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# The role of media in community resilience: Hindsight bias in media narratives after the 2014 Genoa flood

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## Abstract

*Aim:*
*A massive flood due to exceptional rainfalls devastated the town of Genoa on 9 October 2014. Media reports focused on the disaster, its causes and the political accountabilities. Reading facts after the event is commonly biased by the hindsight perspective and the aim of the paper is to investigate the amount and the potential effects of hindsight bias in terms of citizens risk perception and community resilience.*
*Method:*
*We performed a qualitative analysis of the narratives in the national and local news reports during the aftermath to investigate occurrences of a blaming attitude and cognitive biases.*
*Results:*
*The results showed a considerable amount of sentences that were focused on blaming the forecasters, the Civil Protection System, and the local administration. Many narratives were affected by hindsight bias and described the events as simple and linear chain reactions. This led to counterfactual biases, assuming that a simple intervention on a single factor could have prevented the tragic outcome.*
*Conclusion:*
*We claim that the biased nature of the media narratives could affect the citizens' risk perception and their attitude towards the institutions, increasing their exposure to future flood-related threats. We propose the appropriate language would generate correct cognitive frames and, therefore, safer behaviour.*

**Keywords**: *hindsight bias; media; resilience; heuristics; risk communication.*

## 1. Introduction

On the night of 9 October 2014, the town of Genoa, a main city in Liguria in the northwest of Italy, suffered a major flood due to exceptionally heavy rains. Notwithstanding the fact that the forecast models predicted a decrease in precipitation in the afternoon, in the evening the situation rapidly worsened and, in less than two hours, the Bisagno River burst its banks flooding a vast area of the town (Silvestro *et al.,* 2015). The damage to public and private infrastructure was around 300 million euros, and one fatality was recorded. The citizens were shocked by this event, not only because of the serious outcome but also because it occurred just three years after another flood, in 2011, where 6 people lost their lives.

This kind of event has the characteristics of complex phenomena: non-linear trend, unpredictability, and interaction between multiple and uncontrollable factors. Borrowing a term from the sciences of complexity, the flood in Genoa was an emergent property, i.e., the outcome of a complex interaction of factors that could not be explained merely as the summative result of every single factor. The interacting factors were numerous: almost a century of ever-increasing building policy; ineffectiveness of the hydraulic systems in managing the peak discharge; rainfall events that produced hundreds of millimetres of rainfall in a few hours in small basins with complex orography; lack of a deep physical understanding of high impact weather events and consequently high uncertainty in meteo-hydrological forecast; lack of risk perception among citizens; lack of prevention culture in citizens and consequently in institutions.

Since the phenomenon is complex, it should be tackled by the whole community (institutions, technical agencies, citizens, media) with the right approach. We argue that the right perspective should be based on experience learned, avoid a simplistic focus on isolated causes (e.g., the river bed vegetation, the banks, the institutions, etc.), and avoid a reductionist analysis, based on linear links between factors. This is the core of a resilient approach to such a complex system (Hollnagel, Woods, Leveson, 2006). From this point of view, Genoa is not resilient. In the last century, Genoa has had 10 major floods mainly due to the river mouth being paved over.[1] The dynamics of each outcome are substantially

[1] The last 1,5 km of the Bisagno river was paved over in order to make room for a large avenue, connecting the train station to the expo area. As a consequence, just north of the station, the river flows into an underground tunnel that opens into the sea. The capacity of the tunnel is usually suitable to contain the river flow. However, during flash floods, the river flow rate increases dramatically and overflows the banks at the tunnel entrance putting at risk the urban area south of the tunnel entrance.

similar, and many stakeholders claim they are frustrated to be passively repeating the same fate.

Following the resilience approach, we assume that understanding and learning from past events relies on the correct representation of what happened and why. This, in turn, will allow the community to develop an adequate perception of risks. The citizens' risk perception of environmental threats is based both on the nature of risk, and psychological factors, namely cognitive and emotional factors such as their fear surrounding the event, their perceived ability to cope with it, the potential benefits of being vulnerable to risk, and any previous experiences (Janmaimool & Watanabe, 2014). However, numerous researches in literature demonstrate that citizen risk perception is not only based on the immediate balance between the threats and advantages of being vulnerable to risk (e.g., trying to save one's car during a flood or buying a relatively cheap apartment in a high-risk area). Other factors should be taken into account in addition to those mentioned above, for instance, beliefs and attitudes towards risk (Slovic, 2000). Raaijmakers, Krywkow and van der Veen (2008) propose a three-factor model to account for flood risk perception. They claim that the awareness of risk is based on the collection of data and past experience, this will stimulate the citizens' concern about the outcome and therefore they will try to be prepared, adopting preventive protections and learning the required behavioural responses during an emergency. Unfortunately, over time, a strong feeling of preparedness will decrease people's concern and, eventually, affect their awareness of risk. This self-regulating cycle is not new in risk perception research; for instance, the homeostatic risk perception model (Wolfe, 1998) states that people take risks balancing them with the expected benefits from the exposure to the threats. In particular, if the feeling of control is high, people tend to increase their exposure to risk, maximising the benefits (e.g., driving a well-equipped and safe car, people could increase their speed because they feel protected). Dealing with flood risk perception, however, is more complex than in other domains, because the link between worry and preparedness is not direct as a simplistic interpretation of Raaijmakers et al.'s (2008) model could suggest. Other factors mediate citizens' preparedness, such as personal beliefs, attitudes and, most of all, trust towards institutions (Poortinga & Pidgeon, 2003; Renn & Rohrmann, 2000; Siegrist & Gutscher, 2006). As stated by Wachinger, Renn, Begg & Kuhlicke (2013), the personal action taken by citizens in the case of a flood is the result of the interaction of many factors. Some of the key preconditions are people's attitudes (education, personality traits, beliefs, etc.). They affect risk perception together with peer pressure, the available information on the risk, and past experiences. Intervening variables to take into account are: the trade-off between risk exposure and personal advantages; trust towards institutions (which could be balanced, or unbalanced, leading to mistrust, distrust, or over-reliance); perception of personal resources to cope with the situation. As can be seen, trust is a key factor in understanding citizen behaviour in the case of flood risk (Slovic, 1999). If citizens

perceive that institutions are not a credible and an authoritative source of information, they just rely on their own competence ((Siegrist & Cvetkovich, 2000). On the other hand, an over-reliance on institutions could lead to the lack of citizens' commitment and passive attitudes (Terpstra, 2011). As stated by Paton (2008), trust in institutions is a crucial factor when dealing with unfamiliar, infrequent, and complex events like floods.

