REVIEW ARTICLE

Forecast communication through the newspaper Part 1: Framing the forecaster

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Abstract This review is split into two parts both of which address issues of forecast communication of an environmental disaster through the newspaper during a period of crisis. The first part explores the process by which information passes from the scientist or forecaster, through the media filter, to the public. As part of this filter preference, omission, selection of data, source, quote and story, as well as placement of the same information within an individual piece or within the newspaper itself, can serve to distort the message. The result is the introduction of bias and slant—that is, the message becomes distorted so as to favor one side of the argument against another as it passes through the filter. Bias can be used to support spin or agenda setting, so that a particular emphasis becomes placed on the story which exerts an influence on the reader's judgment. The net result of the filter components is either a negative (contrary) or positive (supportive) frame. Tabloidization of the news has also resulted in the use of strong, evocative, exaggerated words, headlines and images to support a frame. I illustrate these various elements of the media filter using coverage of the air space closure due to the April 2010 eruption of Eyjafjallajökull (Iceland). Using the British press coverage of this event it is not difficult to find examples of all media filter elements, application of which resulted in bias against the forecast and forecaster. These actors then became named and blamed. Within this logic, it becomes only too easy for forecasters and scientists to be framed in a negative way through blame culture. The result is that forecast is framed in such a way so as to cause the forecaster to be blamed for all losses associated with the loss-causing event. Within the social amplification of risk framework (SARF), this can amplify a negative impression of the risk, the event and the response. However, actions can be taken to avoid such an outcome. These actions revolve around use of words and quotes that cannot easily be exaggerated or turned into "sledgehammer" or blaming headlines, while tracking the media for developing frames so as to guide future communications.

Introduction

During an environmental crisis, the role of the forecaster is to use those data, knowledge and models that are immediately available to create, update and deliver a forecast that projects potential event scenarios. Such a role is all well-and-good when passing information among like-minded scientists or when dealing with daily reporting to a well-known stakeholder (e.g. civil defense agencies). However, what if the scientist or forecaster passes information directly to the media during a crisis or when forecasts impact other stakeholders with powerful media influence, such as industrial, business or political lobbies? During an environmental crisis of any significant political, social, business or economic impact, the event forecast, the role of the forecaster and the science behind the forecasts have the potential to become distorted as information flows through the newspaper system.

Such a problem was pointed out by Dawson and Lyons (2003) who, following a study of press coverage of Creutzfeldt–Jakob disease (CJD or mad cow's disease) in the UK between 1995 and 2000, stressed the importance of understanding the communication process which can "confound an informed public understanding" of a crisis. Dawson

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and Lyons (2003) added that work needed to focus on "citizens views" of the "reliability of data", with the quantity of media coverage being recognized as posing a challenge to the effectiveness of the forecast communication process. Boin et al. (2008) supported this view, pointing out that media reports can echo and amplify "crisis" frames, with investigative reporting and editorial writing becoming a "crisis catalyst" so that the newspaper can provide a venue without which "blame gaming would not occur." Bytzek (2008) added that crises tend to create an explosion of media interest during which journalists can create their own storylines to produce criticism of alleged shortcomings in preparedness and response, while searching for "culprits" and "accountability", even stirring up old rivalry and exaggerating conflict (Maquire et al. 1999). As a result, Boin et al. (2008) concluded that,

> When publication attention is squarely focused on the crisis story, media reporting can hurt and boost political and bureaucratic reputations, particularly if the various competing media organizations tell more or less the same story and voice the same process.

This was very much the case during airspace closure caused by the eruption of Iceland's Eyjafjallajökull volcano in 2010 (Harris et al. 2012). The eruption began on 14 April 2010 and involved an explosive phase to feed an ash cloud that drifted into Trans-Atlantic and European air routes. This prompted the widespread closure of European and Trans-Atlantic air space, along with many European airports, between 15 and 20 April 2010 (Gudmundsson et al. 2010).

Thus, I here review the media distortion process in regards to forecast reporting using examples taken from the UK newspaper coverage of the 2010 Eyjafjallajökull eruption and the subsequent air space closure. Bytzek (2008) argues that relying on newspapers, rather than television, (1) provides greater information density and (2) gives more detailed information, while (3) revealing explicit opinions about actors' crisis responses and (4) being less biased towards symbolic actions, so as to present a "richer, more balanced picture". The newspaper is also well known as being a powerful influence in setting opinion, even being capable of shaping the evolution of the language used by the population. Lerer (2007), for example, commented that "when we present the features of a language—and when we do so, through authoritative venues such as dictionaries, school texts, or public journalism—are we simply saying how we speak and write are also how we should speak and write." Recognition of the journalist's ability to influence public perception of volcanic hazard and risk was recognized by Donovan et al. (2014) whose survey of 95 volcanologists from 25 countries revealed that "although scientists viewed themselves as relatively well trusted, compared to national governments," they "also rated public trust in family and in the news media as strong." The remarks of Johnson

(1998) support the influence the media can play in dissemination and interpretation of scientific information. Citing a national poll of 2256 adults commissioned by the US National Health Council in 1997, Johnson (1998) summed up the impact of the media in supplying the public with health information by stating,

> Fifty-eight percent had changed their behavior or taken some kind of action as a result of having read, seen, or heard a medical or health news story in the media.

In completing this review, I present content analysis methodologies that can be applied to assess media distortion effects during passage of forecast and scientific information through the media filter.

Pre-amble

My starting point is influenced by the initial content analysis that we completed using a data base of national newspapers from the USA, UK, France and Italy as published during the Eyjafjallajökull eruption in 2010 (Harris et al. 2012). The data base comprises hardcopies of nine daily and six Sunday newspapers published during the period 15–24 April 2010—this being the main period of airspace closure during the eruption. This data base includes all copies of *USA Today, The Telegraph, The Sunday Telegraph, The Times, The Observer, The Sun, Le Figaro, Le Monde, La Repubblica* and *Corriere della Sera*, plus several other single newspaper publications from the UK and France published during the period. Initially, our interest was in understanding the quantity and quality of volcanological information appearing in these newspapers, Eyjafjallajökull being a wonderful opportunity to promote science and its application in a hazard response and decision-making support role.

One of our initial objectives was thus to identify all quoted sources across these newspapers so as to understand whether and how the volcanology perspective permeated the printed news. In all, 699 quoted sources were found in five of the newspapers analyzed. Of these sources, 57 were volcanologists and 53 were individuals, or agencies, involved in the decision-making process that led to the air space closure. However, we were surprised to find that in two of the UK newspapers analyzed, very few scientists were used for quoted source material. While *The Times* used just three named volcanological sources (out of a total of 199), *The Sun* used six (out of 115). This compared with a total of 64 named sources from the airline industry in the same two newspapers. Across the total data set, 220 air industry sources were used. These statistics, coupled with the fact that reports tended to carry a negative air with volcano-expert quotes being placed well down the reporting order, meant that the message was one of a chaotic situation

and response in which the performance of those who could be ascribed blame, i.e., responsible government agencies, being likely framed in a negative manner (Harris et al. 2012).

I use this data base to further test, explore, review and illustrate potential media distortion of an environmental disaster and the associated response. The press is well known for excess (e.g. Horrie 2003; Conboy 2004; Marr 2005; Watson and Hickman 2010). However, the bottom line is that newspaper agencies have to sell their product in a highly competitive market. That is not to say that scientific statements are not subject to the same pressures and influences. Scientific outreach is not always the ideal, value-free, perfectly stated and objective form of communication that we may wish it to be (e.g. Nosengo 2011; Alexander 2014).

The media has long known to be a powerful influence in shaping opinion (e.g. Lippmann 1922), with the newspaper and various other social media, being a pervasive means of information communication. Bogart (1955), for example, argued that "the mass media provide a natural source of conversational material." From his study of cartoons appearing in two New York newspapers, he found that the content provided an "array of collective images" that could be "introduced into conversation" (Bogart 1955). Likewise, Riley and Riley (1951) showed how information received from the media was capable of guiding idea formation and reinforcing "social utility", this being a system whereby useful information can be passed to, used by and shared among more than one individual. Within this framework, Maccoby (1951) had already feared that media communication, in this case due to the influence of television broadcast content on the psychology of children, could (i) control fantasies so as to arouse motivation and produce frustration, and (ii) build up habits of premature closure, as well as encouraging addiction and habit formation.

Within the system of social utility, people become able to make choices regarding payoffs not just to themselves but also to others (e.g. Messick and Sentis 1985), while also thinking about others (e.g. Loewenstein et al. 1989), based on information received through the media (Riley and Riley 1951). In effect, the media can provide reference frames for "reality seeking", so as to keep the recipient up to speed with information allowing interpretation of "important events" (Atkin 1972). As such, newspapers, being a widely used form of information distribution to the public, have the potential to shape community-wide thoughts, talking points and opinion, filtering and guiding the way in which a readership may perceive and share information, so as to influence what the readership thinks and talks about.

The media filter

During a newsworthy environmental disaster such as a major volcanic eruption that impacts human interests, information dissemination will be complicated by the media filter—a filter that takes statements from a few and then re-communicates them to many. In passing through this filter, statements, information and forecasts will become modified and abbreviated, possibly also changed or even distorted. The components of and information flow through this filter are given in Fig. 1 and defined in Table 1. The filter can be split into two levels. The first level involves selection of story, sources and data so as to support a certain point-of-view. As part of this process, certain data sources may be preferred, exaggerated or omitted to enhance a particular perspective. A view point or source can then be placed high (or low) in a story to enhance (or reduce) the impact of the argument. Finally, the story itself can be placed in a prominent, or conversely in an un-important, position within the newspaper so as to create the same impact effect. In this regard, both the front and back pages are high impact locations, while pages deeper in the newspaper are not. Moreover, while it is easy for the reader to turn a tabloid over to quickly access back page information, a third party viewing a newspaper opened by another reader has equal access to both the front and back pages (Fig. 2).

The result of this first filter level is to create bias or to introduce slant and spin. These aspects compose the second level of filtering defined in Fig. 1. Regarding bias, Entman (2007) makes the following distinctions:
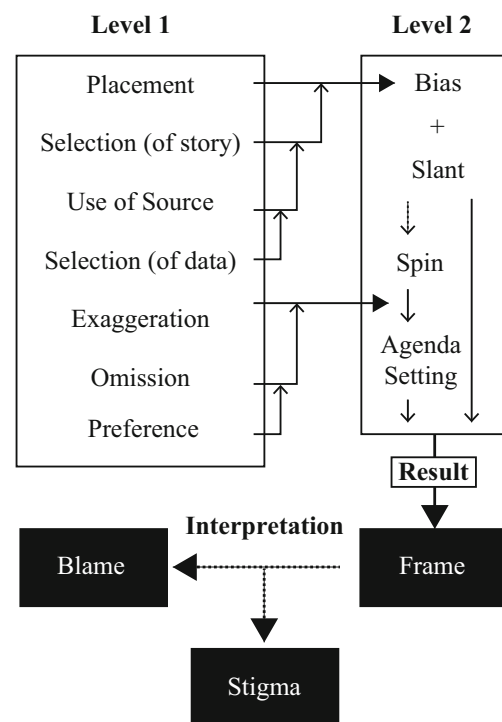

Fig. 1 Flow chart showing the components of the media filter. Components of level 1 are factors which will result in bias, slant, spin and/or agenda setting, these being the components of the level 2 filter. The overall result will be a positive or negative frame which encourages a particular interpretation among the readership, which in this case is one of blame and stigma. See Table 1 for definitions of each component

Table 1 Terms, definitions and issues associated with the media filter of Fig. 1

Term	Definition
Level 1 filter	
Placement	Importance in terms of where in a report information appears, or the page on which the report appears:
	The front page is the most important location. Internal pages become decreasingly important with page number, with the exception of the back page and sports pages.
Selection of story	Journalistic preference in terms of news stories selected for print:
	-Which stories are reported, and which are not?
	-What are the news values of the newspaper?
Use of source	Sources used to provide quotes, information and data:
	-Is one actor used in preference, in place of or in a greater number than another actor with a different, but relevant, expertise and/or perspective?
	-Are the correct (most relevant to both sides of the argument in hand) actors used?
	-Are actors with a certain view point favored as sources?
Selection of data	Facts, information or numeric data used to support an argument are selectively used:
	-Which data are used, and which are not?
	-Are correct and appropriate data and statements used?
	-Is the most relevant data used?
	-Are certain data sources favored over other relevant sources?
Exaggeration	Over-statement of fact:
	-Are certain aspects over-played to gain the reader's attention?
	-Is the situation described or pictured so as to make the event seem more (or less) serious than it really is?
	-Is there fabrication?
Omission	Failure to include relevant information, statements or data:
	-Are any explanations or data that could help in pitching a correct and objective interpretation of the story left out?
	-Are certain aspects omitted to gain the reader's attention?
	-Are explanations or data favoring a contrary argument omitted?
Preference	Selection of a certain source, piece of information or data over another (when other, different, counter or even opposing sources are available) so as to support a particular argument, person or group
Level 2 filter	
Bias	Inclination or prejudice for, or against, an argument, person or group—especially in a way that can be considered unfair
Slant	Presentation of information from a particular perspective, and in an unfair and biased way
Spin	To give a story a particular emphasis or bias
Agenda setting	Exertion of influence to impact reader's judgment; influencing what the readers think
	Result
Frame	Information is organized in a way so as to promote a particular interpretation. Text elements raise the apparent importance of certain ideas, encouraging the readership to think, or decide, in a particular way
	Interpretation
Stigma	The frame results in a strong feeling of readership disapproval about an issue in the newspaper, especially when the result is viewed as unfair
Blame	The frame results in the feeling that a named actor is at fault or responsible for something that is wrong or bad

- Distortion bias is where content delivery distorts or falsifies reality;
- Content bias occurs when the writing style favors one side of an argument, rather than giving equal treatment to all sides of the argument;
- Decision-making bias applies if the argument presented is influenced by the mind-sets and motivations of the writer(s).

