need to keep official (and easy to control) communication channels, as those who were better qualified to fulfil the communication needs of institutions emerged from among the

prefectures' emergency managers. On the other hand, local representatives for emergency management were more attuned to the idea that social media could work as a way of listening to citizens' needs.

The distance between social media and institutions is connected to the second disadvantage: the potential spreading of rumours and hoaxes. Again, emergency managers from the prefecture were the most concerned here, as part of their institutional mission to preserve public order, as emerged in the following excerpt:

> We can't forget that the prefect is responsible for law and order. Therefore, misinformation […] and hoaxes like 'in half an hour an earthquake will occur' may severely hinder public security. Just consider the chance that people believing such news will leave their homes […] Or crowds can be formed, occupying the streets […]; the prefect is responsible for law and order, solely responsible for law and order, primarily responsible for law and order […] The prefect needs to manage correct, honest, verified information […] because misinformation could also cause law and order problems. (Pref.)

The concerns expressed by the respondent fully resonated with what Rodríguez et al. (2007) defined as a command and control approach towards emergency management, which takes a patronising attitude towards the affected population.

Interestingly, the interviewee freely referred to chaos and panic as sentiments typifying those affected by an emergency, thereby corroborating the idea that emergency managers are also, to an extent, prey to stereotypes and false myths (Quarantelli, 1991) when dealing with citizens' responses in emergencies. When we look at hoaxes and concerns about the spread of disinformation and misinformation, a peculiar relationship emerges between the style of narration in social media, spoken of above, and the strength of these worries. In particular, emergency managers characterised by a practical-professional attitude towards social media tended to underestimate hoaxes and rumours, compared to those characterised by the institutional attitude. If the latter cited disinformation and misinformation as the main reasons for limiting the adoption of social media, the former emphasised the fact that, through proper procedures (such as asking for pictures, asking for further information, engaging in a constant dialogue with citizens, carefully checking user profiles), they were able to deal with the issue of disinformation.

The third factor, highlighted in several interviews, relates to what respondents defined as increased aggression towards institutions. According to emergency managers concerned about this topic, social media are an environment that seems to promote hate speech. Though this factor was recalled by several respondents, we again found that the general attitude towards social media played a role in relation to it. Thus, emergency managers with an institutional approach expressed the maximum concern about this topic, while those with a practical-professional approach were able to recall episodes where constant dialogue with citizens, even including those communicating aggressively towards institutions, was a way to re-establish a contact between institutions and citizens.

1.5.3.1. Barriers

Organisational limits and lack of resources were the most frequently named barriers to social media adoption in emergency situations. In more general terms, a lack of resources was given as a typical state of affairs in public administration staff and offices in Italy, though there are differences. While some respondents generically referred to this factor, others offered detailed descriptions of what would be needed to fully adopt social media both in their daily routines and in emergency situations. Emergency managers with a practical-professional attitude towards social media cited organisational limits (lack of policies, lack of integration between different offices) more frequently. One particular respondent gave a vivid description of the contrast between his communicative activism on social media and focus on problem solving and the other offices which tended to answer him through old-fashioned PDF documents.

Besides lack of resources, several respondents highlighted a dearth of specific competences in the use of social media as one of the main barriers to social media usage in emergencies. This consideration relates to a special need for training and for hiring specific and skilled personnel.

Overall, Italian emergency managers agreed that the lack of technical resources was not the key factor in predicting social media use by local institutions. In this respect, they concurred with the main theoretical findings, which has already recognised that the relationship between social media and institutions depends on a cultural change that needs to take place in institutions.

Some respondents, moreover, referred to characteristics within the population (in particular, cultural gaps or old age) as barriers to social media adoption; however, as we have already highlighted, emergency

managers from best practice municipalities were able to further social media penetration among their population, thus demonstrating that different attitudes towards the same topic precede different outcomes in social media adoption.

What emerges from this last point is the apparent need to problematise the relationship between 'barriers' to social media adoption and 'non-use' (or 'basic use'); that is to say: is it the 'barriers' which cause 'non-use' or might it be that emergency managers who do not use social media (or use them at basic level) tend to overestimate barriers as a way of justifying their delay in adopting them?

With organisational barriers (i.e. lack of policies and guidelines) we found again that the general attitude towards social media, and level of social media use, played a role in determining the nature of the relationship between 'barriers' and 'non-use'. Emergency managers with an institutional approach to social media (and often belonging also to institutions that use social media at a 'basic level') referred to legislative barriers that prevent them from using social media in emergency situations. In contrast, emergency managers with a practical-professional approach recognised the existence of these barriers but were precise in identifying potential improvements to regulations, such as official recognition of (public) social media managers, the possibility of using Facebook's promotion features to improve a post's visibility (not allowed at the moment due to restrictions in the guidelines), and the possibility of using an institutional credit card to pay online services related to their social media manager's activities.