Since the resilient management of a complex event requires that all the stakeholders understand the dynamics from the right perspective, media have a crucial role in framing the outcome of a disaster (Kitzinger, 1999; Wahlberg & Sjoberg, 2000). This should be done by building narratives that help the community to learn from experience and to be prepared for future events. On the contrary, when narratives are biased and the representation of the outcome is flawed by simplistic and reductionist conclusions, the citizens' trust in institutions is at stake, their attitude towards risk perception is distorted, and therefore their future behaviour in critical events is affected (Bronfman, Cisternas, López-Vázquez, Cifuentes, 2016).

As we stated before, the problem is complex and multifaceted. Blaming the media would be as reductionist and simplistic as blaming institutions. In this paper, we will focus on media narratives in order to investigate the presence of cognitive distortions in hindsight perspective and we will discuss the potential drawbacks of this phenomenon. The rationale of the paper is summarized in table 1.

| | |
|---|---|
| **Event** | Flood (damages to belongings, casualties, loss of lives) |
| ⬇ | |
| **Emotions** | Post-event shock, rage, frustration, need for restorative justice |
| ⬇ | |
| **Bias** | Distorted interpretation of the events in hindsight |
| ⬇ | |
| **Misrepresentation** | Reductionism, linearity, determinism in representing the events |
| ⬇ | |
| **Blame** | Attribution of blame to someone, search for a scapegoat |
| ⬇ | |
| **Distrust** | Cynicism, suspicion, rejection of institutions' communication |
| ⬇ | |
| **Unpreparedness** | Poor knowledge of self-protective behaviour, risk-taking behaviour, passivity, lack of commitment, and delegation to others |

Table 1 – The cognitive-emotional process describing the reaction after a disaster.

The disaster caused by the flood would inevitably generate an emotional shock. This will trigger distorted interpretation of the events, causing people to describe them as simple cause-effect reactions. This linearity and reductionist approach will lead to the blame of someone (the institutions) and this would affect the citizens' trust in them. Eventually, distrust could interact with individual

attitudes towards risk and other personal characteristics and could affect citizen preparedness in the case of a flood.

We will argue that the description of the events that occurred on October 9th 2014 was biased by hindsight perspective and lead to an improper perception of the complex dynamics that contributed to the flood. We will analyse the narratives reported on television in the weeks that followed the flood and we will discuss their contents in terms of biased descriptions, partial or erroneous recollection of events, simplistic approaches, accusatory attitudes, and risk misperception. This analysis does not only concern the poor quality of the information provided by the media but rather the oversimplification of events that hinders the citizens' comprehension of the complexity of the phenomenon. This may generate inaccurate beliefs and incautious attitudes, which in turn may lead to poor decisions made by institutions, risky behaviour in citizens during critical situations, and inadequate self-protection behaviour.

## 2. The description of the events and the institutional context

### 2.1 The organization of the weather risk management system

The technical and administrative organization of the weather emergency management in Liguria is based on the cooperation of two institutions: the ARPAL, the regional agency for the protection of the environment which has the responsibility of scientific and technical support for the weather forecasting and monitoring, and the Civil Protection Unit of Liguria Region (CPU), which has the decisional and administrative responsibility for the coordination of emergency management activities. The information flow normally starts at the ARPAL level, where the forecasters provide data on the risk of rainfalls to the CPU. After that, the CPU integrates the forecast with vulnerability data and, depending on the resulting risk assessment, it decides to issue a warning to the municipality to promptly alert the citizens (e.g., with an SMS service). Before 2015, the alert rating system was based on two levels: grade 1 and grade 2 alert, the first being the lowest level and the second being the most critical. It has been recently changed according to a colour-coding system as yellow (moderate), orange (intense), red (critical) alert.

### 2.2 Report of the 2014 Genoa flood

The description of the events is based on the official report issued by CIMA Foundation, the International Centre on Environmental Monitoring, which investigated the activity of the CPU after the event.[2] For a detailed description of

[2] The report is part of an internal audit commissioned by the National Civil Protection Department.

the event and meteorological data, see Silvestro *et al.* (2015). Here we present a short account of the main facts.

- 8 October, 10:24 a.m.: ARPAL issued a weather warning of heavy rains with a high chance of stationary and persistent storms over the territory of Genoa.
- 9 October, 9:39 a.m.: ARPAL reissued the warning and started to monitor the evolution of the weather in a constant manner. The monitoring tools (satellite, radar, lightning tracker, etc.) and the available forecasting models predicted that the storm's peak activity would hit in the morning and decrease in the afternoon. ARPAL also activated an internal alert team of experts, thereby reinforcing the monitoring service. During the day, ARPAL constantly updated the regional CPU and provided information on the weather risk on their website (www.allertaliguria.gov.it).
- 9 October, 6 p.m.: the monitoring results of the precipitation and the available models described a progressive eastbound shift of the rainfall and a decrease in its intensity.
- 9 October, 9:18 p.m.: ARPAL assured the CPU that the situation was under constant monitoring, notwithstanding every signal was below any warning or alarm threshold.
- 9 October, 10 p.m.: the precipitation gained strength and the rain gauge in the Polcevera, a river parallel to the Bisagno, signalled an early warning.
- 9 October, 10:17 p.m.: ARPAL warned the CPU about the critical situation developing in the Bisagno river basin. A few minutes later (10:20 p.m.), on its website, the CPD published a warning that the main basins of Genoa were in a critical situation. At the same time, the CPD received an early warning for the increasing level of the Bisagno river. All the technical and administrative institutions were monitoring the evolution of the rainfall and observed a quick deterioration in the situation.
- 9 October, 11:15 p.m.: 75 minutes after the early warning, the Bisagno river flooded at the tunnel entrance to the underground section of the river and its mouth. As a consequence, the water flooded a vast portion of the town surrounding the river mouth.