The forecast communication system is especially prone to bias because the forecaster is not the only actor or stakeholder in the filtering process. Sources, reporters, editors and media owners will all have an influence on the process of "news creation" (Fig. 3). As Gamson and Modigliani (1989) pointed out,

> If one is interested in public opinion, then media discourse dominates the larger issue culture, both reflecting it and contributing to its creation. Journalists may draw their ideas and language from any or all forums, frequently paraphrasing or quoting their sources. At the same time, they contribute their own frames and invent their own clever catchphrases.

Fig. 2 An opened copy of *The Times* published on 20 April 2010 showing front and back pages. This is the view that would be available to the third-party reader facing the reader on, for example, the London tube. Both the front and back pages are of roughly equal impact, depending on reader interest. Subtitle for back page report reads, "Benítez shows sympathy as fans vent anger over travel chaos" (Rafael Benítez at the time was the manager of Liverpool football club)

In creating, news reporters may introduce spin or slant to meet the agenda of the editor or the media owners (Appendix A). The set of media values applied by a newspaper also influences the type and style of reporting. Media or news values are a set of criteria that must be met before an item can be selected as a news story (Harcup 2009). These values are listed in Appendix B. Pressures resulting from implementation of such values may be strong and pervasive (e.g. Watson and Hickman 2010).

There will also be influences exerted by political, commercial, industrial, economic, sports, public, social and moral interests (Einsiedel and Thorne 1999). Like the journalist, these stakeholders all need current news and news that will immediately promote or sell their interests (The World Bank 2010). Needs, perspectives and reactions among these stakeholders are thus strong and immediate; their values needing to be published while the issue is still current so that they are relevant to and influential on a rapidly evolving situation in which they have a stake. They thus have no time to wait for scientific checking, re-analysis, caveat, explanation or debate. Each of these stakeholders will have interests in and opinions on the forecast so that the actions and comments of each will shape the way in which the forecast and the forecaster is presented. This results in agenda setting whereby these third party contributions have the potential to completely reframe the event.

Eyewitness input: the problem of social media data casting

Although the Fig. 3 scheme places eye witness statements as an objective source, such statements are not always objective or reliable. For example, during hurricane Sandy in 2012 (USA), false and over-alarmist news was distributed via Twitter. One tweet stated that a "pillar of the world economic infrastructure (i.e. Wall Street) was in peril". This text caused anxiety and panic. The claim was finally refuted, but not before it had been repeated hundreds of times, including on CNN and the Weather Channel (http://gigaom.com/2012/10/30/tweeting-fake-news-in-a-crisis-illegal-or-just-immoral, downloaded 17/03/2013 18:14:40). Such social media-based "data casting" is an increasing problem due to the current explosion of uncontrolled social media. Bradshaw and Rohumaa (2011), for example, point to the widespread use of tweets, plus blogs, as "live data" to support up-to-the-minute news reporting. In this regard, Lang et al. (2014) note that "current online social media environments may have potential pitfalls for science communicators, and mass communication at large." In their opinion, open and interactive dialogues inherent to Web 2.0 tools such as Twitter and Facebook allow "audiences to repurpose and translate scientists' research findings using their own interpretations and debate them on social media." As a result, "social networks can also
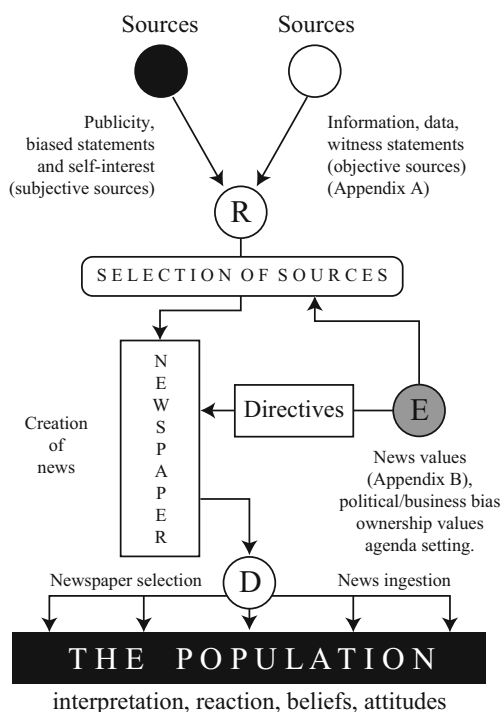
Fig. 3 The news creation process. Chart showing flow of information from source, through the reporter (*R*), the editor/owner (*E*), the newspaper system (layout, print style …), and the distributer (*D*), to the population. Each member of the population is free to choose between those newspapers available at the distribution node. The frames ingested now depend on the presence, level and type of bias, slant and spin in the selected source. Based on the schematic "the newspaper as a filter" of Mathien (p. 61, 1986)

help spread potential misinterpretations of scientific findings quickly among large audiences" (Lang et al. 2014).

Agenda setting

In the first chapter his book *Setting the Agenda*, McCombs (2014a, b) sets out by writing,

> Newspapers communicate a host of cues about the relative salience of the topics on their daily agenda. The lead story on page 1, front page versus inside page, the size of the headline, and even the length of the story all communicate the salience of topics on the news agenda.

McCombs (2014a, b) follows up by arguing that the public use these cues to organize their own agendas and to decide which topics are important so that the agenda of the news media becomes the agenda of the public. Obviously, the news media are the people's primary source of information, so that elements prominent in the newspaper and presentation of those elements selected from the vast amount of information available for communication become prominent elements in individual pictures of that world. As a result, agenda setting can become "the basis for public opinion" (McCombs 2014a,

b). Consequently, agendas set out by newspapers are powerful influences that can focus public opinion on particular themes, issues or viewpoints.

Recently, Vu et al. (2014) introduced the "Network Agenda Setting Model" arguing that "not only can the news media tell us what to think about and how to think about it, they are also capable of telling us what and how to associate." The argument of Vu et al. (2014) is based on the work of McCombs and Shaw (1972) who, following a study of newspaper, magazine and television portrayals of political events argued that that mass media may determine issues by setting an agenda. In the same year, the study of soap opera content for the period 1952–1970 by Katzman (1972) revealed that high rates of exposure to media-filtered information could (i) establish or reinforce value systems, (ii) suggest how people should act in certain situations, (iii) legitimize behavior and (iv) remove taboos about discussing sensitive topics. As a result, Katzman (1972) concluded that "soap operas both reinforce and cause change." Such findings support the sentiments of Cohen (1963) who noted that the press,

> May not be successful much of the time in telling its readers what to think, but is stunningly successful in telling its readers what to think about.

McCombs and Shaw (1972) concluded that the mass media can set an agenda, influencing the "salience of attitudes" toward an issue.

In terms of risk perceptions among newspaper readers, Rowe et al. (2000) observed that it is not just the quantity of coverage that matters, but also the way in which the media discuss and present the hazard. For example, in a study of reports on mass murders in the New York Times, Morris and Peng (1994) found that American reporters attributed more weight to personal dispositions than to situational factors. That is, statement of objective fact was subordinate to statement of opinion.

Cater (1959) added to this aspect of agenda setting by adding that the Eisenhower-Nixon Research Service argued that "scientific analysis of public opinion does more than tell the expert what is going on and what to do about it ... effective analysis reveals how to influence the public mind." Cater (1959) thus concluded that when he was "in a philosophical frame of mind (the journalist) asks himself whether news was ever meant for communicating the 'truth'."

In parallel with this, the newspaper plays an important part in shaping reality by choosing and displaying news, both in terms of the quantity of information given in the news story and its position in the newspaper (McCombs and Shaw 1972). These actions determine the important issues and allow the reader not just to learn about a given issue, but also influences how much importance the reader attaches to the issue. This is agenda setting.

The frame

The resulting frame is the net result of all precedent filters, with the frame being defined as "selection and highlighting of some facets of events or issues, and making connections between them, so as to promote a particular interpretation, evaluation and/or solution" (Entman 2004). Olmeda (2008) adds that a frame offers "meaning" to what many consider as "bewildering and frightening events" so that a crisis frame "forwards particular causes, consequences, culprits and cures" which can "settle—in informal and unforeseen ways—the question of who is to blame."

The frame can be positive (i.e. supportive) or negative (i.e. opposing) to a particular argument or group [for numerous examples, see Reese et al. (2010)]. The frame may also result in assignment of "technological stigma" (Gregory et al. 2001). In such a case, the frame causes something to become "shunned", "avoided" or not trusted, "because it overturns or destroys a positive condition" so that "what was or should be something good is now marked as blemished or tainted" (Gregory et al. 2001). In the case of an event that results in business, industrial, economic, financial and individual loss, the frame is likely to be negative. The ultimate result of a negative frame involving widespread loss will likely be assignment of blame to a named actor or stakeholder (Fig. 1).

The newspaper as an information filter

For this review, our primary information source to the public is the newspaper, this being the main hardcopy format delivery vehicle of a forecast to the general public. We thus need to consider the language, syntax and delivery format that can be correctly used, understood and interpreted by the press, as well as other non-scientific stakeholders such as industry, business, politicians and the public who contribute to the creation of "news"—an issue touched on by Aspinall and Cooke (2013). However, we also need to understand the use of, and framing that may be applied to, the forecast so as to understand and track potential distortion of the original message. Following the flow chart of Fig. 1, my objective is to assess the likely public perception of scientific risk communication as passed through the media filter, reviewing how information can be modified by input from other stakeholders and how (and why) this can result in bias, slant and framing.

Newspaper sources and the tabloidization effect

I here focus on British press coverage for the airspace closure caused by the 2010 eruption of Eyjafjallajökull (Iceland). I use all issues of three British newspapers published between 15 April and 24 April 2010: *The Times*, *The Daily Telegraph* and *The Sun*. While the former can be defined as broadsheets, the latter is a tabloid. The initial aim of the tabloid format was to strive for economy in style, applying brevity and simplicity in the form of short sentences and succinct words. However, the small size and distinct shape/layout of the tabloid page has become central in defining a tabloid (Williams 2010a). Broadsheets are larger in size and contain "more demanding", "serious" or "quality" content (McNair 2009; Williams 2010a). Launched as *The Daily Universal* on 1 January 1785, and renamed *The Times* on 1 January 1788, *The Times* is the longest-running newspaper in the UK and has been considered, by some as "the greatest newspaper in the world" (Howard 1985). However, during 2010, *The Times* was the eighth most popular UK newspaper, with an average daily circulation of 508,250 (Luft 2010). *The Daily Telegraph*, the most popular UK broadsheet in 2010, was the fifth most popular newspaper with an average daily circulation of 691,128. In comparison, *The Sun* had a daily circulation of 3,006,565, and was the UK's most popular newspaper (Luft 2010; Press Gazette 2010).

I also consider four other British national daily newspapers published between 20 April and 22 April 2010: *The Daily Mail*, *The Daily Mirror*, *The Daily Star* and *The Independent*, plus one local weekly newspaper, *The Cornish Guardian* (Truro, Cornwall, UK). Of these, *The Independent* has traditionally been considered a broadsheet, but McNair (2009) argues that as of 2008, *The Daily Telegraph* was the only broadsheet remaining on the market, "all other ex-broadsheets having moved for economic and competitive reasons to a smaller print format". *The Daily Mail*, *Mirror* and *Star* are true tabloids. Although the roots of the tabloid style can be traced to 1919 (Conboy 2011), tabloids really became a major feature of the British press in the 1970s when the "size, values and production methods" associated with Fleet Street's best-selling newspapers changed (Williams 2010a). The change began with the sale of *The Sun* to Australian entrepreneur Rupert Murdoch during September–October 1969 (Chippindale and Horrie 2013), a move generally associated with the "dumbing down" of the British press (Williams 2010a) with even the broadsheets switching to a smaller, "stupider" format (Marr 2005). However, tabloidization of information is an important point to define and bear in mind, because it is now the most popular form of newspaper communication and is thus a major part of the media filter.

The tabloid effect

Since the 1930s, competition for the attention of the popular reader through use of large and frequent pictures, simplified layouts and bigger headlines has been a theme of the press (Conboy 2011). Tabloidization may be defined as (Conboy 2004):

> An increase in news about celebrities, entertainment, lifestyle features, personal issues, an increase in sensationalism, in the use of pictures and sloganized

headlines, vulgar language and a decrease in international news, public affairs news including politics, the reduction of the complexity of language, and also a convergence with agendas of popular and in particular television culture.