The contrast between the proactiveness of these social media managers and the rigidity of public guidelines makes clear that, in this specific situation, limitations at an organisational level are causing a delay in a full deployment of social media in emergency situations. Moreover, only one municipality involved in the study officially recognises the profession of social media manager. In other institutions, social-media-related activities were carried out by single operators, almost on a voluntary basis or by a public relation specialist involved in political communication with representatives at a local level. As we have already mentioned, the overlap between institutional and political communication, including emergency communication, emerged as a typical feature of Italian local institutions.

Furthermore, some interviewees cited the difference between the specific role of institutions and the interactivity and informality of social media as a barrier to the full adoption of social media. Some respondents highlighted that, while social media conversations are by nature

ephemeral, institutions produce legally binding acts. In the context of the specific role of institutions, respondents spoke about the difference between top-down communication (seen as typical of the institution) and the two-way communication of social network sites. Again, what is at issue here is a cultural distance between two antithetical understandings of institutions: institutions as dialogical actors in a communicative environment that promote collaboration and dialogue (following a 'what we can do together in emergency' approach), and institutions as actors oriented towards top-down, prescriptive communication (following a 'what you − the public − have to do in an emergency' approach).

Some respondents, moreover, pointed out the problematic relationship between public institutions and private business-oriented platforms as a barrier to social media usage. While Italian institutions used to have decent relations with media outlets that recognised the role of institutions (i.e. public service radio and television or major Italian commercial radio and television players), the contemporary media environment is characterised by a gulf between the ownership of the platforms and local government and institutions.

1.5.3.2. Operators' Desiderata

When it came to expressing opinions about hypothetical improvements in social media usage practices, or directly suggesting some implementations, respondents exhibited a number of difficulties in dealing with desiderata. Consistent with the aforementioned barriers to social media use, a majority of respondents mentioned staff enhancement as the main way of improving the current situation. In more general terms, emergency managers seemed pessimistic about the possibility of influencing their institutions or the social media platforms. Among the few emergency managers able to express their desiderata, we found very specific requests such as enhancing geo-localisation services, enhancing conversation-monitoring tools, obtaining a 'certified account' on social media platforms, and having the cooperation of social media platforms (Twitter in this case) in adopting codified hashtags for emergencies.

1.6.   Case Study 2. A Quantitative Study of Italian Local-level Institutions' Social Media Usage Practices

In order to obtain a generalisation of the main findings of the qualitative phase outlined above, we designed a 50-question survey that was

administered to Italian emergency managers and emergency communicators in May 2017. This quantitative analysis of the communication strategies of local Italian institutions was inspired by Plotnick et al. (2015) and realised in collaboration with the authors.

We discuss here the main results of the survey, considering the 279 respondents and focusing on top-down information dissemination strategies put in place by Italian local-level institutions.

As expected, a vast majority of respondents were from municipalities (63.4%), followed by the Italian Red Cross (22.2%) and Civil Protection (4.3%). Apart from these institutions, other local institutions including the Police (2.5%), Prefecture (0.7%), Fire Brigades (0.7%), Army (0.4%) and Region (0.4%) showed little willingness to answer the questionnaire.

As already highlighted by the above-mentioned literature, personal characteristics of emergency managers play a role in influencing their attitude towards social media (Reuters et al., 2016). More specifically, younger emergency managers are likely to have a more positive attitude towards social media. Under this respect, the average age of Italian respondents (44 years) (see Table 1.1 for more details) describes a population of emergency managers able to address the cultural change needed to fully adopt social media.

With respect to job descriptions, a majority of respondents were responsible for civil protection activities and emergency management (21.1%), followed by those who held political office (mayors, councilors, etc.) (17.6%), then those in charge of civil protection and emergency management (12.2%), Ufficio Relazioni con il Pubblico's (URP's) responsible (public relations' officers) (10%), and URP's staff (9%). The prevalence of respondents with high-level responsibilities within their staff (very often responsible for the office) is reflected by the respondents' educational level, being well-educated, as is shown in Table 1.2.

Table 1.3 shows respondents' geographical origins, in which there is a large imbalance as only two regions (namely, Emilia-Romagna and Lombardy) constitute almost one-third of all respondents. Even if data discussed here are not representative of the Italian population of emergency managers, we can discuss such a disproportion considering that contextual variables influence the willingness to answer the questionnaire. More specifically, it is meaningful that the two over-represented regions (namely, Emilia-Romagna and Lombardy) are considered advanced in terms of socio-demographic indicators, as it can be hypothesised that a relationship exists between interest in social media

Table 1.1: Respondents' Age.

Age	Respondents ($n = 194$)
Up to 19 years	1%
20−24	2.6%
25−29	6.7%
30−34	9.8%
35−39	11.9%
40−44	17.1%
45−49	13%
50−54	16.6%
55−59	12.4%
60−64	6.7%
65 years or more	2.1%

Table 1.2: Respondents' Level of Education.