According to Silvestro et al. (2015), it has been "an 'almost perfect' flash flood". The accumulated rainfall over 24 hours reached a peak of more than 400 mm; the rainfall intensity peaks were approximately 200-250 mm/h. The authors investigated the spatial and temporal scales of precipitation and estimated that the probability of generating events with similar effects was extremely low. In other words, even taking into account the real data recorded *ex-post*, and not just weather forecasting, existing models demonstrated that the scenario that occurred was very unlikely and, therefore, the observed ground effects of the storm were highly unpredictable.

## 2.3 The reaction of public opinion

The reaction of public opinion and the media after the event was strongly affected by emotional stress due to negative outcomes and losses. However, while understandable from a psychological point of view, this approach did not allow people to have a clear comprehension of the problem. The emotional reaction was enhanced by the rhetorical sensationalism of media reports. This set the ideal conditions for the propagation of irrational and biased interpretations of the events in public opinion. As a result, the development of cultural, social and urban resilience to cope with future events was at stake. In this paper we will analyse TV programmes, however other media outlets reported emotionally charged reactions as well. As an example, we mention an excerpt from an article published in *La Repubblica*, an important Italian newspaper, on 11 October 2014. It is a compendium of irrational contamination that could elicit a reductionist and simplistic interpretation of the events. The blame was placed on the ARPAL forecasters since their forecasting models did not foresee what was supposedly evident. "According to the Government of Liguria, the ARPAL forecasters were fooled by the mathematical models that failed to report the state of risk. But last night, even the most uneducated people in meteorology and, we argue, even the dumbest citizens, looking out of the window, could have understood that an epoch-making cloudburst was going to hit Genoa and that the umpteenth flood would have been the inevitable outcome. If the ARPAL forecasters, instead of looking at their ineffable mathematical models, had looked at the sky, they could have understood what was going on".

These few words contain the seeds of the *post-hoc* thinking (Fischhoff, 1975). The flood was claimed to be predictable ("even the most uneducated people in meteorology… could have understood that…") and inevitable ("the umpteenth flood would have been the inevitable outcome"). In addition, there is a rhetorical use of irony ("even the dumbest citizens, looking out of the window, could have understood that an epoch-making cloudburst was going to hit Genoa"). This ironic statement contrasts the patent critical situation with the supposedly dumb stubbornness of forecasters working with their mathematical models. Moreover, there is a hint of a counterfactual fallacy in claiming that if somebody (the forecasters) had done something (looking at the sky) instead of something else (studying the mathematical models), the flood could have been predicted and the outcomes would not have been so devastating. Here the fallacy lies in the belief that a change in one element of the scenario (the forecasters' performance) could have affected the whole situation. The situation was, in fact, the emergent phenomenon of many interacting factors.

## 2.4 The cognitive bias

Psychological research has been investigating the hindsight thinking fallacy for a long time. It is known as "hindsight bias" (Fischhoff, 1975, 1982a,b; Roese & Vohs, 2012). It consists of the misjudgement of the probability of an event when analysed after its occurrence. There is the tendency to project the knowledge people have received after a fact onto the minds of those that were involved in the situation before they knew the outcome. This cognitive bias has relevant drawbacks from the legal point of view and may affect the investigation for the assessment of the accountability in accidents (Goodwill *et al.*, 2010) and, in general, is one of the major threats of accident analysis in terms of resilience and safety (Dekker, 2007, 2011; Holden, 2009). Several cognitive models of hindsight bias have been proposed in recent years (for a review, Blank & Nestler, 2007). In this research, because of its broad perspective, we adopted the Roese and Vohs (2012) framework to analyse the media's reports on the Genoa flood. It integrates the several aspects of the hindsight bias and describes its possible behavioural effects. The model is broad because it represents the relationship between attitudes, needs, cognitive processes and subsequent behaviours. It is broad also because it takes into account memory distortions (reading the past) and probability misjudgements (anticipating the future). Since we are interested in the emotional, motivational and behavioural effects of hindsight bias, we believe that this model could provide a comprehensive view of the phenomenon.

This model represents the hindsight bias as a hierarchical distribution of mental distortions:

(1) memory distortion: people erroneously recall they were able to predict the event ("I said it would happen");
(2) inevitability of the event: people think that, according to the conditions before the event (but recalled in hindsight), the event was inevitable ("It had to happen");
(3) foreseeability of the event: people think that the pieces of information available before the event (but recalled in hindsight) were clear enough to foresee it ("I knew it would happen").

According to the authors, the three levels are presented in a hierarchy, since the latter can take place only if the former occurred. Therefore, people may have memory distortions without probability misjudgements. While, if they claim an event was foreseeable, they may also be biased in the assessment of its inevitability and in recalling their capacity to anticipate it. The hindsight bias is enabled by psychological conditions at several levels, such as:

- errors in recollection, since mnestic traces are dynamically transformed in our memory, we may believe, in hindsight, that what we recall now is what we knew earlier;
- knowledge updating, which tends to select data that can fit the previous knowledge, and neglects inconsistent information that was known but that is not compatible with the current evidence;
- need for sensemaking, which leads to order and over-simplification of events, providing a simple and cognitively undemanding explanation of our world;
- need for cognitive ease, which is based on the fact that when we find it easy to come to a conclusion, we misattribute ease of our cognitive process for certainty of the event;
- need for control, which promotes predictability and order when facing complex events;
- need for self-esteem, because we want to preserve or enhance our view of ourselves, of our capacity to foresee an outcome, and of our control of a complex phenomenon.

The behavioural consequences of hindsight bias are very important for the purpose of this research. First of all, hindsight bias can lead to overconfidence in one's own capacity to foresee and manage events. Overconfidence brings a poor understanding of personal skills and knowledge, and an attitude towards overconfident choices in the future. In addition, hindsight bias could favour myopia in the understanding the events, because it highlights only the pieces of information that, in spatial and temporal terms, are closest to the outcome, while neglecting the whole picture and producing an oversimplified representation of the events. Finally, hindsight bias can foster a blaming attitude towards those who did not foresee and manage the events. Blame, in turn, will lead to distrust towards the institutions in the event of future threats (Hugh & Dekker, 2009).