The tabloid is thus an "easy-to-consume" format (Rooney 2000), that is "packed with sledgehammer headlines, big photographs" and "human interest stories" (Horrie 2003). It is a format which has now spread to practically all news media (Conboy 2011). Take the tabloid-esque headline from a page 11 piece in *The Sunday Times* on 27 April 2014:

Britain faces climate chaos from toxic volcanic blast

For this full-page "scientific" piece about the potential effect of a Laki-type eruption on Europe's climate, half of the page was actually devoted to an advert, with (as we see later) "chaos" becoming a tabloid word used to label an environmental disaster or event that impacts human operations. The evocative word "toxic" is then added to create a "sledgehammer" headline.

Due to tabloidization, the reliability of the press as a reporter of objective information has declined (e.g. Davies 2009), it being influenced by corruption, self-interest and excess (e.g. Watson and Hickman 2010). This has resulted in the British press, in particular, becoming the "least trusted" in Western Europe (Curran 2010). However, the press is a huge, detailed and influential data base (Mathien 1986) which is updated daily. As such, the newspaper remains a widespread, easy-to-access and digest source of information for the bulk of the population.

Eyjafjallajökull—filtering the story

Based on a Google Trends search, Burgess (2011) argued that there "was no 'no risk campaign' mounted by a newspaper" during the Eyjafjallajökull event. That is, newspapers argued and lobbied that the ash cloud presented no risk to aviation; and that is true. However, a deeper content analysis of the same newspapers reveals there was an attritional use of biasing statement and story placement, plus selective story, source, argument, word and quote usage, especially regarding forecasts. By attritional use, I mean that the frame may not have been clear from a cursory glance at a single report or newspaper; but when all reports in all newspapers during the entire period of the crisis are considered, a pattern emerges that frames the news against the forecaster. This frame biased the argument against a hypothesis that airspace closure was a necessary response to the very real hazard posed by the ash cloud (Harris et al. 2012). The press may not have "developed its own narrative" to "coalesce on a particular angle" (Macrae,

2011), but the manner in which the event was scripted and imaged framed the narrative against the forecasters. Here, I follow the hierarchy of the level 1 filter process laid out in Fig. 1 to show how the frame developed.

Placement

Bias due to placement is achieved by making access to certain information easy and obvious, while reducing the importance of other information by burying it deep in the piece or newspaper. In this respect, Cohen (1963) argued that,

The daily newspaper is more than just the end product in the transmission of information; it is the starting point for news. For unless a story is actually printed, and printed relatively prominently, it is not regarded as 'in the news,' and thus it exerts little claim on the attention of the reader and the reporter alike.

The placement problem during the Eyjafjallajökull event is evident from Table 2. Strong, negative statements linked to the forecaster were always placed on the front page in large, bold font. That appearing on the front page of *The Telegraph* on 20 April 2010 was one of the more obvious (original font style retained):

Met Office got it wrong over ban on flights

Such a negative frame was exacerbated by use of the common placement order found for setting a frame by Semetko and Valkenburg (2000). This being: (i) attribution of responsibility, (ii) conflict, (iii) economic consequences, (iv) human interest and (v) morality. Take, for example, the analysis of *The Times* on 21 April 2010 in which we can find, in the following order within the newspaper,

(i)   Attribution of responsibility (p. 1, article 1):
      Under the title "Skies reopen for business after airline deal", this front page piece flagged that a meeting had been held between airlines, regulators and Lord Adonis (the UK Transport Secretary in April 2010), thus attributing responsibility for reopening to the airlines.
(ii) Conflict (p. 3, article 2):
      In the next piece, entitled "Many happy returns: skies reopen", the closure decision was challenged, with one actor not agreeing with the blanket ban, and the other thinking that (with hindsight) it may have been possible to "run some services." Thus, a conflict, involving disagreement over the necessity of the closure decision was apparent.
(iii) Economic consequences (p. 3, article 3):
      Under the headline "Industry counts cost of air embargo", the article stated that the airspace closure was likely costing Europe £400 million a day in lost productivity. Plainly, an impressive economic impact.

Table 2 Headlines and opening paragraphs appearing in *The Daily* and *Sunday Telegraph* between 16 and 24 April 2010

Date	Page	Headline	First (opening) line
16 April (Friday)	Front	*Ash forces the first no-fly zone*	BRITAIN became a no-fly zone for the first time yesterday as a vast cloud of volcanic ash swept over the country, causing travel chaos for thousands of people.
17 April (Saturday)	Front	*Misery for a million as airlines count the cost*	MORE than a million British airline passengers have been left stranded and their plans disrupted by the volcanic ash cloud sweeping across Europe.
18 April (Sunday)	p. 12	*Months of eruptions to disrupt travellers*	THE ICELANDIC volcano causing travel chaos across Europe could go on erupting for months, geologists warned last night.
19 April (Monday)	Front	*BA flies in face of ban* Airline chief takes to the skies as authorities are accused of overreacting to volcano danger	BRITISH AIRWAYS last night challenged the blanket ban on flights as its chief executive took to the skies to test the effects of volcanic ash on its aircraft.
20 April (Tuesday)	Front	*Met Office got it wrong over ban on flights*	THE Met Office was blamed last night for triggering the "unnecessary" six-day closure of British airspace that has cost airlines, passengers and the economy more than £1.5 billion.
21 April (Wednesday)	Front	*Why was ban ever imposed?* As airports were opened late last night after six days of chaos, BA chief says the shutdown was an over-reaction	THE blanket ban on flights was lifted last night as British Airways claimed the unprecedented shutdown was unnecessary.
22 April (Thursday)	p. 10	*Blanket ban on flights 'was a costly shambles'*	MINISTERS are under pressure to explain why Britain took so long to lift the flight ban as the travel industry condemned the Government's response to the crisis as a 'shambles.'
23 April (Friday)	p. 11	*Ash cloud passengers face delay in claiming back costs*	STRANDED air passengers were warned last night they could face a lengthy battle to reclaim the cost of hotels and meals despite low-cost airlines agreeing to reimburse them.

(iv) Human interest (p. 3, article 4):

With the title "First home, tired and a little bit nervous" this article covered the experiences of those returning home and included the words "exhausted", "very stressful", "jubilant", "hugged", and "relief". The article was all about the experiences of stranded passengers and full of human interest stories.

(v) Morality (p. 4, article 5):

Under the headline, "Airlines are accused of ignoring EU rules on paying food and hotel bills", this article dealt with cases of airlines not providing support to passengers stranded due to flight cancellation. The article clearly challenged the morality of leaving stranded passengers without help.

So, how far down the paper was the sixth, scientific, theme? On 21 April 2010, as on three other days (22, 23 and 24 April), it appeared in *The Times* as a piece entitled "Weather Eye". The piece actually had no title, just a weather cockerel as its header, and appeared on pages 62, 71, 95 and 83 during the four days, respectively. It contained a scientific point-of-view on all four days, with that appearing in *The Times* on 22 April 2010 arguing that:

(vi) Scientific point-of-view (p.71, article 23):

Previous eruptions worldwide did not cause as much "chaos" because they never affected such a congested airspace.

The placement issue can also be found within individual reports. Journalistic training encourages placement of the most important information in the first paragraph. Information then becomes decreasingly important with paragraph number so that the least important information appears in the final paragraphs (e.g. Brooks et al. 2008; Martin-Lagardette 2009). Such an "inverted pyramid" analysis of a news piece can thus be used to both assess placement of various items in the news story, as well as the relative importance ascribed to items by the journalist (Figs. 4, 5). For the report analyzed in Fig. 4, we see that information regarding the airlines is the most important information and that regarding the forecaster (The Met. Office) is the least important. We can complete the same analysis for the newspaper as a whole and again find that scientific news, as appearing in "weather eye", is always relegated to the base of the pyramid (Fig. 5). One article about the volcanic impact of the event appeared mid-way down the pyramid of 19 April (Fig. 5). It was entitled "Days are turned to nights as clouds of falling ash cover everything in sight", but was about the local (Icelandic) impacts of the eruption and, given the intensity and magnitude of this eruption, was somewhat exaggerated while paying little attention to the cloud and the European air space impact.

Story selection

McCombs (2014a, b) argued that "both the selection of objects for attention and the selection of attributes for picturing those objects are powerful agenda setting roles." Thus, we need to consider not just the topics of the stories that are selected, but also the resulting comprehension of the story content which has the potential to form "pictures in our heads" (Lippmann 1922). While selection of stories that are good and positive can be used to support an argument and place an issue in a positive light, selection of bad and negative stories can be used to create bias against an issue, point of view or stake holder. For example, to determine how cancer news coverage reports about cancer care and outcomes, Fishman et al. (2010) completed a study of eight large-readership newspapers and five national magazines published in the USA. Their conclusion was that "very few news reports about cancer discuss death and dying, and even those that do generally do not mention palliative and hospice care", which was surprising because half of all patients diagnosed as having cancer in the USA do not survive (Fishman et al. 2010). This could be argued as selective reporting to frame a situation in a positive light.

Story selection aided in developing the frame during the Eyjafjallajökull event. The first (and only) positive story that I can find in *The Daily Telegraph* was not published until 23 April 2010, the day after Eyjafjallajökull had been downgraded from front page status (Table 2). The story, entitled "Tourists rescued in five-star style", explained how more than 2000 stranded holidaymakers were brought home on a luxury cruise ship. The experience resulted in statements such as (*The Daily Telegraph*, 23 April 2010, p. 11):
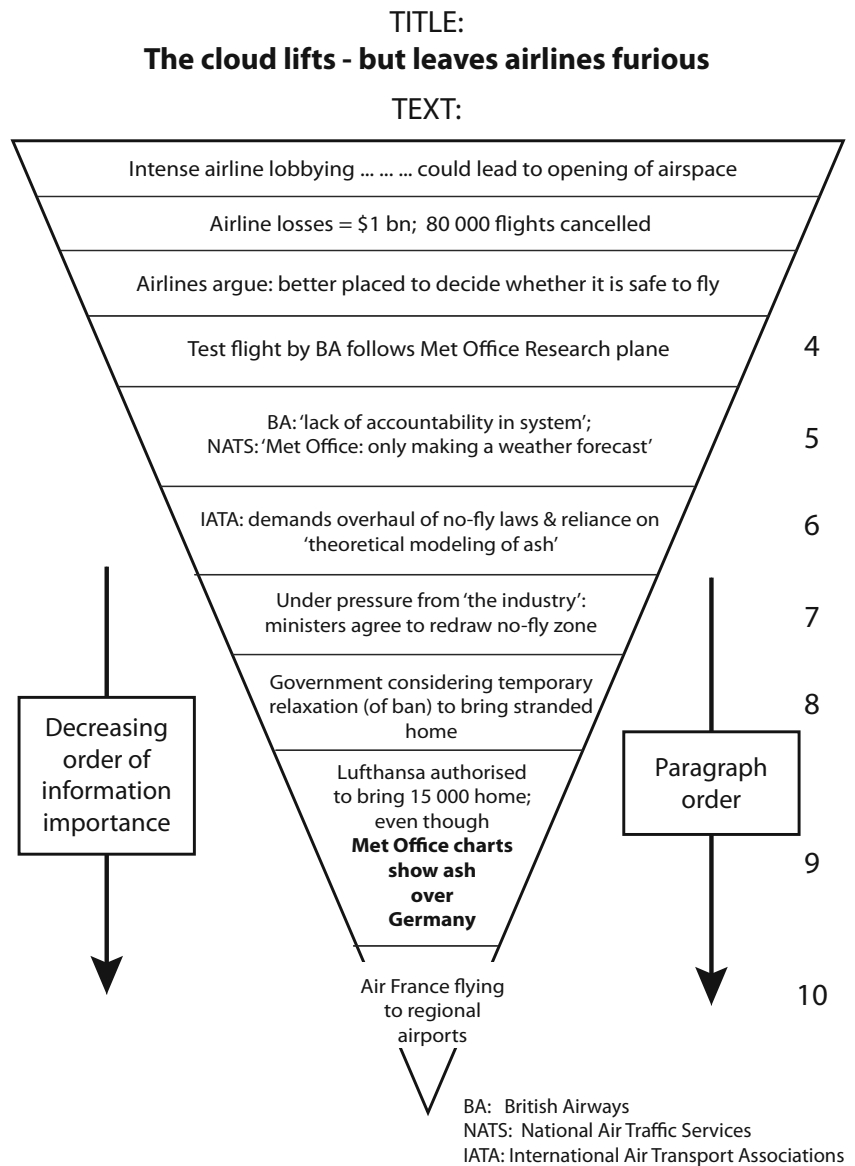
- "This is just fantastic;"
- "We're retired and not rich, but we have always wanted to go on a cruise;"
- "We've heard there is a real lawn so can't wait to have a (soccer ball) kick about."

Apart from this one example, as I explore in the next section, negative stories were always selected over positive stories.