Education	Respondents ($n = 194$)
Elementary school	1%
Junior high school	3.6%
High school	35.6%
University	50%
Post-graduate	9.8%

(represented here by the tendency to answer the questionnaire) and the degree of organisation of the institutions.

Respondents were well experienced both in terms of years of service (as shown in Table 1.4) and as 73.8% said they had dealt with an emergency situation in activities relating to their work.

In order to shed light on emergency managers' attitudes towards social media (considered as mean to spread top-down information), as is consistent with the research project by Plotnick et al. (2015), we asked about the main barriers to the full adoption of social media. As already discussed in Plotnick et al. (2015), this type of question represents a shift in perspective because it is no longer focused on potential applications of

Table 1.3: Respondents' Geographical Origins.

Region	Respondents ($n = 206$)
Emilia-Romagna	23.7%
Lombardy	18.9%
Veneto	9.7%
Tuscany	8.2%
Piedmont	7.2%
Abruzzo	4.8%
Sicily	4.3%
Marche	2.9%
Campania	2.4%
Friuli-Venezia Giulia	2.4%
Lazio	2.4%
Sardinia	2.4%
Umbria	2.4%
Liguria	1.9%
Molise	1.4%
Trentino-Alto Adige	1.4%
Valle d'Aosta	1.4%
Puglia	0.9%
Calabria	0.4%

Table 1.4: Respondents' Year of Service.

Years of Service	Respondents ($n = 194$)
Less than 1	6.7%
1−2	7.7%
3−5	14.9%
6−10	20.1%
More than 10	50.5%

social media to enhance institutional communication strategies but on the actual barriers to those potential applications. In detail (see Table 1.5), a lack of staff is the first barrier cited by Italian emergency managers (the same applied to US emergency managers), though the Italian average (3.94) is lower than the US evaluation (4.6) (Plotnick et al., 2015). Lack of staff (skills) is the second barrier mentioned by Italian emergency managers (3.81 the average evaluation), whereas it was the third barrier mentioned by US emergency managers (3.3). The third barrier is lack of training opportunities (fourth in the US context), while a lack of guidance/policy documents is the fourth (it was the second barrier in the US context). Age of population as a barrier to social media usage and the unsuitability generally of social media for public communication are Italian peculiarities in terms of barriers cited, when compared to those highlighted in the North American context (Plotnick et al., 2015).

The fact that a lack of policies and guidelines is one of the most cited barriers to social media dissemination of top-down information

Table 1.5: Barriers to the Dissemination of Information through Social Media (Scale 1−7).

	Mean	Standard Deviation	Don't Know %
Lack of staff (quantity)	3.94	2.05	2.43
Lack of staff (skills)	3.81	2.01	2.43
Lack of training opportunities	3.78	1.94	1.94
Lack of guidance/policy documents	3.52	2.04	4.37
Old age of the population	3.30	1.75	2.91
Lack of experience with social media	3.24	1.92	2.43
Lack of support from management	3.12	2.14	5.83
Social media are not fit for public communication	3.07	1.90	3.88
Legal or privacy concerns	2.93	1.92	6.80
Lack of software	2.87	1.93	4.85
Lack of compatibility	2.82	1.81	5.34
Limitations of social media	2.78	1.80	4.37
Lack of hardware	2.26	1.61	6.31
Other	1.00	0.00	

Table 1.6: Type of Policies for Top-down Information Dissemination through Social Media.

Type of Policies for Top-down Information Dissemination through Social Media	Respondents ($n = 194$)
Formal policies	36%
Informal policies	32.4%
No policies	25.7%
Don't know	5.6%

resonates with data about the presence of specific policies used to norm such an activity (Table 1.6). More specifically, if one-third of respondents belong to an institution where formal policies exist (36%), more than half of respondents work in local institutions where the dissemination of information through social media is guided by informal policies, when not guided at all (informal + no policies = 58.1%).

Broadly speaking, the whole picture of Italian local-level institutions using social media to disseminate top-down information is fragmented. The fact that a significant proportion of respondents are well educated and have important role within their institutions testify that public top management (at least at local level) is interested in social media. This can be considered as a prerequisite for a future development of social media strategy, but Italian local-level institutions are far from reaching the optimum required to fully exploit social media potential. Overall, barriers are perceived, but they do not seem to be determinants, as the most important weakness of the Italian system seems to be the lack of a generalised willingness to use social media. National guidelines are needed in order to transform the current *spontaneism* into a more systematic and standardised social media communication strategy.

1.7. Case Study 3. INGV and USGS Communication Strategies on the Web: A Comparative Analysis (by Piero Polidoro)

By Piero Polidoro

Geophysical agencies have scientific research as their main task, but they also have to inform their different stakeholders (political and

governmental institutions, public opinion, scientific community) about their activity. This implies not only spreading of data but also explaining reasons, advantages and modalities of their research; in other words, they have to develop a complete and complex discourse and thus be aware or not of this (hopefully coherent) communication strategy.