## 3. The research

### 3.1 Method

We performed a detailed, qualitative analysis of all the television coverage broadcast on the flood (around 500 programmes) during the three weeks after the event. We decided to focus on TV reports, since it was the main communication channel, even though other media were involved in recounting the event (radio, Internet, social media, etc.). From now on, our analysis of the media will make reference to television programmes.

Thanks to the cooperation with the Press Service of the Italian Civil Protection Department (CPD), we collected and analysed the videos of all the

main news reports broadcast in Italian television networks between 10 October and 31 October 2014. These videos were selected because they reference the Genoa flood that occurred on 9 October 2014.[3]

The Roese and Vohs (2012) framework was adopted in order to identify sentences that presented the hindsight bias. The words from the news reports were taken verbatim from journalists who were describing the situation or from citizens who were interviewed on the disaster. We did not distinguish between the two sources (citizens or journalists), because both could have some credibility and may influence the audience's attitude (Cialdini, 2007). The citizens are thought to be credible because they have been directly involved in the events, or because they are perceived as peers. The journalists are thought to have credibility because they are seen as professionals, reporting verified data and objective descriptions of events.

According to the literature on hindsight bias and blame culture, we identified eleven themes that can occur in biased reasoning and we listed eleven broad criteria:

(4) presence of a conditional reasoning (e.g., if… then…), as a potential sign of counterfactual reasoning;
(5) presence of emotional contents (e.g., reference to rage, fear, contempt, etc., …), as a sign of a sentence where the reasoning could have been biased by the emotional state;
(6) presence of blaming attitudes (e.g., words like "shame on", "the fault is…", "guilty"), as a sign of blame culture;
(7) reference to the recollection of factual data (e.g., words like "at 8 pm it started raining", "it had been raining for 3 days"), in order to check for that the recollection was correct;
(8) presence of foreseeability reasoning (e.g., words like "everybody knew that it was going to happen") as a sign of hindsight bias and attribution of prior knowledge;
(9) presence of inevitability reasoning (e.g., words like "it had to happen");
(10) presence of suspicion of conspiracy (e.g., words like "they knew it but they did not want to take action");
(11) presence of reductionist reasoning (e.g., words like "the only cause is…");
(12) reference to the noticeability of weak signals in hindsight (e.g., "notwithstanding it had been raining for three days, they did not…"), as a sign of foreseeability;

[3] The videos were stored in a private repository and were made accessible for the purpose of the current research. A list of the video titles and a detailed description of each of them (containing the programme title, the broadcast time, and the TV channel) is available upon request to the corresponding author.

(13) reference to the balance between bad choices and bad consequences (e.g., "the mayor was at the theatre and then the river flooded"), as a sign of the symmetry bias, simplistically putting the blame on people according to the consequences;
(14) presence of simplistic reasoning (e.g., words like "the flood happened because of their mistake"), as a sign of a linear cause-effect interpretation of events.

This list of criteria allowed us to define a set of categories that was used as a provisional coding method for our data (around 500 programmes). According to this method, the literature review and our research hypotheses led us to identify a set of categories to be used further in the analysis (Saldana, 2009). Taking into account the eleven themes listed above, we followed a content analysis method (Hansen, Cottle, Negrine, Newbold, 1998) and we identified a series of codes to analyse the biased reasoning that occurs in narratives about the event. One of the research team members watched the videos and selected the parts that matched at least one of the codes.

All the videos were therefore marked as containing one or more of these signs and, for each video, the specific sentences were transcribed. This first selection produced 827 records. After that, a second independent group of researchers read all the sentences and selected only the ones that reported signs of hindsight bias (e.g., "all the models foresaw the high risk in advance") and not just generic complaints or comments (e.g., "all the politicians are greedy") that were not accompanied by a reference to cognitive distortion.

Some programmes reported the same content two or three times a day, especially in the period immediately following the event. We decided to also count the repetitions because, from a psychological point of view, the reiteration of the bias worked as a reinforcement and could have relevant effects on viewers.

### 3.2 Results and discussion

After the analysis of TV programmes in the 20 days following the flood, a total of 827 sentences were reported, according to the eleven criteria listed above. All of these records reported sings of blaming, contempt, polemics, rage, memory mistakes, simplistic reasoning, etc. However, we wanted to strictly select only the sentences where hindsight bias was present and we came up with 78 occurrences of cognitive biases. As showed in Figure 1, the number of biases was high during the first few days after the event and dropped radically within a week.

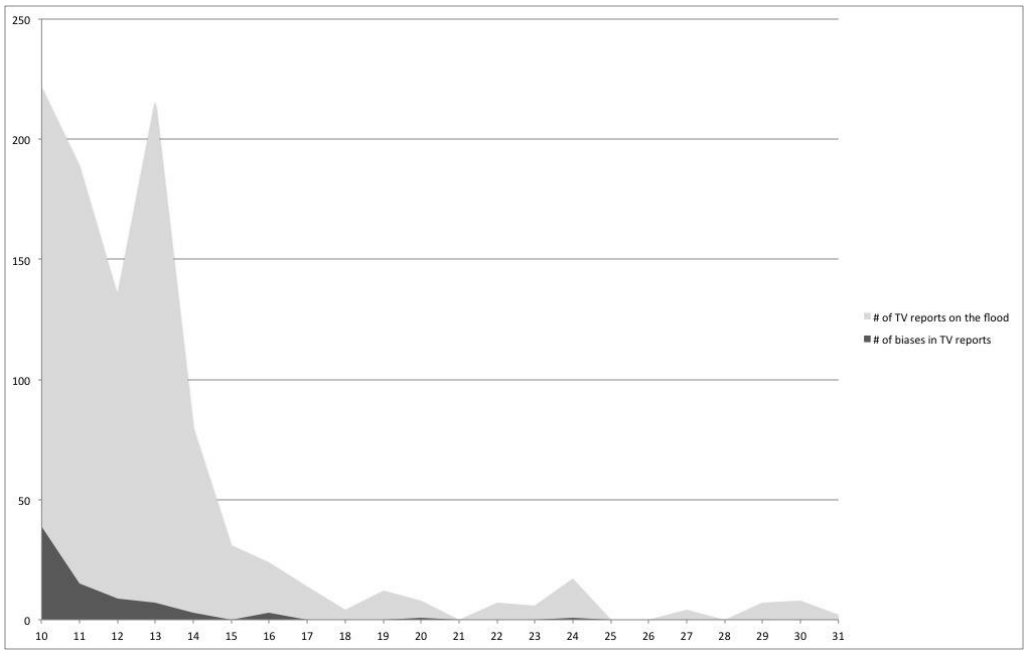


Figure 1 – Absolute number of TV reports about the flood and of cognitive biases during the 22 days following the event.