Instead, negative objects and attributes were focused on, with arguments for air space re-opening being given more prominent space than arguments supporting closure. Very few stories included discussion as to what could happen if air space did reopen and an aircraft flew into ash. For example, a report that appeared on page 3 of *The Times* on 20 April 2010, entitled "The cloud lifts but leaves airlines furious" began,

Favorable winds and reduced volcanic activity could lead to the opening up of European airspace, closed

Fig. 4 Inverted pyramid analysis of a full page report appearing on page 3 of *The Times* on 20 April 2010. This inverted pyramid organizes the information in a single report in order of decreasing importance in terms of its position in the report, with the first paragraph being the most important. Degree of importance, accessibility or reader impact falls off thereafter, i.e. as we move down the inverted pyramid. Thus the most important information as given in the first paragraph of the report appears at the *top of the inverted pyramid*, and the least important at the *base*. Paragraphs are analyzed in sequential order (paragraph number given on the *right*) and the main theme, or opening statement, is summarized for each paragraph

TITLE:

The cloud lifts - but leaves airlines furious

TEXT:

Intense airline lobbying ... ... could lead to opening of airspace

Airline losses = $1 bn; 80 000 flights cancelled

Airlines argue: better placed to decide whether it is safe to fly

Test flight by BA follows Met Office Research plane　4

BA: 'lack of accountability in system';
NATS: 'Met Office: only making a weather forecast'　5

IATA: demands overhaul of no-fly laws & reliance on
'theoretical modeling of ash'　6

Under pressure from 'the industry':
ministers agree to redraw no-fly zone　7

Government considering temporary
relaxation (of ban) to bring stranded
home　8

Lufthansa authorised
to bring 15 000 home;
even though
**Met Office charts
show ash
over
Germany**　9

Air France flying
to regional
airports　10

Decreasing order of information importance

Paragraph order

BA: British Airways
NATS: National Air Traffic Services
IATA: International Air Transport Associations

since the Icelandic volcano Eyjafjallajokull first sent its debilitating cloud across the continent last week.

Nowhere in the report was it mentioned why the cloud should be viewed as "debilitating". Instead, the third paragraph read,

Fifty test nights took to the skies to add empirical weight to claims that, in cutting off Europe's busiest aviation hubs, the authorities were being too cautious. When the last of the passengers, including 150,000 Britons are finally repatriated, airlines are likely to press for a greater say in how much airspace needs to be closed when the next volcano erupts.

On the same day, *The Sun*, in a page 11, report entitled "Ash landing: pilot aborts rescue trip in dust drama" detailed a potential ash encounter by a commercial airliner taking off out of Manchester airport (UK). However, very few news reports about Eyjafjallajökull discussed potential aircraft problems due to an ash cloud encounter, and even those that did placed this issue low in the report or newspaper.

Use of data, source and anecdotes

Restless leg syndrome is an urge to move the legs due to an unpleasant feeling in the legs. Symptoms primarily occur at night and can thus interfere with sleep. In completing a content analysis of all major newspapers published between 2003 and 2005, Woloshin and Schwartz (2006) found that while nearly 75 % of newspaper articles highlighted the
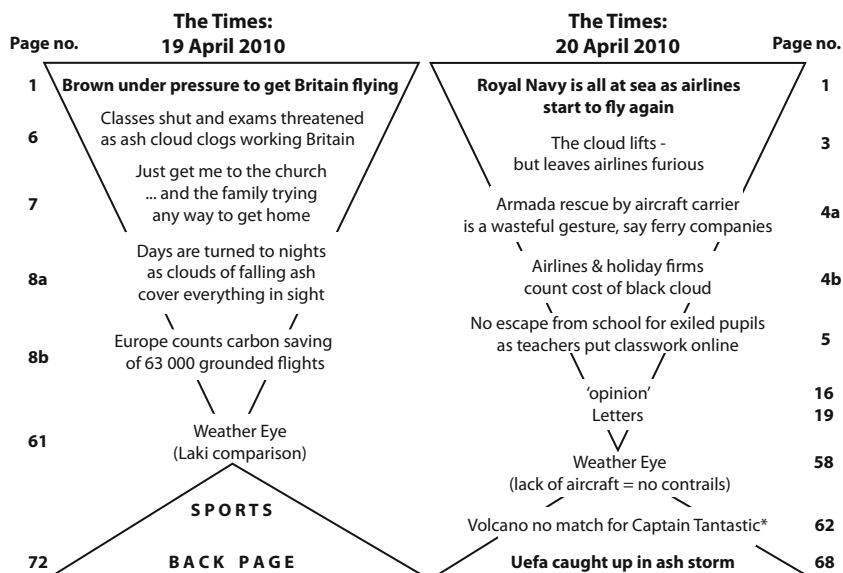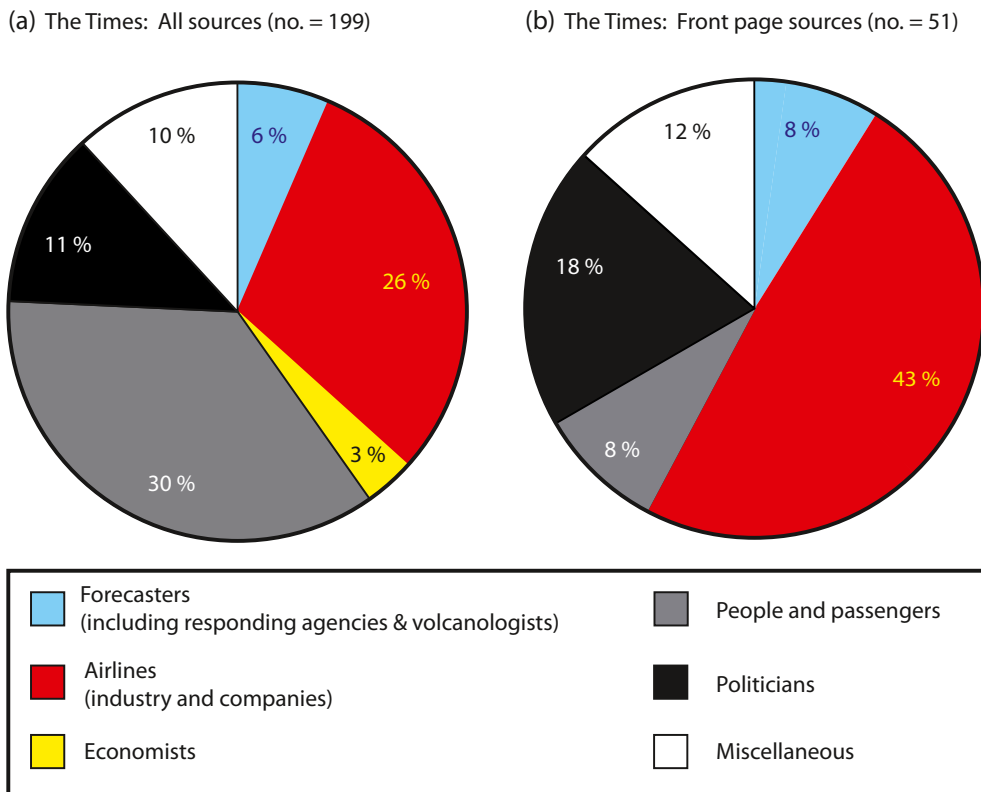
Fig. 5 Inverted pyramid analysis (see Fig. 6 for definition) for whole issues of *The Times* on 19 and 20 April 2010. Now, the report becomes the coding unit, so that the most important information as given in the first report in the issue appears at the *top of the inverted pyramid*, and the least important at the base. Pages are analyzed in sequential order (page numbers shown on sides) and the title of each report is given for each entry. A smaller non-inverted pyramid opens at the *base*. This is due to increasing importance through the sports pages to the back page which is just as accessible as the front page (see Fig. 2). In the two cases, the back pages were pages 72 and 68, respectively. Entry marked with an *asterisk* refers to the return to London, from Tenerife, of Gary Lineker where he hosted the popular Saturday evening BBC1 soccer review program, Match of the Day (MOTD). Lineker captained the England soccer team between 1984 and 1992, and has hosted MOTD since 1999

potentially serious physical, social and emotional consequences of restless legs, over 40 % of the articles provided anecdotes about people with severe disease. However, no article provided anecdotes about people who did not find their symptoms especially bothersome. Woloshin and Schwartz (2006) argued that news

Fig. 6 Affiliation of quoted sources appearing **a** in all Eyjafjallajökull-related reports in *The Times* and **b** just on the front page of *The Times* during 15–24 April 2010

(a) The Times: All sources (no. = 199)

(b) The Times: Front page sources (no. = 51)

Forecasters (including responding agencies & volcanologists)

People and passengers

Airlines (industry and companies)

Politicians

Economists

Miscellaneous

coverage of restless legs syndrome was "disturbing" because it exaggerated the prevalence of disease and the need for treatment, and failed to consider the problems of over diagnosis. They concluded that,

> It is easy to understand why the media would be attracted to disease promotion stories and why they would be covered uncritically. The stories are full of drama: a huge but unrecognized public health crisis, compelling personal anecdotes, uncaring or ignorant doctors, and miracle cures. The problem lies in presenting just one side of the story. There may be no public health crisis, the compelling stories may not represent the typical experience of people with the condition, the doctors may be wise not to invoke a new diagnosis for vague symptoms that may have a more plausible explanation, the cures are far from miraculous, and healthy people may be getting hurt.

This is a good example of preference given to certain data and sources, where one side of the story is exaggerated through the selection process so as to meet news values and sell the newspaper.

For Eyjafjallajökull, it is easy to find evidence for bias through preference given to specific data or sources in the newspapers. That is: data, sources and statements become selected to support one side of an argument over another. For example, under the headline:

> BA demands government compensation as airlines watch reserves go up in smoke

the following paragraphs appeared in the Economy Section of *The Independent* on 20 April 2010 (p. 42–43),

> 'The Association of European Airlines and airports group ACI Europe echoed criticism that Europe is over-reacting. 'The eruption of the Icelandic volcano is not an unprecedented event and the procedures applied in other parts of the world for volcanic eruptions do not appear to require the kind of restrictions that are presently being imposed in Europe,' the organizations said in a joint statement.
> The main criticism is that European watchdogs are using computer models of theoretical volcanic output and local wind speeds to estimate affected area, and then banning all flights. In comparison, the system in the US tracks eruptions using a satellite to establish the spread and concentration of the debris, and allows airlines to shift flight plans to keep flying as far as possible but avoiding affected areas."
> BA's Mr Walsh said: 'The analysis we have done so far, alongside that from other airlines' trial flights, provides

fresh evidence that the current blanket restrictions on airspace are unnecessary. We believe airlines are best positioned to assess all available information and determine what, if any, risk exists to aircraft, crew and passengers'.

The statement clearly poses just one side of the argument from a single stakeholder—the airline industry. It says nothing as to the evidence, information or knowledge held by other stakeholders, or members of the cloud tracking and forecasting system. Nor does it explore well-recorded cases of air space restrictions caused by volcanic clouds, especially those well-documented cases across Alaska and Kamchatka (e.g. Casadevall 1994; Guffanti et al. 2010; Schaefer 2011), or the differences, problems and difficulties to bear in mind when comparing previous cases in the USA and the case in-hand. These are alluded to in the first paragraph, probably being the "volcanic eruptions" to which this opening statement refers.

Such arguments also confused, and failed to address, two discrete issues—the question of where the ash was and the uncertainty over how much ash was safe for jet engines. Only the first issue is a scientific one. The other is the domain of the airline industry and engine manufacturers. The decision not to fly was not only based on scientific uncertainty about volcanic ash dispersion, but also on the industrial uncertainty. However, it is the former issue—use of models and theory—that is focused on in this story, with a rather worrying contention that the airlines "are best positioned to assess *all* available information."

Entman (2007) pointed out that slant and bias can be quantified through assessment of the percent share of the media space devoted to a particular stakeholder. During Eyjafjallajökull, industrial, public and political views received by far the greatest levels of coverage. In *The Times*, quoted sources from the public and politicians amounted to 41 % of all cited quotes. The airline industry accounted for 27 % of all quotes, increasing to 43 % if we just consider the first piece appearing in the newspaper (Fig. 6). In contrast, forecasters and scientists together accounted for just 6–8 % of all quoted sources. Given the two discrete issues scientific versus industrial, the balance does not appear justified.

Selection of data: the effect of financial, societal and personal loss

Kahneman and Tversky (1984) pointed out that "decision problems can be described or framed in multiple ways that give rise to different preferences" and that "the acceptability of an option can depend on whether a negative outcome is evaluated as a cost or as an uncompensated loss." During Eyjafjallajökull personal costs and uncompensated financial losses were immense and widespread. There were thus many descriptions of uncompensated loss for both the airlines and

the passengers. From reports scattered across *The Times* and *The Sun*, Harris et al. (2012) estimated that up to £5 billion may have been lost by passengers trying to find alternative means to get home, being a problem faced by around 7 million people. Associated reports focused on maximum-loss cases, containing details of stranded passengers paying as much as:

- €3700 for a taxi from Barcelona to London (*The Times*, 19 April 2010, p. 7);
- £2000 to get to Spain in the hope of being shipped home by the Royal Navy (*The Sun*, 21 April 2010, p. 10–11);
- £16 000 to get home (to the UK) from China (*The Sun*, 24 April 2010, p. 15).

Meanwhile, airline losses were reported as reaching up to US$1.7 billion (*The Times*, 22 April 2010, p. 2), although *USA Today* pointed out that losses were less than those associated with winter ice storms in the USA (Harris et al. 2012). Other reports indicated that neither passengers nor airlines were likely to be compensated. This was apparent from headlines such as:

- "Airlines are accused of ignoring EU rules on paying food and hotel bills" (*The Times*, 21 April 2010, p. 4);
- "Vol-caned: BA bailout bid as flights axe costs £100 m" (*The Sun*, 20 April 2010, p. 39);
- "Who's going to pay?" (*Daily Mirror*, 22 April 2010, p. 4).