We will analyse and compare the way in which two geophysical governmental agencies − the Italian INGV and the US USGS tell their story and activity in order to show how two institutions dealing with the same scientific issues and having similar public tasks − can produce very different images of themselves. To do this, we will focus on a very important text in the online communication of an organisation: the 'About' page or section of the official website.

1.7.1.   INGV Presentation on Its Website

The 'about' page is the first page in the navigation tree of INGV's website (www.ingv.it; last consulted on 26 October 2017). This choice corresponds to what we can call an 'institutional' communication strategy. In other words, the focus of the agency's communication is the agency itself: its goals, story, organisation. This institutional approach is also present in a relevant stylistic choice: the text uses the third person singular to talk about INGV; on the other side, the readers are never directly involved in the discourse. The effect is an objective but detached communication.

For this analysis, we will use a narratological model developed by the French semiotician A.J. Greimas (Greimas, 1990; Greimas & Courtés, 1982) and his school between the 1960s and the 1980s. One of the main features of Greimas' theory is the so-called 'actancial model': in each story, we can detect actants that are narrative basic functions. Actants must not be confused with actors, because the latter are what we usually call 'characters' and are thus recognisable individuals acting in that story, while the former are more abstract and they have to be considered − as we have seen − as pure narrative functions. As a consequence, an actor can embody more than one actant (it can have more than one narrative function in the mechanism of the story) and, vice versa, a single actant could be embodied by more actors. Greimas counts six actants: the Subject is the hero of the action (i.e. the knight struggling to free the princess) and it always aims to an Object (in our example, the princess); to reach or preserve this Object (or to get rid of it, if it is a negative Object) it tries to fulfil a Narrative Program. In the

course of its action, it can be helped by a Helper or impeded by an Opponent (third and fourth actants). In order to have a Narrative Program, the Subject needs to receive it – as a task – from an Addresser (Amlet's father asking his son to revenge him is Amlet's Addresser; Edmond Dantés, The Earl of Montecristo vowing to have revenge is his own Addresser); the Addressee is the actant that receive the task and it usually coincides with the Subject. Addresser and Addressee are the fifth and sixth actants. Greimas also consider the existence of another very important narrative function represented by an anti-actant: the Anti-Subject is another Subject trying to fulfil a Narrative Program contrasting that of the Subject whose perspective we have chosen to tell the story.

INGV's presentation clearly puts INGV itself as the main Subject of the story. In the third paragraph, we discover that the 'main mission' of INGV (and thus its Narrative Program) is 'the monitoring of geophysical phenomena in both the solid and fluid components of the Earth'. The gathering of 'all scientific and technical institutions operating in Geophysics and Volcanology' in a single institute, a task that has been described in the first two paragraphs, seems now only a secondary Narrative Program, instrumental to the fulfilment of this one.

If INGV is the Subject, what is its Object? It is a form of *knowledge*, knowledge about seismic and volcanic phenomena that is concretely represented by data and models. INGV's role towards this knowledge is dual. From one side, it is the Subject that performs actions in order to seize this knowledge. From another side, it transfers this knowledge to other Subjects ('the data […] are regularly distributed to the public institutions concerned, to the scientific community and to the public') that will use it for their Narrative Programs ('for research and civil defence'). From this point of view, INGV is the Helper of these Subjects. It is worth noting that the Italian version of the text does not include the reference to other Subjects and to their Narrative Programs: we only know that INGV is a research institute, but we cannot be sure that the results of this research are shared with others.

As we have seen, in Greimas' theory, every Subject has received its task from an Addresser. To better understand this concept, and how it can be detected in a text, we can consider the very beginning of the presentation of another governmental agency, the Japanese JMA. On JMA's website (http://www.jma.go.jp/jma/indexe.html; last consulted on 26 October 2017) we can read that 'as part of Japan's government, the Japanese Meteorological Agency (Jma) implements its services with the following ultimate goals in compliance with the Act for

Establishment of the Ministry of Land, Infrastructure, Transport and Tourism (Mlit) and the Meteorological Service Act […]' JMA *must* respect goals established by national laws and authorities; even in other parts of the text, it is quite clear that the Addresser is the Government, as legal representative of Japanese society. Who is INGV's Addresser? The text does not give us any hint of its identity. In this case, we could also think that INGV itself is its own Addresser.

Another important aspect of every narration is the Subject's capacity to fulfil its task. To do this, it has to have the right knowledge and tools (it has to *know* how to reach its goals, and it has to be able to do it). INGV seems to have both: it can count on 'state-of-the-art networks of geophysical sensors' and on 'specialized personnel'. Technology and staff competence can be seen as mighty Helpers; on the other side, the text does not mention any obstacle (Opponent) to the agency's action; in addition, we do not have an Anti-Subject. As a consequence, INGV's action appears as non-problematic and relatively easy (and thus also narratively less interesting).