Taking into account the ratio between the biases and the total number of TV reports on the flood, the decreasing trend is less steep, as can be seen in Figure 2.

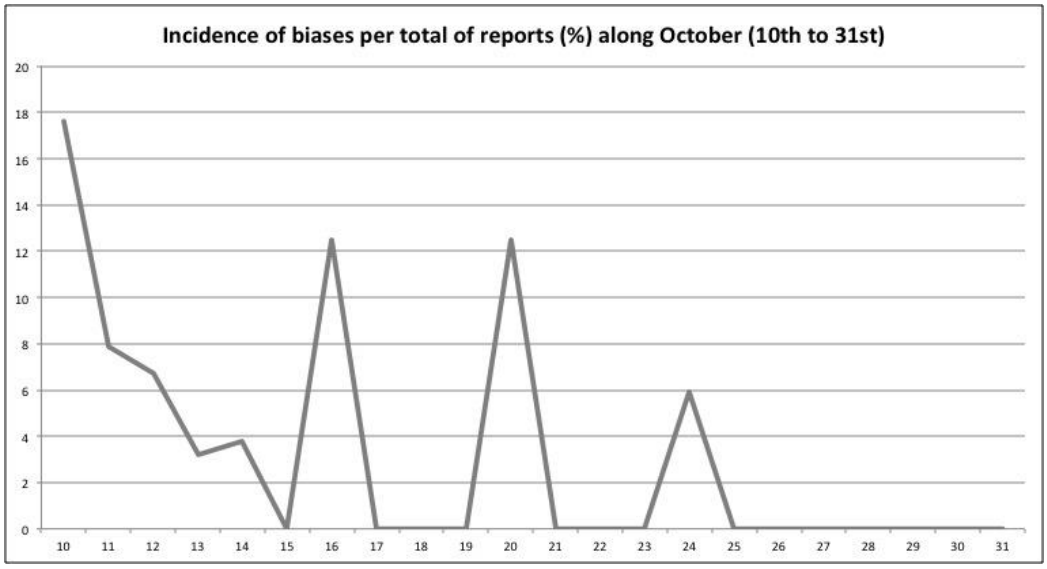


Figure 2 - The incidence of biases per total number of reports represents the ratio between the number of biases and the total number of TV programmes.

As demonstrated by the rate of biases during the 22 days following the flood, the relevant presence of biases right in the aftermath could be due to an emotional interference on rational thought. In fact, the media's description of the flood was mainly characterised by reactions of an emotional nature such as anger, contempt, accusations, sadness, desperation, and need for revenge and justice. Only ten days after the event the media reported more detached descriptions, mere reports about the damages and the investments for the recovery of the city.

According to the Roese & Vohs (2012) model, we could frame the biases at three main levels: memory distortions, inevitability and foreseeability.

### 3.2.1 Memory distortions

As stated above, after the event people may have false memories of their previous knowledge in order to justify the foreseeability of the event, strengthening their need for closure, the feeling of control over threatening situations, and the need for sensemaking. People tend to remember only the pieces of information that are compatible with what actually happened. For instance, we observed the tendency to have wrong memories of the meteorological data before the flood. The following table 2 reports some exemplary sentences affected by memory distortion, where recalled details are inaccurate.

| **Biased sentence** | **News report reference** |
|---|---|
| The first warning from the Civil Protection Department about a possible river overflow was issued at 11:19 pm, the flooding had begun 3 hours earlier | TG5, 8 pm, 10/10/14 |
| Neither warnings nor alerts were issued, notwithstanding it had been raining intensely for two days | TG2, 1 pm and TG1, 8 pm, 10/10/14 |
| It had been raining for five days in Genoa, why did nobody deliver a warning? | SKY TG24, 2.20 pm, 10/10/14 |
| Nobody was monitoring the situation, notwithstanding the situation had been a matter of concern since the morning | TG5, 1 pm, 24/10/14 |

Table 2 – Exemplars of memory distortions.

As we can see from these excerpts, people's recollection of facts and data is faulty and variable. Most of all, it is biased in favour of a coherent explanation of what happened in the following hours; the number of rainy days before the

Bisagno overflowed ranges from 2 to 5; the meteorological situation in the morning of 9 October is defined as worrying, as it was a clear warning of the forthcoming disaster; the fact that the meteorological models had forecast the rainfall in the morning was not mentioned. According to the official reports, the morning rainfall was considered to be the peak event of the perturbation and the forecasters expected a decrease in the evening. Therefore, the morning rain was not the warning of the forthcoming storm, but rather it was the main event, as predicted by the available tools and knowledge. A good example of memory distortion is what was reported by the TG5 at 8 pm on 10 October, where it was claimed that the flood begun 3 hours before the warning was issued by the CPD, i.e., around 8 pm. According to the available data, the first warning of an increase in the water level was issued at 10:30 pm, the riverbanks overflowed at 11:15 pm and the peak wave was registered at 11:45 pm (Silvestro *et al.*, 2015). This means that the event lasted little more than one hour. It is possible that the flood mentioned in the media report was describing the overflow of another part of the river in the outskirts of Genoa but, if so, this was not specified, and it may have left room for ambiguous interpretations and misunderstandings.