The final headline appeared under the banner "Volcano Chaos" (printed across the top of the page in red capital letters). These headlines do not explicitly contain the word "blame", but encourage a hunt for a guilty party, a party responsible for the societal and industrial losses. Unfortunately the final headline appeared in the same issue that carried the front page banner: "Ash Test Dummies" (*Daily Mirror*, 22 April 2010, p. 1); a headline that carries obvious connotations.

There were also more widespread economic losses and shortages for numerous reasons, such as shut down of air freight operations or vacationing employees being unable to return to work, as was detailed, for example, in a report entitled "Volcano Ash wreaks supply chain havoc for retailers" appearing in *The Daily Telegraph* on 17 April 2010 (p. 29). While *The Daily Telegraph* warned,

Experts predicted shortages of imported fresh fruit, vegetables, flowers and medicines due to the shutdown" (*The Daily Telegraph*, 17 April 2010),

The Sun led a page 4 piece on 19 April 2010 with the headline

£1bn bill … & rising: Huge cost as volcano fall out hits economy.

On 18 April 2010, *The Mail on Sunday* also devoted a page 15 piece to economic losses entitled "Britain's fragile economy under threat". Impacts on education were also reported so as to focus on vulnerable groups such as children. For example, information in *The Daily Telegraph* included,

- "Chaos may force schools to close" (17 April 2010, p. 2)
- "Missing teachers shut schools" (20 April 2010, p. 3)
- "Stranded pupils miss vital exam revision" (20 April 2010, p. 3).

The closure of airspace was thus likely an option not easy to accept amongst actors suffering severe financial loss and inconvenience, as well as the readers receiving such information. The atmosphere of financial loss thus made framing headlines, such as (*Daily Mirror*, 22 April 2010, p. 5),

We made an ash of flight ban

extremely easy to deliver.

Word use and phrase exaggeration

Linguistic framing of an issue is not uncommon (e.g. Wallis and Nerlich 2005). Selective use of words can aid in framing an issue in a positive or negative light, and certain evocative words can be chosen to install a "picture" in the readers head (Lippmann 1922). Compare the words "torture" versus "abuse" when used to describe the treatment of prisoners-of-war. "Abuse" provides a much lighter connotation and creates a less negative frame, thus being that selected by some US media covering scandals involving prisoner-of-war treatment during the Second Iraq War (Bennett 2006). Exaggerating words may also be used to tabloidize a headline and report. Take the following four headlines:

- "Volcano ash wreaks supply chain havoc for retailers" (*Daily Telegraph*, 17 April 2010, p. 29);
- "Chaos may force schools to close" (*Daily Telegraph*, 17 April 2010, p. 2);
- "Total diseruption—Flight chaos hits 100,000's" (*The Sun*, 17 April 2010, p. 4–5);
- "More ash jet chaos" (*The Sun*, 17 April 2010, p. 1).

This semantic association frames the event as one of "chaos", "disruption", even "havoc." In this regard, we can easily find similar exaggerating words within the ensuing pieces themselves, such as (*The Daily Telegraph*, 23 April 2010, p. 11):

Catastrophic closure of European airspace over the last seven days … … … .

Use of such strong and negative words to describe the airspace closure built an extremely negative frame in regards

to the event, the forecast and the response. In this sense, the event was costly to the government and industry, and also extremely inconvenient to travellers. Local impacts of the eruption in Iceland were also severe. But it is the position of the word "catastrophic" that is the issue here. The closure itself was not catastrophic; but the effects on industry and individuals were. This is not conveyed by this syntax.

Exaggerating "struggles" and "desperation"

The negative frame was strengthened by the words and stories selected and used to qualify the difficulties experienced by stranded passengers. Newspapers were littered with stories regarding the experiences of the stranded and their "struggles." On 22 April 2010, in a piece entitled "We won't pay compensation, Ryanair boss says", *The Daily Telegraph* wrote,

> Those trying to leave the country face an equally tough struggle … … …

A double page special report in *The Sunday Times* on 18 April (p. 9–10) finished with a passenger statement that,

> It's shocking to see parents struggling with tiny children and seeing the airport authorities leaving them to it.

Such a "parental struggle" theme can found in many other quotes used by the sources studied here, such as (*The Sunday Telegraph*, 18 April 2010, p. 12),

> It's been a headache, especially with the children

and (*The Daily Telegraph*, 20 April 2010, p. 3),

> it's a nightmare when something like this happens when you have children in tow.
> Finally (*The Mail on Sunday*, 18 April 2010, p. 15),

> It's really scary. We just don't know what to do. We've no credit card. We've been thinking of hiring a car and driving to a channel port but haven't got the money to do it.

In these stories, the word "desperate" was prominently used. For example, while the *Daily Mirror* ran a 20 April 2010 piece describing the experiences of a number of stranded passengers under the headline (p. 6–7):

> The unwilling exiles desperate to come home,

The Sunday Times reported on a passenger (18 April 2010, p. 8),

> Desperate to get back,

as well as,

A desperate German family who wanted to get back.

In *The Daily Telegraph,* we have (22 April 2010, p. 11),

> There were people desperate to get back home … … …

The exaggeration of desperation trickled down to the local level, with the Cornish Guardian running a piece on a stranded passenger in which the primary quote was (21 April 2010, p. 10),

> I am desperate to get back to Egypt where I work as a teacher … … …

With the agenda set in the press as being one of "desperation" among "struggling" passengers, focusing on families and including teachers, it is not difficult to frame an event against a specific actor. Being a content analysis-based search, these are just the words selected for print in the newspapers, where words and quotes may be selected and arranged so as to help set up an agenda. Many quotes and words must have been recorded during interviews, but those used here for illustrative purposes were typical of those selected by the newspapers examined and that exaggerate a "desperate struggle" aspect for those stranded by the air space closure.

Headlines and a note on the use of the question mark

The headline is liable to have a disproportionate influence on the reader than the rest of the article. It will indicate the content of the report, and possibly also its tone or bias. This may determine whether the article is considered by the reader. Thus, "one might expect headlines to be somewhat dramatic and controversial in order to attract the attention of readers" (Rowe et al. 2000). To this end, in their analysis of hazard reporting in the British press, Rowe et al. (2000) found headlines to be alarming in 35 % of the 301 cases examined and reassuring in just 5 %; 24 % played on conflict. I note that of the eight front page headlines taken from The Daily Telegraph and The Sunday Telegraph as given in Table 2, the first two could be argued to be alarming, the fourth through seventh appear to play on conflict or argument, and none are reassuring.

A number of the headlines and sentences taken from the newspaper sources consulted here are followed by a question mark. It is useful to note what Marr (2005) says of use of a question mark in a newspaper headline:

> A headline with a question mark at the end means, in the vast majority of cases, that the story is tedious and oversold. It is often a scare story, or an attempt to elevate some run-of-the-mill piece of reporting into a national controversy and, preferably, national panic.

With question marks being used in several of the headlines printed during the Eyjafjallajökull air space closure that

played on the conflict or argument frame, was this the case here? Unfortunately, I cannot avoid summing up this note with a question mark.

Omission (and fabrication)

Omission is the failure to include data, information or sources that support the counter argument. Particular words may also be omitted or changed. A good example is the omission of quotes that are not supportive of a particular slant. However, it may also involve elimination of quote parts or even rephrasing of quotes so as to make the statement more hard hitting. The resulting bias may be exaggerated by the tabloid effect. In Watson and Hickman (2010), an ex-journalist for the *News of the World* is quoted as saying,

> Sometimes quotes were written before we ever left the office; before we knew who we were interviewing.

Unfortunately the only way to illustrate this problem is through personal experience, because it is the individual who knows what they said and what the newspaper then wrote.

On 8 December 1998, a story picked up from an American Geophysical Union (AGU) press release appeared on page 9 of *The Times* entitled, "Satellites spot volcano ready to erupt". The press release resulted from a presentation at the December 1988 AGU Fall Conference in San Francisco (USA) that showed how, at that time, Pacaya volcano (Guatemala) was undergoing repeated cycles of satellite-sensor (GOES-Imager) detected radiance ramps culminating in explosive paroxysms (Flynn et al. 1998). Subsequently, I was phone-interviewed by a *Times* reporter regarding the GOES hot spot detection system that was, at the time, being set up at the University of Hawaii (Harris et al. 2002a,b). The next day the reporter wrote:

> Andrew Harris, based at the Department of Earth Sciences at The Open University in Milton Keynes, who was a member of the team, said, 'We saw it coming from space. To date this has not happened before'.

I absolutely did not say that. However, it makes for good reading. The piece went on to state that,

> The team also detected the eruption of a volcano in the remote Galapagos Islands three hours before it began to erupt.

Again, this was not true. The hot spot was not detected before the eruption began, but around 60 min after the eruption began and 4 h before first visual observations were reported (see Mouginis-Mark et al. 2000). The eye-catching picture that took up 33 % of the piece was entitled "a time exposure of Popocatepetl in Mexico last month after it was detected by satellites." This, again, was wrong in many senses, one being that it was not

photographed because, or after, we had detected it. Interestingly, the article failed to mention that the hot spot detection system was only sensitive to effusive eruptions and was not designed to track explosive events, but exaggerated:

> Aircraft are also at risk. In 1982 a British Airways Boeing 747 nearly fell from the sky over Java after volcanic dust got into the engines.

Again, this is good reading, but hardly an appropriate example to support what the detection system being reported on was actually doing.

Use of bad, un-validated, information

This experience brings up a problem highlighted by Schwartz et al. (2002). Their study of news stories printed in the five months following five scientific meetings held in 1998 showed that 147 abstracts presented at these meetings received substantial attention in high-profile media. This happened even though many of these studies remained unpublished, thus having had no formal peer review by the scientific community. In the case of Schwartz et al. (2002), 25 % of these projects subsequently failed to live up to their early promise: 25 % were never published, 25 % were published in low-impact factor journals, and the reminder in high-impact factor journals. However, press coverage at such an embryonic and un-validated (in terms of peer review) stage of a project may leave the public with the false impression that the data are in fact mature, methods valid and findings widely accepted (Schwartz et al. 2002). This led Schwartz et al. (2002) to conclude that such coverage of un-reviewed material was "too much too soon", with results frequently being provided to the public as "scientifically sound evidence rather than as preliminary findings with still uncertain validity."

Preference: use of imagery

Based on the work of Naccarato and Neuendorf (1998), Neuendorf (2002) defined those content elements that go into making the perfect advertisement. This being a presentation format which maximizes readership informativeness, attractiveness and recall (Neuendorf 2002). The main elements are:

- Headline placement at top;
- Subject apparent in visuals;
- Color;
- Large size of sub-elements.

Naccarato and Neuendorf (1998) also found that large, tabloid spread advertising units were best recalled. We see all of these elements applied to the front page report examples given in Fig. 7. In each,

the theme and message is maximized, with the message being common and consistent across the three examples, note also the subject of the imagery in each report. The main words used are "planes", "grounded", "pressure" and "why?", thus the message is: planes are grounded … … … why?

Fig. 7 Three broadsheet front pages printed during Eyjafjallajökull's 2010 eruption which shows the four elements that go into making the perfect advertisement of Neuendorf (2002): (i) Leading headline; (ii) eye-catching visuals; (iii) color, and (iv) large format. a Front page of *The Independent* on 16 April 2010—front page report by Martin Hickman (© *The Independent*, 16 Apr 2010, www.independent.co.uk). b Front page of *The Times* on 19 April 2010—front page report by David Brown (© *The Times* 19 Apr 2010, http://www.thetimes.co.uk/tto/news/). c Front page of *The Daily Telegraph* on 21 April 2010—front page report by G. Rayner, D. Millward and J. Kirkup (© Telegraph Media Group Limited 2010, 21 Apr 2010, www.telegraph.co.uk)

b

Brown under pressure to get Britain flying

Airlines call for 'immediate reassessment' as test flights report no damage

DAVID BEBBER FOR THE TIMES

A test flight carrying the BA chief executive Willie Walsh leaves Heathrow yesterday. The European aviation agency denied that the blanket ban was over-cautious

David Brown

An emergency meeting of ministers will decide today if Britain should re-open its airspace after the Navy was put on standby to rescue holidaymakers stranded by the volcanic ash cloud.

Military and requisitioned commercial ships could be used to pick up thousands of Britons, the Government announced as it came under pressure from airlines to review the ban.

The Association of European Airlines, whose 36 members include British Airways and Virgin Atlantic, called for an "immediate reassessment" of restrictions after test flights reported no damage from the dust. It said the ban on flights covering more than 20 countries did not match the response to volcanic ash in other parts of the world.

Airlines including KLM, Lufthansa

and Air France carried out more than 30 test flights over the weekend to see if safe paths could be found through the ash. A BA 747 jet carrying Willie Walsh, its chief executive, made a two-hour journey from Heathrow before landing at Cardiff last night.

Forecasters say that the cloud of ash from Iceland's Eyjafjallajökull volcano could remain over Britain until at least the end of the week. Einar Kjartansson, of the Icelandic Meteorological Office, said: "It is likely that the production of ash will continue at a comparable level for some days or weeks."