In conclusion, INGV's website tells the story of a Subject that has no explicit Addresser and has to fulfil a Narrative Program represented as not very difficult. It can count on technologies and skilled personnel, and it has no Anti-Subject. Its Object is an abstract one, knowledge, but the reader cannot understand if it is a goal per se or it has an instrumental value, that is, it is searched because it will be useful to do something else and to reach other goals. In this frame, INGV could seem a self-referential institution, aimed at the research of knowledge for knowledge's sake.

1.7.2.   USGS Presentation on Its Website

In its website, USGS makes different choices (https://www.usgs.gov/, last consulted on 26 October 2017). First of all, 'About' is not the first but the last label of the main menu. It is preceded by 'Science', 'Products', 'News' and 'Connect'. This is part of a different communication strategy, no more 'institutional' but rather 'pragmatic'. In other words, the main focus is not on the agency but on what the agency can do for its stakeholders. This different approach is also evident in some lexical choices, such as the use of the label 'Products', that reminds us a commercial website.

The same pragmatic style is present in the 'About us' page, where 'history' (the most institutional content) is only the last section, while

the text overlapped to the big opening image (the so-called 'hero banner') is a statement about USGS's role and usefulness.

The Subject of this story is clearly USGS, and its Object is knowledge produced by research, as with INGV: 'We monitor, assess, and conduct targeted science research'. But this time, we have a clearer idea of the function of the Object. Its value is not per se but instrumental, because USGS conducts research 'so that policy makers and the public have the understanding they need to enhance preparedness, response, and resilience'. Besides, as is written further in the text, 'our scientists develop new methods and tools to enable timely, relevant and *useful* information about the Earth and its processes' (my italics).

The Narrative Program 'Research' is thus instrumental for another Program: 'Enhance preparedness, response, and resilience'. This Program is, in its turn, instrumental for another one, the ultimate Narrative Program of this story. We can find it clearly expressed in the first sub-page of this section, whose title is 'Who we are'. Preparedness, response and resilience are needed to 'minimize loss of life and property from natural disasters' and to 'enhance and protect our quality of life'. The ultimate Object of the whole Narrative Program, of which USGS is a part, is 'survival' and 'quality of life'.

But whose quality of life we are talking about? This is a very important question in order to understand the Addresser of this story. In the beginning of the paragraph, we have just quoted we can find the answer: 'The USGS serves the Nation […]'. As in JMA discourse, we have a social Addresser, the Nation. But in JMA's website, the Nation was present in its legal embodiment, the State, while here it seems to coincide with the American people, as suggested by the iterative use of the first-person plural ('our quality of life' in this page, and 'we rely on', 'our ecosystems and environment' in the main page 'About us'). It is very important to underline the frequent shifting from an 'inclusive' use of the first-person plural (where 'we' is meant as the union between 'we the speakers' and 'you the public') and an 'exclusive' one (where 'we' indicates only the speakers and thus USGS).

A very important difference, comparing this discourse with that of INGV, is the kind of task the Subject has. In USGS's website, it is presented as a very difficult one. Words as 'preparedness', 'response' or 'protect' imply a conflictual structure. This conflict can produce serious consequences, such as 'loss of life' and 'natural disasters', and opposes people (or the Nation) to something other. What, exactly? An Anti-Subject that 'threatens lives and livelihoods' and takes the shape of 'natural hazards'. In USGS's story, thus, Nature is a double actor,

which can be both an evil Anti-Subject, trying to destroy our properties and lives, and a good Helper, offering 'natural resources we rely on'.

The fact that USGS's task is a difficult one, whose final result is not certain, is underlined also by some lexical features of the text. A complete confidence in the Subject final victory is never expressed. Verbs and nouns used in the presentation very often express ideas of 'partiality' and 'relativity': loss of life and property are 'minimised' not 'avoided'; quality of life is 'enhanced', which means it gets better but not at the best. Actions performed by the Subject cannot assure a complete and perpetual fulfilment of the Narrative Program; besides, USGS, in this more complex frame, has only the role of the Helper offering the information (the knowledge) needed to other actors to protect and defend people.

Summarising the narrative structure of USGS's discourse, we could say that the American people as Addresser assign to a community of scientists (the USGS, that has the role of Subject1) the task to provide reliable and useful information about natural events; but Subject1 is part of the Addresser itself, as showed by the frequent use of the inclusive first-person plural. This makes us understand that USGS scientists' motivations could be stronger than those of, for instance, JMA ones because they do their job not only because they must, but also because they want to do it, considered that it will be useful to protect and save their own lives and those of the community they belong to. Once fulfiled its difficult task, Subject1 will have to communicate this information to a wider Subject2, of which it is a part and for which it plays as Helper: the integrated system of US agencies involved in monitoring natural events and protecting people from them. USGS's actions are thus put in a more complex frame of relations than the virtual isolation of INGV.