### 3.2.2 Inevitability

Another aspect of hindsight bias is the impression of the inevitability of the event. It is based on the need to make sense of events, and the illusion that the story was already "written", enabling people to identify clear causes of what happened. This approach is very limited in tackling complex events since it aims to highlight linear cause-effect relationships and does not grasp any interaction among factors. By explaining occurrences in linear terms, we build up stories and narratives that help us bear the cognitive burden of facts and relationships among factors. The resulting story is fluid, simple, and linear; it provides us with the ease of a coherent explanation of events in terms of inevitability. Weak signals are highlighted in hindsight; we tend to give them more relevance and meaning than what they really had before the outcome. For example, in media narratives of the flood in Genoa, we can find reports crediting some independent meteorologists who claimed they foresaw the flood or reinterpreting the satellite images as a clear warning of the forthcoming disaster. In fact, according to the weather reports on 9 October, none of the main forecasting services, private or institutional, foresaw the worsening of the precipitation in the afternoon. Unfortunately, this cognitive oversimplification neglects the role of unpredictability in complex events and reinforces an ingenuous view of science as a body of definite and indisputable knowledge, rather than a probabilistic and perfectible approach to events. Moreover, the inevitability found in media narratives reinforces a feeling of necessity, i.e., the outcomes were the necessary consequence of an irresponsible and slack approach on the part of institutions to a clearly critical meteorological condition. This feeling of necessity is again reinforced when we take into account

the fact that Genoa suffered a very similar calamity in 2011 when 6 people died in a flood in the same area of the flood that occurred in 2014. Two major and very similar events in three years could easily become proof that institutions and scientists are unable to predict and manage these situations. In table 3 we report some examples.

| **Biased sentence** | **News report reference** |
|---|---|
| Could the tragedies of 2011 and yesterday have been avoided? It seems so | TG5, 1 pm, 10/10/14 |
| They assured us that it would not have happened again […] and then it happened. How is it possible that such a huge meteorological event was not foreseen? | TG5, 8 pm, 10/10/14 |
| The ARPAL did not foresee that storm […] they did not classify it as a condition worth issuing a warning | TG1, 8 pm, 10/10/14 |
| How is it possible that we lack the scientific certainty to issue a warning? | SKYTG24, 1:21 pm, 10/10/14 |
| Nobody foresaw such a heavy rainfall over Genoa […] but some meteorologists warned us of the risk! The Civil Protection did not consider it necessary to issue the alert […] to allow the city administration […] to protect the citizens | TG4, 7 pm, 10/10/2014 |

Table 3 – Sentences reporting the inevitability bias.

The feeling of inevitability brought on by hindsight bias is linked to the counterfactual fallacy, i.e. the implication that, since X caused Y, if X had been different, it would not have caused Y (Roese, 1997). In the case of the Genoa flood, it is thought that if the meteorologists had looked at the sky, instead of wasting time with their mathematical models, they could have issued an alert and the consequences would have been reduced. When the counterfactual thinking can focus on a relevant antecedent that contributed to the event, it becomes a solid explanatory factor. For this reason, the counterfactual thinking is a powerful tool for hindsight explanations: it reduces the complexity and provides order. In table 4 we list some examples where the unwanted outcomes (the death of the person and the damages to vehicles and shops) could have been reduced or avoided if the causing factors (institutions' behaviour, forecasters' performance, etc.) had been different.

| Biased sentence | News report reference |
|---|---|
| If they had issued an alert, perhaps that driver would have stayed at home […] they said the event was a surprise, only because nobody alerted the citizens […] an alert would have saved Antonio Campanella [the victim] and would have let the other citizens move their cars away | La vita in diretta, 4:56 pm, 10/10/14 |
| Just a grade 1 alert would have been enough […] Genoese citizens could have moved their cars […] they could have protected their shops with barriers | TG4, 11:53 am, 10/10/14 |
| If they had completed the hydrological interventions[4], the flood could have been avoided | SKYTG24, 1:01 pm, 12/10/14 |
| There are serious investigational elements about the missed alert […] this could have allowed people to save some of their goods | TG2, 6:21 pm, 14/10/14 |

Table 4 – Sentences reporting the counterfactual thinking.

These excerpts demonstrate the widespread belief that if the institutions had issued the alarm, the victim (Antonio Campanella) would not have died and citizens would have been able to save their goods. The oversimplification is quite strong in these words since the alarm would not have reduced and limited the risky behaviour of the victim, who approached the riverbanks to see the flood. Even more critical is the interpretation of the alarm as a signal to save one's own goods such as cars and shops. The alarm invites the citizens to avoid risky behaviour and to follow some basic rules such as climbing to a higher location, not to leave home, not to use private transport, not to cross bridges or drive in underground tunnels, and not to try to save items in underground basements. However, the above quotes demonstrate that people would have done exactly these things to save their goods if they had only received an alarm. It poses a serious issue about the need for a more coherent and clear communication between institutions and citizens, in order to provide the adequate risk perception and suggest the appropriate behaviour in case of floods. In addition, we noticed a certain confusion in using the terms alarm ("*allarme*") and alert ("*allerta*"), which are often used as synonyms even though they refer, respectively, to the critical situation where people must do whatever possible to save their lives during the emergency, and a warning before an expected storm.

[4] The reference here is to the construction of a floodway that could reduce the water level of the Bisagno river during rainfalls.

### 3.2.3 Foreseeability

The feeling that an event was foreseeable is based on the metacognitive process of ease of activation of some thoughts more than others. In other words, when some conclusions are cognitively accessible and easy to process (e.g., missed alarm, therefore, disaster), the fluency of the cognitive processing is consolidated as certainty (Schwarz *et al.*, 2007). Since it is easy to link the missed alarm to the disaster, people may think that the lack of an alarm provoked the disaster. The ease of activation is in turn sustained by the availability heuristics (Kahneman, Tversky, Slovic, 1982). It is a suboptimal cognitive process, which is often effective even though it is not rationally perfect, but it allows the person to save mental resources. Unfortunately, heuristics could have negative consequences in analysing complex events such as the Genoa flood, because they oversimplify the situation. The availability heuristic is based on the overrating of the probability of an event simply because it is easier to access information in our memory that is in favour of this hypothesis, rather than the proofs against it. Therefore, if the media reinforce the association between the missed alert and the disaster, this will become increasingly more accessible in the citizens' memory and will be further easily activated, fostering the hindsight bias.