A British toddler was in a critical condition last night after bone marrow needed for a transplant was held back in Canada. She was one of 16 patients said to be in "critical need" because of the lack of bone marrow supplies.

Gordon Brown met ministers and

scientific advisers and the Government's Cobra committee was due to meet at 8.30am today to consider if the latest evidence could lead to a Europe-wide easing of restrictions. Ministers are also investigating bringing Britons stranded in the US home via Spain.

1.3 million
tonnes of carbon dioxide emissions saved over the past four days

The International Civil Aviation Authority said that the disruption was worse than that caused by the shut-down of air travel after 9/11. Airlines are reported to be losing at least $200 million (£130 million) a day.

The Eurocontrol aviation agency

said that 4,000 flights were expected in European airspace yesterday compared with 24,000 normally. It hopes that half of services will fly today.

Brian Flynn, its head of operations, denied that the authorities were being over-cautious, saying they were using the "accepted methodology" of guidelines set by the International Civil Aviation Organisation. But the British Airline Pilots' Association raised questions about the blanket ban on flights and called for a banking-style rescue of the industry, warning that a number of airlines faced the threat of bankruptcy.

Conservatives urged ministers to ensure that border controls did not scupper rescue efforts after French police stopped theTV presenter Dan Snow bringing home stranded Britons.

Fig. 7 (continued)

The frame

An analysis of headlines and opening phrases that appeared in *The Daily Telegraph* between 16 and 23 April 2010 shows how negative framing, and association of the frame, with the forecaster developed with time during Eyjafjallajökull (Table 2). Headline analysis is particularly important because

headlines are designed to attract attention and deliver the message (Martin-Lagardette 2009). During the first three days of the crisis (16–18 April) there was some headline exaggeration, with use of words such as "vast" and "misery". However, headlines were objective and naming was on the basis of the countries that were the source and location of the "crisis" (Britain and Iceland). Following 19 April, naming of actors

The Daily Telegraph

Wednesday, April 21, 2010   FINAL   **NEWSPAPER OF THE YEAR**   No 48,174   £1.00

Why was ban ever imposed?

As airports were opened late last night after six days of chaos, BA chief says the shutdown was an over-reaction

A fleet of BA jets lies idle at Heathrow. They were able to take to the skies again last night when the no-fly ban imposed because of the dangers of a volcanic ash cloud was lifted after nearly a week. Travellers face days of disruption as they struggle to rebook flights

By Gordon Rayner David Millward and James Kirkup

THE blanket ban on flights was finally lifted last night, but the Government faced an immediate backlash as British Airways claimed that the unprecedented shutdown was unnecessary.

The Conservatives called for an inquiry into the "fiasco" which has cost the economy more than £1.6 billion, left 500,000 passengers stranded and disrupted schools.

The decision to re-open the skies from 10pm last night was taken after ministers were put under pressure to explain why British flights were grounded while most European airports were open, despite the cloud of volcanic ash from Iceland.

At a meeting between the Civil Aviation Authority, Lord Adonis, the Transport Secretary, and airlines, a decision was taken to follow the lead of other European countries, which had already relaxed travel bans after deciding the ash no longer posed a threat.

At 9.50pm BA84 from Vancouver became the first passenger flight in six days to land at Heathrow. The first person through the arrivals door, Neil Rodgers, said: "It's good to be back." Those onboard the flight learned they were heading to London an hour before landing after circling Shannon airport on the west coast of Ireland.

"As we were coming in to land I was concerned as we were coming through the cloud," said Mr Rodgers, of Little London, near Reading.

However, travellers stranded abroad were warned it could take weeks to get them all home, with fears that chaos could descend on British airports this week as tourists scramble for any available seats.

Authorities at Gatwick warned of queues and told travellers not to go to the airport unless flights were confirmed "as speculative trips will cause major congestion".

Passengers arriving more than four hours before a confirmed flight would be asked to leave.

The airline industry's most senior figures lined up to criticise the Government's handling of the crisis.

Willie Walsh, the chief executive of BA, said: "We will have plenty of time to look back over what could have been done better and I do believe that lessons can be learned and will be learned from this."

Theresa Villiers, the Tories' transport spokesman, said: "The question angry airlines and passengers will be asking is why was this not done before. We have to have a full inquiry into the Government's fails responsibility for this fiasco."

Boris Johnson, the Mayor of London, questioned the science behind the lockdown.

"What I would really like to know is whether we are absolutely certain that the initial decision taken to close down UK aviation at this level of risk was correct," he said.

It emerged that two vastly differing maps of the ash cloud were being circulated by official bodies.

One, prepared by the government-controlled Met Office and used by the CAA and Nats, the air traffic control authority, showed the ash cloud covering much of Europe. A second, produced for Eurocontrol, the European air traffic control co-ordinator, limited the areas of danger to two clouds over the Atlantic.

This second map and extensive test flights helped persuade many other European countries to reopen their air space.

The flight ban has cost British airlines £130 million per day, and there is now intense pressure for the Government to foot the bill. Roger *Continued on Page 2*

Brown is just so desperate, says Clegg

By Andrew Porter
Political Editor

NICK CLEGG has delivered his most outspoken attack on Gordon Brown, calling him "a desperate politician" as he signalled that he would find it difficult to do a deal with the Prime Minister in a hung parliament.

Labour has become increasingly keen to ally itself with the Liberal Democrats as its chances of victory fade.

But in his first newspaper interview since his party's shock rise in the opinion polls, Mr Clegg told *The Daily Telegraph* that Labour had failed to deliver in its 13 years in charge and could not be trusted now.

He said: "Brown systematically blocked, and personally blocked, political reform. I think he is a desperate politician and I just do not believe him." He added: "And do I think Labour delivered fairness? No. Do I think the Labour Party in its heart has a faith in civil liberties? No. Do I think they've delivered political reform? No. They are clutching at straws."

The highly personal attack on Mr Brown's integrity will lead to further speculation that the price for any deal with Labour would be that it ditches Mr Brown as leader.

David Miliband, the Foreign Secretary, has been touted as a possible replacement who would be acceptable to the Lib Dems.

Mr Brown made overtures to the Lib Dem leader in last week's television debate, which catapulted Mr Clegg's popularity to previously unthinkable levels.

However, Mr Clegg is exasperated with the way the Prime Minister has suddenly decided to talk about changing the electoral system.

The Lib Dem leader also said it was incumbent on politicians to talk in the event of a hung parliament and

suggested David Cameron should halt his opposition to any talks if there is no outright winner on May 6.

A Populus poll for *The Times* last night showed that the Lib Dems' support has risen 10 points in a week.

The party now stands on 31 per cent, with Labour down five points on 28 per cent and the Conservatives down four on 32 per cent.

However, a ComRes poll for *The Independent* gave the Tories some relief, showing them on 35 per cent and enjoying a nine-point lead over both the Lib Dems and Labour. That would still leave Mr Cameron short of a majority.

Speaking about post-election negotiations, Mr Clegg yesterday said: "I would be open about the fact that, clearly, politicians should be able to speak to each other. David Cameron doesn't seem to accept this, but if the British people have voted then of course you have to try to provide good stable government." So far, Mr Cameron and his advisers have been unwilling to countenance anything other than a clear Tory win. However, one senior source said it was something that would possibly be considered "in two weeks' time".

Mr Clegg refused to say which party he would back in the case of a hung parliament, which will lead to accusations that he is not being honest about his intentions. He simply said that the party with the most seats would be the winner, despite the possibility that Labour could come third in the popular share of the vote and still end up with the most MPs due to the electoral system.

Mr Clegg said the system was "clearly bonkers", adding: "It would be preposterous for Gordon Brown to end up like some squatter in No 10 because of some constitutional nicety." Senior *Continued on Page 4*

'I'll drive you to Calais on condition that you don't talk about Nick Clegg'

Bank staff's bumper bonus pot

By James Quinn
in New York

GOLDMAN SACHS staff are to share a pay and bonus pool of £3.6 billion as a result of a near-doubling in profits.

The Wall Street bank, under fire on both sides of the Atlantic for carrying out an alleged fraud, made a profit of $3.46 billion (£2.2 billion) in the first three months of the year, up 91 per cent on the same period last year.

The bank made some of the money from betting on mortgages and risky credit products, the type of transactions which were responsible for the global financial crisis and the ensuing economic recession.

Goldman Sachs, branded "morally bankrupt" by Gordon Brown as a result of the fraud charges in the US, will pay each of its 33,100 staff an average of $166,000 (£110,000) for those three months alone the equivalent of $664,000 (£430,000).

Goldman Sachs employs approximately 6,000 people in London.

Business: B1 and B5

Debt-hit MGM on the brink

Report: Page 15

NHS tunics scratched

By Murray Wardrop

NEW colour-coded NHS uniforms could be scrapped after staff complained that they caused painful rashes.

The tunic-style garments, in different shades of blue and green, are being introduced in Wales at a cost of nearly £1.5 million to help patients identify different grades of nurses. However, tests have been ordered on the fabric after nurses wearing it complained of skin irritation. Similar problems have been reported in Scotland, where standardised uniforms are also being introduced.

The Welsh Assembly said it was "disappointed" because the uniforms, made from 67 per cent polyester and 33 per cent cotton, had already undergone thorough testing.

Fig. 7 (continued)

began each of whom became associated with loss and blame. The series ended with "shambles" as the event frame, with reporting focusing on financial loss for passengers during 22–23 April. The UK Meteorological Office (the Met. Office) had already been named during 19–21 April as the agent responsible for the forecast and the results. The Met. Office could, by association, thus be viewed as the guilty party, responsible for the air space closure and all associated problems, even though they were not the decision makers (see Part 2).

Testing the frame using content analysis

We can test the validity of this association by applying a content analysis (e.g. Bytzek 2008). Holsti (1969) defines content analysis as a form of "information-processing in which communication content is transformed, through objective and systematic application of categorization rules, into data that can be summarized and compared." Berelson (1952) proposed five purposes to content analysis:

1. To describe the substance characteristics of a message;
2. To describe the form characteristics of a message;
3. To make inferences regarding producers or sources of content;
4. To make inferences regarding the content audience or recipient;
5. To determine the effects of the content on the recipient.

Neuendorf (2002) grouped these objectives into two analysis categories which distinguish between descriptive content and inferential content analysis. While descriptive analysis deals purely with data and describing the analysis, inferential analysis attempts to infer motivations among the message source and its likely effect on the recipient.

I here run a descriptive analysis which is then used for an inferential assessment. To do this, I used all articles appearing in *The Times* published between 15 and 24 April 2010 that either mentioned, or referred to, the Eyjafjallajökull eruption and its impacts; as entered into the data base of Harris et al. (2012). Summary texts for each piece were then combined and entered into QDA Miner version 4.8.1. This software, published by Provalis Research (http://provalisresearch.com/), allows entry of a text project to which a content analysis can be applied by running the module WordStat 6.1.20. This module allows the generation of statistics for words and phrases appearing in the text, as well as potential relationships between the words and phrases.

As a first step, WordStat was run to produce a dictionary, this being a list of all key descriptive factual words appearing in the text with their frequencies (Weber 1990). The dictionary function includes an "exclusion list" (also known as a stop list) which is used to remove all words that are not to be included in the analysis, these being words with little semantic value such as pronouns and conjunctions. The first, most basic analysis is generation of a word frequency plot (Fig. 8a), a result that is commonly displayed as a word cloud (Fig. 8b). This, by accessing the dictionary and its statistics, allows the importance of words used to be assessed in terms of their frequency. When dividing these results into three-word groupings, we move from ash-flights-people (combined frequency=206) through airlines-stranded-travel (combined frequency=130) and insurance-Britain-cancelled (combined frequency=73) to Office-affected-Met. (67).

To understand the relation between these words, we can begin with a dendrogram-based cluster analysis. The results of a ten group cluster analysis based on words with frequencies greater than 12 is given in Electronic Supplement 1. To create the dendrogram, WordStat uses an average-linkage hierarchical clustering method to create clusters from a similarity matrix on the basis of words appearing together in the same paragraph. We find three interesting clusters. The first contains "Met. Office" and includes "volcanic", "plume", "ash-cloud", "weather-report", "transport" and "UK-air." The second contains "airlines" and includes "million-day-lost" and "cancelled-flights." Finally, the cluster containing the word "volcano" includes "holiday-cover" and "companies-travel-insurance." This supports the premise that, for the airlines and passengers, the event was associated with loss, and the Met. Office was associated with the event, reporting and airline transport, but not the volcano which was associated with losses related to holiday and travel cancellation. This seems to be borne out by the results of the four cluster analysis given in Fig. 9 which identifies three main groups and a fourth smaller one. The three main groups, when defined by the most frequent word in each cluster are as follows: (i) "ash", (ii) "people" and (iii) "flights." The "Met. Office" appears in the "ash" cluster along with words such as "weather", "report", "eruption", "plume", "European", "British" and "airspace". However, the "flights" cluster contains "airlines", "stranded", "lost", "cost-costs" and "stuck."