1.7.3. *Conclusions. Two Different and Alternative Strategies*

In these considerations, we have seen how similar realities and activities can be described and told in very different ways. INGV has an 'institutional' strategy, aimed to objectivity and distance. This strategy is focused on the agency itself. The story it tells is essential and does not explicit many of the narrative functions (actants) of Greimas' model. On the contrary, USGS has a 'pragmatic' approach, whose goal is to highlight its active usefulness for stakeholders. The story is more articulated and describes the complex and integrated network of relations of which USGS is a part. In addition, USGS represents its task as a

difficult one and proposes a conflictual vision where Nature is something that may harm us.

Which is the best strategy? More objective and neutral, as INGV's one, or more thrilling and dynamic, as that used by USGS? It depends on the goals each organisation has or chooses. What is really important to understand is that scientific organisations do not only spread data, but, consciously or not, also build narrations where they play a role and that contribute to creating their own image among their public.

1.8.   Case Study 4. Infographics and Natural Disasters: A Typology (by Piero Polidoro)

By Piero Polidoro

In recent years, growing attention has been devoted to infographics. They are a trademark of the new forms of journalism, both in more traditional paper journals and in the latest experimentations in digital journalism, such as in the case of the so-called 'news packages' (Koci Hernandez & Rue, 2016). Even if academic literature on this theme is still not wide, an increasing number of articles deals with the efficacy of infographics (if they assure a better understanding or memorisation of data) or with their main features. Lazard and Atkinson (2015), for instance, have proposed to two different groups two pro-environment messages: one was only textual, while the other was mainly based on infographics. They found 'significantly higher levels of elaboration for individuals who saw the infographic compared to individuals who were exposed to text-based message' (Lazard & Atkinson, 2015, p. 12), where the level of elaboration was given by subject responses about 'the volume of thoughts the viewer has in reaction to the message, the vividness of these thoughts, and sensitivity to the message'.

1.8.1.   *Infographics: Formal Definition and Models*

But what is an infographic? According to the online Oxford English Dictionary, an infographic is 'a visual representation of information or data, e.g. as a chart or diagram'. Wikipedia definition adds something interesting: 'infographics are graphic visual representations of information, data or knowledge intended to present information quickly and clearly'; in this case, we have also a functional definition: infographics aim for a quicker and clearer presentation of information.

What both these definitions lack is a formal definition of info-graphics, i.e. a definition indicating the main features of infographics as a language. Before discussing the use of infographics in risk management and earthquake-related communication, it will be useful to better define what an infographic is in order to recognise infographic from other forms of visual communication.

1. Certainly, infographics are intended for a visual fruition (even if it is not necessarily only visual). But how are we to interpret the adjective 'graphic'? Does it mean 'non-figurative', because infographics show only schemes or abstract diagrams? These are certainly very important components, because they assure representation of data and quantities, but we also have a lot of figurative images in infographics. On the other hand, it would be difficult to understand 'graphic' as a reference to a specific representation technique (as in Wölfflin's opposition between *graphic* and *pictorial*; Wölfflin, 1915): it would be a too subtle and not relevant distinction and, besides in recent years, infographics have often been embellished with photographic or highly realistic images. In fact, it seems the use of the adjective 'graphic' is misleading or at least redundant.

2. Infographics do not use only images and graphics, they present information and data also through verbal texts and numbers. Infographics are thus what Semiotics would call a 'syncretic text', that is, a text in which different languages (figurative language, verbal language, etc.) coexist.

3. In infographics, information and data are usually represented through visual metaphors. Some of them are more evident but even a line-chart or a bar-chart are visual metaphors, because they represent a quantity through a rule of transformation (a quantity is mapped as a length or a height).

4. Infographics are for the presentation of information and data. According to Alberto Cairo (2013), the first thing to do in creating an infographic is to select those data that are really interesting and relevant and choose different points of view on those data. A good infographic is always layered: the user can read the main data that have been proposed, but he has to be invited to explore text, investigate secondary aspects, make comparisons and look for a personal discovery or further explanations. Infographics are used to represent systems of relations, be they comparable quantities or cause—effect nexus or others. Such relations can be visually represented in other ways too. A temporal connection (before—after) or a causal nexus

(cause−effect) can be represented in a painting: for instance, something happening in the background can be the cause of the situation represented in the foreground (Polidoro, 2016). So, what is the difference between a painting and an infographic as for the representation of relations? The answer is that in infographics, representation of relations (1) is not only possible, but one of the main features (almost necessary) and (2) is usually explicated and marked through meta-textual mechanisms (parts of the text that say something about the text itself, such as arrows, indicators and captions).

We can now propose a formal (and stricter) definition of infographics: infographics are syncretic (and sometimes multimedia) texts that may include visual, verbal, numeric elements, and represent, essentially in a visual way and through visual metaphors, information and data, whose relations are made explicit by meta-textual mechanisms. This is a list of non-necessary features: we could have more prototypical infographics, including all of them, and more peripheral ones, lacking something. But this list can help us to recognise what can hardly be considered as an infographic. For instance, a table with numerical data is not an infographic, because there is no visual metaphor or syncretism (data are presented only in their raw numerical aspect) and meta-textual elements (row and column labels) are used to classify data and not to highlight relations among them.