The illusion of foreseeability of events comes from the human need for control. We feel uncomfortable in dealing with unpredictability, and the fear of chaos is intrinsic in western culture. Only recently have sciences reintroduced chaos into the realm of knowledge, but this process if still far from being accomplished in our cultural background. Meteorology is a probabilistic science and tries to model chaotic phenomena like storms. However, the public opinion could expect the science to be exact and infallible, and the world to be foreseeable and controllable. When this belief is disconfirmed, someone has to take the blame. The need for closure, to protect us from the unexpected, is pervasive and there is the tendency to find strong signals before the event, even though they were not strong at all. The suspicion for conspiracy creeps in, people may believe that the same knowledge they have after the event was already available, clear and unambiguous, before the fact. Here in table 5 follow some examples.

| Biased sentence | News report reference |
|---|---|
| The satellite images and those from the ground confirmed the forecast […] nothing good could have come from that situation | TG2, 8:56 pm, 19/10/14 |
| You citizens expected that, but nobody warned you | La vita in diretta, 4:56 pm, 10/10/14 |
| Accusations are directed towards those in charge of issuing the alert but who never did it, […] ARPAL did not foresee that the situation could have evolved this way | RaiNews24, 12:01 am, 10/10/14 |
| The mayor was at the theatre, the Civil Protection emergency number did not work, and the alarm was issued after the flood | Che tempo che fa, 9:10 pm, 12/10/14 |

Table 5 – Sentences reporting the foreseeability bias.

These excerpts show the illusion of foreseeability of events. It looks like everybody but those in charge was aware of the situation. The mayor was at the theatre and the meteorologists were sunk in their models. The hindsight bias prompts for the search of a scapegoat, even distorting the facts.

### 3.2.4 Consequences of the hindsight bias

The simplistic explanations provided in the narratives on the flood in Genoa could bring with them serious consequences in terms of public attitudes.

First of all, we noticed there was an urge to find the original cause of the events, and it is usually present in people who are closer to them (e.g., the forecasters, the models, the political administrators, the CPD). Behind the legitimate investigation for accountability, the search for a scapegoat tends towards a quick and simple justice. Scholars on complex systems talk about this phenomenon as the "blame culture" (Dekker, 2007). It focuses on people rather than systems; it looks for linear relationships, rather than concurrent factors. The hindsight bias generates the "creeping determinism" (Nestler, Blank, von Collani, 2008), the belief that events are ruled by clear, unique, and regular causal relationships. These causes are often looked for in people's behaviour, often falling to another cognitive bias: the fundamental attribution error (Ross, 1977). This error has been widely investigated in social psychology and is based on the tendency to explain other people's behaviour in terms of the internal and stable states of the person, rather than the contingent situations. Therefore, through the eyes of blame culture, the forecasters did not foresee the incoming storm, not because their models lacked critical data, but because they made mistakes in interpreting the data; the river flooded before the issue of the alarm, not because it

was exceptionally quick (less than one hour), but because the CPD made a mistake while monitoring and managing the emergency; the mayor was at the theatre, not because the available data were not critical, but because he was unconcerned with and oblivious to the situation. The search for someone to blame is evident in the excerpts in table 6.

| **Biased sentence** | **News report reference** |
|---|---|
| Whose fault is this? [...] this kind of river should have been monitored, cleaned out, made safe. Nobody did it. Because of this person that did not do to his duty, we are here mourning for a man who lost his life | MattinoCinque , 9:19 am, 10/10/14 |
| It's shameful! Nobody issued an alert. Nobody is here to explain to us who was in charge of issuing it […] ARPAL did not issue the alert, the sensors did not signal it | Studio Aperto, 7:03 pm, 10/10/14 |
| I expect the worst punishment for whoever made this mistake | TG4, 11:53 am, 10/10/14 |
| Someone made a mistake. There's no room for defence […] an evaluation mistake and the missed alert […] the Civil Protection should have had a different evaluation […] someone should be responsible for the structural works that are still incomplete […] bureaucracy, politics, institutions are to blame […] | TG5, 8:11 pm, 11/10/14 |
| Many have been accused: bureaucracy, meteorologists, mathematical models, the sirocco, enterprises' pleas. Everyone but the one who is truly responsible: the president of Liguria, Claudio Burlando | TG4, 7:11 pm, 11/10/14 |

Table 6 – Examples of sentences affected by the blame attitude.

## 4. Conclusions

In this paper, we analysed the media narratives after the flood that occurred in Genoa in 2014 with the purpose of identifying possible cognitive distortions because of hindsight bias. According to the Roese & Vohs (2012) model, we divided the biased sentences into three domains: (i) memory distortion; (ii) overrating of the event's inevitability; (iii) overrating of the event's predictability. We claim that the language adopted in the narratives (metaphors, implications, adjectives, etc.) set the groundwork for cognitive bias such as the hindsight evaluation and oversimplification of the events. The disaster was a complex phenomenon emerging from the interaction of many factors like the orographic nature of the town, its urban development, unpredictable

meteorological dynamics, the coordination of many stakeholders for the emergency management, etc.

Again, hindsight bias enhanced the fundamental attribution error in describing peoples' behaviour. They were depicted as intentionally (and unprofessionally) overlooking the obvious problem (e.g., the forecasters were accused of being unable to foresee the disaster, the CPD supposedly did not take into account the "evident" signals of the forthcoming flood, the mayor was believed to be carelessly uninformed about the situation, etc.). Moreover, blaming single factors (e.g., the mathematical models) or people (e.g. the mayor) gives the illusion of control and recovery from risk, while the situation is still very dangerous.