Finally, we can produce a proximity plot. This is a measure of the proximity of a key word set, in this case "Met." and "Office", to all other words. In Fig. 10, I plot the 26 words which most closely relate to the words "Met." and "Office." We see "plume", "ash", "cloud", "weather report" and "transport", as well as "companies, "planes", "services", "fly", "flights", "people", "passengers" and "stranded." This points to a frame whereby the "Met. Office" was associated with the "ash cloud" and was viewed as "weather" reporting. Those reports were then directly linked to the airline industry, as well as their "services" and "flights", as well as the "passengers" who had become "stranded."

Constructing the frame

Framing can be achieved, or avoided, in a number of ways (e.g. Anastasio and Costa 2004; Bennett et al. 2006; Robinson

Fig. 8 **a** Bar graph showing the frequency of the top 21 words for all articles appearing in *The Times* published between 15 and 24 April 2010. **b** Word list of the top 56 words produced from the same dictionary. *Word size and color* is a function of frequency; words are listed in frequency order (most frequent first, least frequent last)
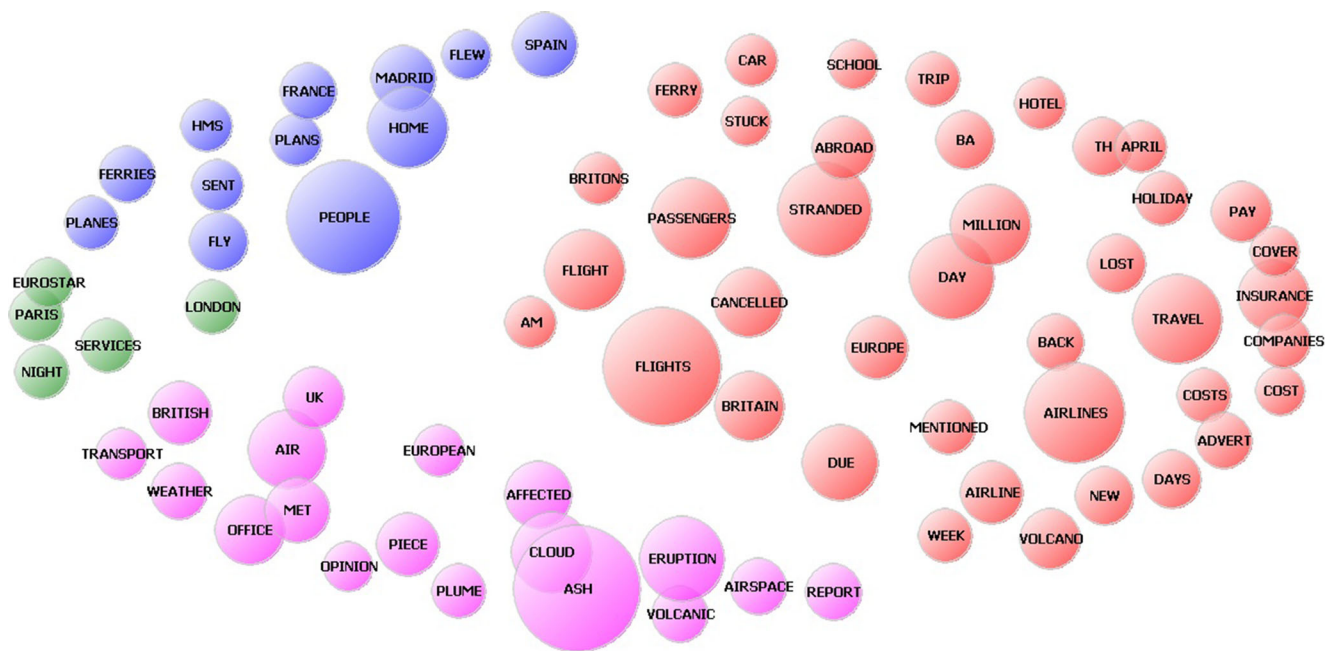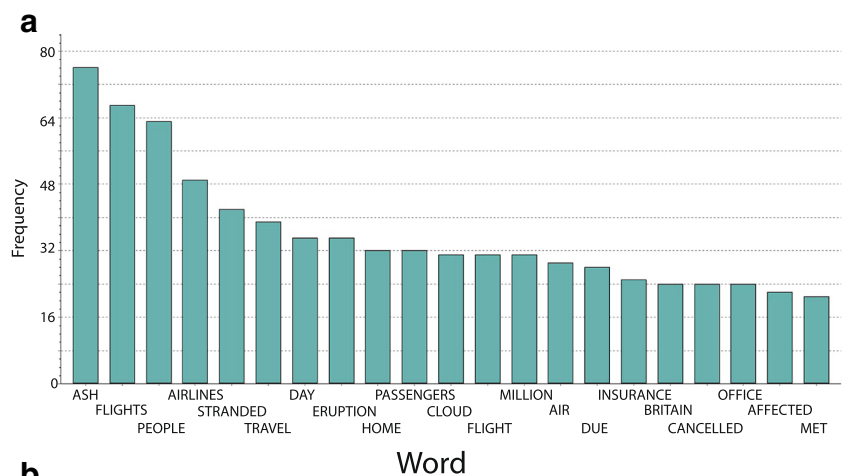
a

b

ASH FLIGHTS PEOPLE
AIRLINES STRANDED TRAVEL DAY
ERUPTION HOME PASSENGERS CLOUD
FLIGHT MILLION AIR DUE INSURANCE BRITAIN
CANCELLED OFFICE AFFECTED MET MADRID SPAIN
ABROAD AIRLINE BRITISH EUROPE PIECE PAY UK VOLCANO BA
DAYS FLY LOST NEW TH ADVERT AIRSPACE VOLCANIC BACK
FERRIES FRANCE REPORT WEATHER COMPANIES COSTS FERRY
HOLIDAY LONDON MENTIONED NIGHT PARIS PLANES PLUME SERVICES

Fig. 9 Results of the cluster analysis performed on *The Times* dictionary. The size of each *circle* is a function of the frequency of usage for each word, and the *color* divides them into groups defined by the clustering of words on the scale of the paragraph: that is, they always appear in the same paragraph and are thus linked to the paragraph theme. We can identify three main groups. The largest (*red*) group has "flights" as the most frequent word, with "airlines", "travel", "millions" and "passengers" also being prominent, as well as "cost". The next largest (*purple*) group has "ash" as the most frequent word, and contains "Met", "Office", "weather" and "report." The third (*blue*) group is dominated by the word "people". A fourth small (*green*) group covers alternative means of getting back to the UK, notably by using the Eurostar train service between Paris and London
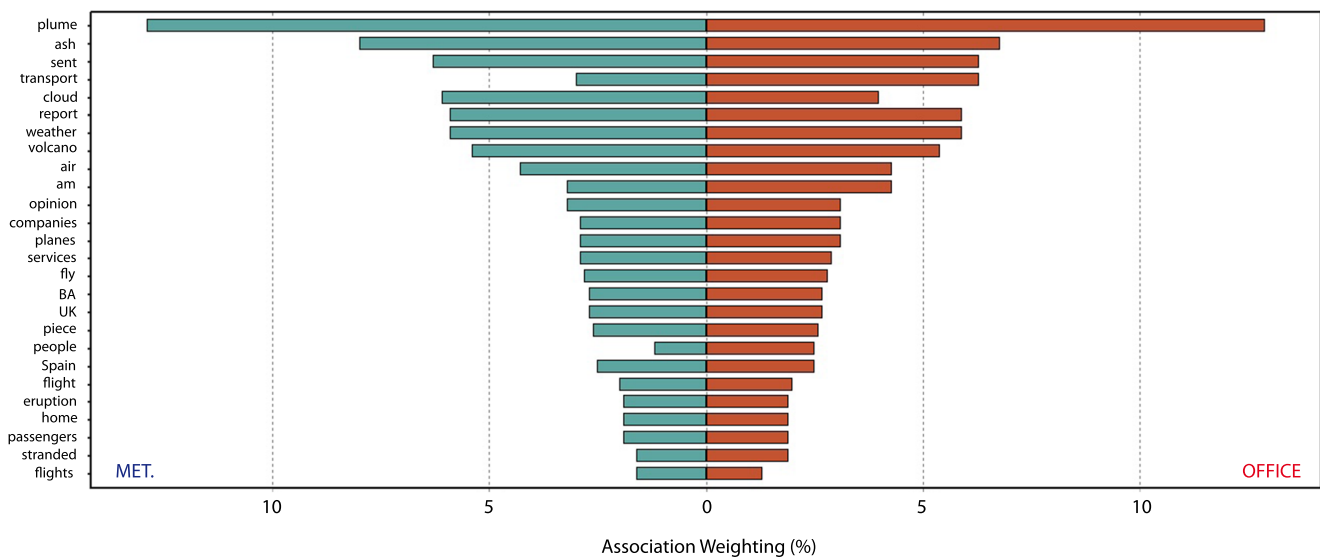
Fig. 10 Words most strongly related to the key words "Met" and "Office" in all articles appearing in *The Times* between 15 and 24 April 2010. Length of *blue bars* extending to the *left* are a function of the strength of relation to each word on the y-axis to the word "Met" in *The Times* dictionary. Lengths of *red bars* extending to the *right* reveal the strength of the relation of each *y*-axis word to the word "office". Plot is for the 26 most important words. It shows a strongest relation with the string "Met.-Office" to "ash-cloud", then "weather-report" and "air companies" and "services", through "people", "home", "passengers" to "stranded", revealing a strong newspaper syntax association between the Met. Office and these themes

et al. 2009; Porpora et al. 2010; Aday 2010). Blame and finger pointing can always be assigned by the media (Scharrer et al., 2003), but a blame frame can also be unwittingly or consciously constructed. From the forecasting point-of-view, the following three framing-cases are of interest in understanding the assignment of a frame that involves blame:

- Knobloch-Westerwick and Taylor (2008) found that when the active voice was used in news stories to describe actions relative to an event, the actor was more seen as the cause of the event than when the passive voice was used.
- Dixon (2008) found that, in the USA, over-representation of African-Americans as being criminals on local television news in Los Angeles was positively related to the perception of African-Americans as violent.
- Rauhala et al. (2012) found that in regards to child care policy in Canada, political figures outnumbered activists, parents and child care providers in commenting on child care policy.

In relation to each of these findings, for the Eyjafjallajökull case, we can identify:

1. Naming of the forecaster, in this case the Met. Office, and
2. Setting of their actions in a negative light ("only making a weather report"), while including
3. A high proportion of quotes from actors with agendas other than delivering forecasts, such as the airline industry.

Each assignment can potentially frame the news against the forecaster, resulting in blame.

The blame frame

Attribution of blame is central to human interaction (e.g. Coates and Tognazzini 2013). Blame and anger are almost impossible to avoid and there are many cases where blame has been directed at the forecaster following a bad weather event (see, for example, Appendix C). Worse, in assessing emotional experiences of individuals in 37 countries, Mikula et al. (1998) found that anger-producing events were most frequently perceived as very unfair. The perception of injustice was associated will all negative emotions; unjust events being described as "immoral" and "obstructive to plans and goals." Feelings associated with unjust events were also longer lasting and more intense than those associated with just events (Mikula et al. 1998).

The first level media filter explored above can be collapsed into a frame where the forecaster (in this case the Met. Office) is blamed for all negative aspects of the environmental disaster, which in this case is a volcanic eruption, its ash cloud and its impacts. This contention matches the findings of Washer (2006) who, based on an analysis of newspaper coverage during the outbreak of mad cow disease in the UK, found

that the appearance of the novel disease in the community led to the threat being externalized and blamed on a specific group. In the case of Washer (2006), these groups were foreigners and "out-groups" who were unfortunate enough to have been first afflicted by the disease. They were then blamed for the genesis of the disease. Washer (2004) reached similar conclusions from an analysis of representation of severe acute respiratory syndrome (SARS) in British newspapers, finding that the mechanism of "othering" was again used. That is, the problem was unlikely to personally affect the UK reader because the population it effected was different to "us" and so "other".

On 20 April 2010, *The Daily Telegraph* opened a front page report (entitled "Met Office got it wrong over ban on flights") with the sentence:

> The Met Office was blamed last night for triggering the 'unnecessary' six-day closure of British airspace which has cost airlines, passengers and the economy more than £1.5 billion.

Further down the report we find,

> much of the blame was directed at the Met Office's Volcanic Ash Advisory Centre (VAAC).

The page 2–3 continuation of the report carried on with:

> This may well open the way for wider litigation against the Met Office and other government agencies who are found to have failed in their duty of care.

Only buried late in the report (on page 3) do we find a short defense:

> The Met. Office said it merely provided the data that mapped the direction, shape and density of the volcanic ash cloud. It was the airline industry and its regulators who ruled that planes could not fly through it.

In this case, it is not difficult to see the Met. Office being set up as Washer's (2006) "out-group." This, due to the novelty of the situation, resulted in the event and its effects being, in Washer's words, "externalized and blamed on a specific group."

Assignment of blame

Reviewing the conditions involved in assigning blame in human relationships due to wrongdoing, as reviewed in Bell (2013), is useful in understanding construction of such a blame frame. According to Bell (2013), the conditions required for blame assignment are:

1. *Y*'s wrongdoing is *X*'s business.
2. *X* and *Y* are contemporaries and inhabit the same moral community.
3. *X* has not engaged in similar wrongdoing in the past.
4. *X* is not responsible for or complicit in *Y*'s wrongdoing.