Once we have a definition of infographics (even if temporary and incomplete), we can try to classify them or, better, to observe their use in different conditions and for different purposes.

Eric K. Meyer (1997) proposed a useful schema, inspired by a classic model from journalism to recognise different genres of infographics and to understand what they are best for:

- Who? = Bio box (a visual box with verbal information on the biography of a person).
- What? = Breakout (a visual box with highlights, explanations, details).
- When? = Timeline.
- Where? = Map.
- Why? = Pro/con breakout.
- How? = Process diagram, flow chart.
- How much? = bar chart, line chart, pie chart.

More recently, Börner and Polley (2014) have elaborated a similar scheme, even if more complex and less rigid, their model considers four

main questions: when (temporal data), where (geospatial data), what (topical data), with whom (tree and network data). A more systematic classification of infographics has been proposed by Segel and Heer (2010), who have built an analytical grid based on formal parameters such as genre, visual narrative and narrative structures.

1.8.2.   *Infographics and Scientific Information*

Infographics can be used to explain complex concepts (as scientific ones) and to help memorising information and procedures. Thus, they can be useful in natural risk communication, even if probably not all the infographic genres we have listed are fit for this task.

We will now explore and discuss different kinds of infographics that are used by some agencies to spread information and data about scientific aspects of natural events and preparedness practices. In the terms of the model proposed in this book, we will consider infographics as examples of top-down information sharing.

A main distinction has to be made on the basis of the infographic's ultimate purpose related to the public: to give a scientific knowledge about natural events or a pragmatic one.

In the first case, infographics aim to create what French semiotician A.J. Greimas (Greimas & Courtés, 1982) would have called a 'savoir', that is a theoretical knowledge about something. In other words, this kind of infographic explains how the natural events happen or gives some scientific data about them. Sometimes this can have an immediate practical value. Each time an earthquake occurs in Italy and passes a given magnitude threshold, the INGV posts on its website and social media a short description of the event, most relevant data about it and a map with a pin indicating the epicentre (a basic example of infographic). The public can use this information in different ways: people who perceived the earthquake with weak or medium intensity can understand if it was a near minor event or if it was a major event occurring many miles away; people living far from the event can immediately visualise where the epicentre was and suddenly contact friends or relatives they may know in that area.

But infographics can be used also in other circumstances. Both INGV and its US equivalent USGS periodically publish posts explaining scientific aspects of natural events. In these cases, infographics, such as maps, diagrams, or a complex mix of images, labels and arrows, are used.

Infographics used to spread 'knowledge' can be divided in two main groups:

1. Process diagrams, flow charts and other schemes show causes, phases, and consequences of an earthquake. They answer 'how' questions and give an explanation of the seismic event. They can also be used to explain the technical aspects of seismologists' work, sharing with the public part of their knowledge.
2. Maps, and sometimes other kind of charts, are mainly used to show the extension and relevance of the phenomenon.

These messages do not have an immediate practical purpose. Nevertheless, all these agencies make great efforts to spread at least a basic knowledge about earthquakes, because knowing the phenomenon (and understanding its seriousness) is probably considered the first step towards consciousness of the problem. To better understand this mechanism, we can consider the AIDA model, one of the oldest and most used in advertising and marketing studies. According to it, a customer passes through four main phases: Attention (he becomes aware of the product), Interest (he learns about benefits and features of the product), Desire (he desires the product) and Action (he buys the product). Adapting this model to our case, we could think that scientific posts and infographics may create attention and interest towards natural events in order to stimulate desire of being safe and consequent actions (such as preparing an emergency kit or participating in emergency exercitations).

Unfortunately, scientific explanation through infographics is a difficult task. In the case of seismology, the task is even more difficult, because we have only probabilistic models to describe earthquakes, which are unpredictable events. Spiegelhalter, Pearson, and Short (2011) have studied various problems usually encountered when representing and communicating uncertainty, issues that seismology shares, for instance, with medicine. Normal people do not like very much probability and their understanding of it is usually reduced by many factors, such as low numeracy, influence of positive or negative framing, misunderstanding of ratio or frequencies (ratio bias or denominator neglect).

An example of how difficult it can be to make scientific information comprehensible through an infographic is the use of colour to indicate continuous dimensions such as seismic risk (a probabilistic measure). INGV has produced a map where seismic risk in Italy is represented through a colour scale that goes from green (low risk) to red (high risk).