One of the most serious drawbacks of blame culture is the false belief that by blaming those who are "responsible", the whole system will be safer. It is like restoring order by punishing guilty people. The headlines of many media reports are based on accusations against the mayor, Marco Doria, the missed alert issued by the Civil Protection, a generic blaming of bureaucracy, local administrations, and so on. Forcing administrators to resign is understandable from the emotional point of view, but it is ineffective in making the territory safer. For example, the city administration board was changed after the flood occurred in 2011, in which 6 people lost their lives. Three years later another flood devastated the town. This is evidence that changing the administration board did not make Genoa any safer. Administrators' inertia is the easy target of blame, but the problem deserves a more complex approach, in which all the stakeholders, administrators, citizens, and technical institutions can play their role.

These kind of narratives are misleading and do not help the community to improve its resilience. The media report vague accusations mixing contingent factors (the missed forecasting), and chronic factors (the nature of the territory, the delays in the construction of the floodway). Instead of describing the complexity of the situation, the topic is focused on blaming someone or something. This argument is cognitively slippery, since the accusation of the delay in the construction of the floodway or the poor maintenance of the riverbed are valid, but are used in counterfactual reasoning: if they built the floodway, the disaster would not have occurred. However, the situation is more complex than that. The floodway, the banks, etc., would reduce the frequency and the severity of the outcomes, but they would not eliminate them. The total safety of a town like Genoa, from the hydrogeological point of view, is a dangerous expectation that could be sustained by the simplistic narratives we have discussed above. The improvement and recovery of the territory is a long-term goal, in the meantime Genoa will be exposed to the risk of further floods. It is important to sustain the commitment of every stakeholder. The media should monitor the administrators' behaviour, but should also cooperate in the development of a shared responsibility culture and an adequate perception of risk.

The words reported in the above excerpts, and the records of the previous fatalities that occurred during the floods in Genoa, demonstrate that citizens could misperceive the risks. The alarm is believed to be a warning to save properties and belongings, instead of an emergency call to keep oneself in safe conditions. The alert is believed to be a forecasting of an incoming flood, instead of being a probabilistic warning. The message conveyed by the alert is particularly difficult since it is based on probabilistic evaluations. Unfortunately, when citizens receive the message of an alert, they may misunderstand this warning as an alarm and, in the case of a false positive, their trust towards the system may decrease considerably. Reducing false positives, while avoiding false negatives, is a great challenge for the institutions. Citizens should be enabled to understand that a certain number of false positives is physiological, due to the probabilistic nature of weather dynamics. The self-protection behaviour of citizens depends on their risk perception and also on their trust toward the institutions that issued the warning (Dejoy, 2005; Wachinger, Renn, Begg, Kuhlicke, 2013). The citizens' attitude towards the institutions is based on two aspects: (i) the credibility of the institutions, i.e., their acknowledged scientific and administrative authority; (ii) the citizens' trust towards the institutions, that are perceived as being transparent, honest, thorough, sympathetic, and coherent with the community's values and needs (Covello, 2009). Taking into account the media narratives after the 2014 Genoa flood, the credibility and trust towards the institutions could be weakened by the cognitive bias we have outlined in this paper. The media simplistically described the event as highly predictable, thus enhancing the mistrust towards the forecasters and their models. The suspicion on their reliability may increase inappropriate behaviour in case of alarms, behaviour such as driving in flooded roads and crossing bridges.

Risk communication is a complex challenge and mass media have a crucial role since they amplify the usual information processing and analysis of dynamics that occur at the individual level (Lundgren, McMakin, 2009; Walaski, 2011). Human reasoning has proven to be fallacious when we need to perceive risks. Risk is defined as the combination of the probability of an event and the severity of its outcome. The gravity of a disaster like a flood is easy to perceive and communicate, since the media cast images reporting devastated streets, collapsed bridges, and piled up cars. However, the probability of an event is not as easy to perceive and communicate as its outcome. We have cognitive limitations that bring us to heuristically simplify probability in dichotomous terms (it will happen/it will not happen). Hindsight bias leads us to the conclusion that if something happened, it had to happen, and it was foreseeable (Kahneman, 2011).

Journalists suffer the same cognitive bias as any other person. However, we claim it is important to be aware of the potential consequences of the proliferation of this bias through media. The hindsight bias will foster mistrust in institutions and a misperception of risk, which, in turn, could change attitudes and behaviour in risky situations and, in general, weaken community resilience.

Debiasing the approach to such a complex issue is not easy, even though hindsight bias could be reduced if the decision makers were helped in tackling the problem by restraining heuristic shortcuts (Fischhoff, 1982a; Kahneman, 2011, Larrick, 2004: Roese & Vohs, 2012). Some essential guidelines can be summarised as follows:

- reinforce doubt on hindsight perspective: when analysing events in hindsight, it should be useful to consider that the recalled story is a reconstruction after the event, which is different from what people knew before it;
- maintain a sceptical attitude: when investigating an event, try to assume other perspectives and try to put into discussion the easier conclusion;
- resist oversimplification: instead of looking for causes and effects, try to look for interacting factors and conditions, keeping in mind that the event was an emergent property rather than a simple outcome;
- stimulate probabilistic thinking: in describing events, it is better to avoid expressions of certainty and prefer conditional formulations;
- accept the role of chaos: in complexity, partly for our ignorance and partly for the intrinsic nature of the events, chaos plays a crucial role; it is important to remember that many outcomes have happened also because of chaotic and unpredictable factors;
- avoid blame culture: notwithstanding it is a human attitude, the search for the scapegoat is not effective in complex systems, since blame does not bring any safety to the system.

The results of our research cannot be generalized since they depend on the social, cultural, political, and physical environment in which the events took place. However, we believe that the 2014 Genoa flood could be a useful case study to understand the critical relationship between media narratives, cognition, and emotions after a natural disaster. Another limitation of this study was the restriction of the focus on television reports. Other media could be analysed and further research may provide useful insights, taking into account newspapers, social media, online blogs, and news websites.

The media have a crucial role in reporting the events and helping people to make sense of what happened. Making sense means to create stories that could help us to learn from experience and to cope with the future. If these stories are biased, they will affect people's mental representations of the events, their attitudes, and the resulting behaviour. The community's resilience is at stake, i.e., the capacity of a social, cultural, infrastructural, orographic, political, legal, and economic system to approach the threats as challenges and opportunities to improve. This is only possible if all the stakeholders play their role if the script is shared, and if the narrated story has the same meaning for all of them.

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