In 2011, Borkin et al. (2011) have developed a new kind of visualisation of human arteries. They have discovered that simplicity is better and so they have substituted 3D models with 2D models and, above all, the traditional rainbow scheme (used also in the seismic risk infographic) with a single colour scheme, where the only information is given not by hue but by saturation. Medical doctors found this scheme much more efficient. This is probably due to the fact that blood pressure (or seismic risk) is a single dimension information and a continuous one. Therefore, it can be visually mapped by a single dimension of representation: for instance, saturation. Borkin's model uses only one dimension to represent this information, while the rainbow scheme of traditional representations of blood pressure uses two dimensions, because we have not only a scale of hues but also the saturation differences within a hue. In addition, while the convention at the basis of the monochromatic model is clear (less saturation = less pressure; more saturation = more pressure), we need a key to read the correspondence between blood pressure and hues. Thus, we should consider saturation the best way to express a quantity such as blood pressure or seismic risk. But things are not so easy, because 'using shading to represent probability is unsuitable for fine quantitative comparisons' (Spiegelhalter et al., 2011, p. 1399). A rainbow scheme is more suited to distinguishing differences in values: while the simple saturation scheme gives an immediate idea of the relative positions on a scale, it is more difficult to report a single value of saturation to the scale to have a precise measure. In other words, there are many factors to consider and the most important one is the real aim of the representation (saturation can be useful to have a general idea, rainbow scheme is better for precise measures).

1.8.3. *Infographics and Pragmatic Information*

The second group is made of infographics used to give a pragmatic knowledge, that is the knowledge about what to do in case of an earthquake or a natural disaster in general. In Greimas' terms we would say that, while the first kind of infographic offers a 'savoir', this one offers a 'savoir-faire'. And, indeed, while scientific infographics are usually produced by geophysical agencies such as USGS and INGV, the 'pragmatic' ones are more frequently a prerogative of governmental agencies in charge of prevention and rescue, such as the American Fema and the Italian Protezione Civile.

In this group, we can find different kinds of infographics. At the basic level, we have many cases in which there is an image accompanying verbal instructions. These might also not be considered as proper infographics, because usually there is not a strong integration between visual and verbal text, and the main focus is still on the latter. Usually, they give indications about the correct behaviour during an event (in this case, the image catches an instant of a developing action) or about the things to remember or to prepare (in this case, the infographics can visually represent these things). This is a fast way to create posts that catch the attention of the user; in addition, images can help these users to understand the meaning of the verbal instructions and to better memorise them.

At a higher level, we find what we can certainly consider infographics. Many of them take the form of what Meyer (1997) called a 'breakout', that is a visual symbolic element containing some verbal text; this is the case of a Fema's post in which we see in a point-of-view shot two hands holding a notebook where someone has written (and ticked) the most important things to do in case of hurricane emergency. Verbal text must not necessarily be a part of the represented world: It can also accompany and explain or highlight the visual content.

We can also have a sort of bio boxes: in an infographic whose title is 'What to expect when Fema is in your community' we see three symbols representing three different kinds of Fema officers (assistance teams, disaster recovery centres and mobile registration intake centres); each is followed by a short explanation of its function and how it can help people. In this case, we have no information on a specific person (as it should be in a proper bio box) but on a category of people (assistants, registration staff, etc.).

Diagrams and flow charts can be used to explain procedures and are particularly indicated for bureaucratic issues. Fema has also used timelines when it wanted to summarise the main steps of its response in specific emergencies.

This leads us to another consideration. Infographics can be used in all the phases of a natural event. In normal times or in case of cyclical or predictable events, they are used to build people preparedness: they can explain or recall what to do in case of natural disasters. During an event (for instance, a series of aftershocks or when a hurricane is approaching a region), infographics can give scientific information and explanations in order to combat rumours or prepare people. After an event, they can spread information about what to do (to whom ask for help, how to behave, how to participate in rescue, etc.) or they can serve

the accountability policy of governmental organisations. After the two catastrophic hurricanes Irma and Maria that struck respectively Florida and Puerto Rico in late summer 2017, Fema and the US Army Corps of Engineers produced many infographics. Some of them explained and showed how to behave to help the federal action; for instance, a highly professional infographic showed people how to gather and place in front of their own houses debris in order to expedite the removal process. Other infographics were intended to give account of the efforts and the actions of federal organisations involved in the crisis: timelines showing their quick response to the events and complex infographics, including charts, periodically giving data about rescue and reconstruction.

1.8.4.   *Conclusions. A Lack of Interactivity*

As we have seen, infographics can help in explaining scientific concepts, stimulating interest and reflection about preparedness and natural event issues, memorising information and best practices. They are increasingly used also by governmental agencies, both before, during and after natural disasters. Considering the state of the art of infographics in private media companies and the models proposed by academic literature, what still is lacking in the use of this form of communication by governmental and scientific organisations is interactivity. The largest part of these infographics is seen through digital media, but they are mainly conceived for traditional paper media. They are static contents, and they do not offer any kind of interaction (such as those identified by Segel & Heer, 2010; hover highlighting, filtering and searching, navigation and tutorial). And yet, this interactivity could foster that exploring attitude that Cairo (2013) considers so vital for an infographic and that support even more than now their educative and pragmatic value.