Bell (2013) adds a list defining what is involved in blaming someone:

1. For *X* to blame *Y* for some action *a*, *X* must believe that *Y* performed *a*.
2. *X* must believe that *a* is wrong, and
3. *X* must express this belief form in some form of communication.
4. *X* must believe that *Y* is blameworthy for *a*, and
5. *X* does not believe that any excusing or exempting conditions pertain.

Allocation of blame is also an easy attribution to make in the case of loss. In his study of accidents caused by human error in the industrial and transport sectors, Whittingham (2004) concluded that (p. 254),

> Managers surrender to the apparent inevitability of errors and revert to the easier and simpler remedy of allocating blame. Blame places the responsibility for an error with the individual making the error. This removes the need to understand why the error occurred since it is believed future errors can be prevented by punitive measures against the individual.

Likewise, a study of newspaper sports pages by Lau and Russell (1980) revealed a tendency to make internal attributions for success and external attributions for failure. That is, it is natural to claim personal responsibility for success but to blame perceived failure on someone or something else. Lau and Russell (1980) also found that while more attributions were made after unexpected outcomes, more stable attributions were given after expected outcomes. As a result of such an endemic blame frame, the attribution-of-blame model has been developed. The model is based on the perception that somebody's entitlement has been violated so that the person, group, agency or business regarded as responsible for violating the entitlements of the aggrieved party is blamed despite insufficient justification (Mikula 2003).

Experiments by Fast and Tiedens (2010) suggested that blame is socially contagious finding that politicians, students and organizational representatives who were initially associated with blame were subsequently blamed for other unrelated failures. This seems to have happened during Eyjafjallajökull when the Met. Office was initially blamed for poor analysis and then also for the airspace closure, airline financial losses

and finally, all subsequent economic losses (e.g. *The Daily Telegraph*, 20 April 2010: see Table 2). In this regard, the following lines written by Douglas (1992) seem relevant, even if Douglas' guilty actor was the witch:

> The cleverer they are in (occult) knowledge the more incredible the crimes that can be attributed to them. For this reason evidence that might count in their favor was regarded as suspect.

In our case, we could argue that the process behind, and difficulties in making, the forecast by those with the appropriate "knowledge" were not understood, and so they committed the perceived "crime" and all "evidence" was therefore against them.

The blame culture problem

Blame culture means that actors may be specifically targeted to shoulder responsibility for perceived failures. As part of this process, companies or industries may over-emphasize individual blame at the expense of correcting defective systems (Whittingham, 2004). Individual blame logic (IBL) is an accusatory approach in which guilty individuals are searched for (Catino 2008). It is a well-known approach commonly used in business organizations and healthcare systems to determine the causes of a failure, accident or loss and to identify responsible agents (Catino 2009).

A form of IBL appears to have been applied to the Eyjafjallajökull case. Evidence can be found in the statements published in various newspapers. Take, for example, the lines published in *The Daily Telegraph* on 20 April 2010,

> 'The Met. Office and other government agencies' were 'found to have failed in their duty of care.'

In other words, blame culture led to the Met. Office being singled out as guilty. But, guilty of what? I argue here that some actors used IBL, consciously or unconsciously, to pin all blame for the airspace closure and associated loss on the Met. Office. Within the frame of IBL, one source claimed that (*Daily Mirror*, 22 April 2010, p. 5):

> They (the Met Office by implication) underestimated the severity of the consequences of the decision.

Pertinent here is that the decision to close airspace was not the Met. Office's to make, nor did they make it (see Part 2). However, this did not stop another source from arguing that (*The Daily Telegraph*, 20 April 2010, Front Page),

> This may well open the way for wider litigation against the Met Office and other government agencies.

Such a blame culture has been found to inhibit medical incident reporting (Waring 2005). However, it should not inhibit the objective to deliver and appropriately receive scientifically correct and sound forecasts. Rather, forecast delivery needs to recognize the potential for application of IBL and be communicated in a format that avoids the potential for blame frame application.

The responsible agent

Scientists who have no official role in advising the government, but who speak to the media, have no protection against litigation, whether what they say to "reassure" people works or fails. Likewise, agencies charged with providing assessments and forecasts to aid in the response and decision making process are liable to be accused for any resulting catastrophe or loss, against which there is not always legal protection (Aspinall 2011). The analysis completed here shows that during Eyjafjallajökull, the finger of blame was pointed squarely at the forecaster, namely the Met. Office.

Because the scientist or forecaster is usually the least politically powerful player in the game, they are an easy scapegoat for such finger pointing. Italy's L'Aquila case, for example, was initially likened to a "frivolous attempt by over-zealous local prosecutors to make scapegoats out of some of Italy's most respected scientists" (Hall 2011). However, as Alexander (2014) pointed out, for L'Aquila, "the mass media, if not the scientists, totally confused prediction with warning and ignored the finer distinction of warning citizens and providing them with advice. The scientists failed to correct this misassumption." Could the same be argued for the Eyjafjallajökull event? Here, an implicit link between forecast and "grounding" of planes, for example, appears to have been assumed.

A related misassumption is that the scientist or forecaster is not the decision maker. Instead, these actors are usually charged with providing advice, information and forecasts so as to allow regulatory bodies to make informed decisions (see Part 2). In the case of Eyjafjallajökull rapid propagation of the ash cloud imposed "unexpected demands on the chain of decision-making that extended both within and between European Civil Aviation Conference (ECAC) states." Johnson and Jeunemaitre (2011) thus explain:

> The UK Meteorological Office's London Volcanic Ash Advisory Centre (VAAC) issued an initial warning following advisories from the Icelandic Met. Office. The VAAC alert triggered a swift reaction from Eurocontrol; the Central Flow Management Unit (CFMU) sent warnings to individual Air Navigation Service Providers (ANSPs) around Europe. They also prepared for worst-case scenarios with zero-rate regulation, assuming there was a possibility of prolonged closures to national airspace. The decision was taken after an

emergency video conference with the United Kingdom's National Air Traffic Services (NATS).

This response chain is iterated by Donovan and Oppenheimer (2012) who clarified that although it was the VAAC at the Met. Office who issued warnings, they did not make the decisions. Instead, normative scientific guidelines argue "that scientists are there to advise while policymakers and elected politicians make the decisions" (Donovan and Oppenheimer 2012).

However, Donovan and Oppenheimer (2012) add that "channels of advice to the government during the (Eyjafjallajökull) eruption were less clear." This meant that it may have been easier for the press to single out the agency at the source of the chain as the target for blame. Due to the loosely defined and hourly evolving communication demands with which the forecasters were linked, they then lacked provision of supporting explanation by, and protection from, those higher up in the decision-making chain. In fact, nowhere in the newspaper sources examined here was the pan-national decision making process, as described above by Johnson and Jeunemaitre (2011), used as the scapegoat. Nor was the process or role of each actor in the chain clearly defined or explained. Instead, it was the Met. Office that was left to shoulder the blame. Alleviation of such mis-conceptions requires intervention of other more powerful actors who need to clarify and protect the role of those lower in the chain of decision making. As Aspinall (2011) pointed out, when lawsuits were tabled against the volcano observatory during the Montserrat volcanic crisis, "the government countered that it had acted lawfully and, pertinent to us, on scientific advice."

The journalists

Scientific journalists generally have good scientific backgrounds (Russell 1986). This, though, is not necessarily true for more general journalists who may deal with a story that involves the scientist as a minor actor or who work for a regional newspaper (Crisp 1986). In terms of reporting health research and policy, Voss (2002) found that, of 165 reporters at 122 newspapers in five US Midwest states, between 66 and 85 % of the reporters found health reporting as "sometimes difficult" to "nearly always difficult." Voss (2002) also found no significant differences in perceived difficulty in reporting health issues as a function of training or newspaper size; concluding that "reporters may have difficulty understanding complex health issues and interpreting statistics because they are inadequately trained." It is in the health sector that a number of studies can be found that indicate the level of difficulty a journalist encounters when reporting on a scientific issue.

Experiences from the health sector

In the health sector, Cassells and Lexchin (2008) found that only between 8 and 31 % of information in media stories regarding quantification of harms of treatment, cost of treatment, sources of information and quantification of benefits of treatment were "satisfactory." This finding was supported by the results of Schwitzer (2008) who reviewed 500 health stories in the US media out of which only 41 (8 %) received a "satisfactory" requirement for all ten assessment metrics used. Moynihan et al. (2000) studied 207 stories appearing in US news regarding the benefits and risks of three medications used to prevent major diseases. They found that 83 (40 %) of the stories did not report benefits quantitatively, but 98 (47 %) mentioned potential harm to patients. In an analysis of Australian newspaper reports, Smith et al. (2005) found that newspapers "often do a poor job in conveying important information on new medical treatments to the public", finding 55 % of material in the print media to be "satisfactory". The main areas of weakness were inadequate presentation of evidence on benefits and harms of the interventions, failure to mention the costs of treatments or to obtain independent expert commentary (Smith et al. 2005). These findings seem to echo the Eyjafjallajökull case examined where reporting lacked expert commentary on the benefits of the action, harms represented by the phenomena and potential cost of an accident. In this regard, Smith et al. (2005) concluded that,

> It is important that the responsibility for poor medical news reporting is not borne solely by journalists and editors. In a number of the articles we reviewed, it was apparent that the high quality was due, in part, to the involvement of researchers in disseminating information to the press. We do not have direct evidence but it is likely that many poor articles could have been improved if investigators had taken the trouble to communicate effectively with journalists.

In the lack of such communication, Smith et al. (2005) suggested that it was "difficult for journalists to do their job properly." As a result, Woloshin et al. (2009c) argued that scientific bodies (and in our case, also the responding agencies) can and should work harder to promote accurate translation of output into news. In the opinion of Woloshin et al. (2009c), "the most obvious way is to make it easier for journalists to get it right" is by ensuring that press releases routinely present and describe the results, while highlighting limitations.

Journalistic pressure

Journalists are under tight time deadlines as well as editorial and ownership pressures, and a need to sell their newspaper (e.g. Friedman 1986; Williams 2010b). Sir Alex Ferguson sums up well when commenting on the newspaper reaction

to his retirement as manager of Manchester United Football club (UK) in 2013 after 27 years in charge (Ferguson 2013):

> I had my run-ins with the written press down the years but I never held grudges. I know journalists are under a lot of pressure. They have to try to beat television, the Internet, Facebook, Twitter and many things, and they may have an editor on top of them all the time. It's a hard industry.

In support of this view, Cater (1959) commented that the one of the journalist's audiences are his "bosses." According to Cater (1959), the pressure varied from boss to boss, but news is "big business" which places pressure on the journalist causing a "gnawing compulsion to devise ever more resourceful ways of perfecting 'leads' and 'angles' to his stories"; thus encouraging an agenda-related frame.

The journalist has also to be selective with information and efficient with use of words due to tight space limits (e.g. Cappon 1999). They also cannot be expected to become experts in a field they may be encountering for the first time and need to write a story about in just a few hours. Therefore, they need to rely on those sources they have, know and trust. Finally, journalists cannot be expected to find the most relevant expert given a few hours of time to put their piece together, especially if relevant experts are not on the list of known sources. Given the absence of "academic", "forecaster", "researcher" and/or "scientist" from the list of main sources used during Eyjafjallajökull given in Appendix D, this seems to have been particularly true for this high-impact volcanic event. Thus, the journalist needs to be made aware of who to go to for information before the event occurs. The journalist then needs to be able to trust that the source will give reliable information in a useable language. Recognizing this problem, Slovic (2000) recommended,

1. Acknowledge the problem: understand that risk and uncertainty are inherently difficult to communicate, but that the media are the dominant source of risk information.
2. Enhance science writing by educating reporters on the importance and subtleties of risk stories.
3. Develop science news clearinghouses: reporters need to know how and where to access relevant, knowledgeable and cooperative sources.
   To this, we can add,
4. During a developing "crisis" the reporter can be directly approached and given appropriate material.

Developing a relationship with, and/or providing a relevant expert list to, the press prior to a crisis is one simple solution. As Goldin (2009) commented,

> Journalists are under newer and greater pressures than previously due to budget cuts and shrinking of the news

industry. (Scientists) can play an important role in this: work with journalists to represent scientific findings accurately and wholly, and encourage them to promote scientific thinking in the mainstream.

News values

The forecast is not a key news value; news values being those factors that help journalists estimate the relevance and interest of a potential story to the audience (Appendix B). In other words, information needs to be relevant to the story under consideration if it is to be used. This means that while some forecasts and communications that meet news value requirements will be reported, those that do not will not be reported. As Kasperson and Kasperson (1996) pointed out,

> Risk and risk events compete for scarce space in the media's coverage, and the outcome of this competition is a major determinant of whether a risk will be socially amplified or attenuated in society's processing and disposition of the risk.

If the communication is used, the application of news values will further filter those elements of the communication that the story uses or focuses upon.

Harcup (2009) defines three types of journalistic approach by story type: (1) objective, (2) investigative and (3) entertainment. The first report type requires use of "truth" from credible sources. The aim is an objective report that has balance. That is, it presents both sides of an issue, separating fact from opinion, while avoiding slant or agenda setting. The second type involves investigating a story by finding as much information as possible. By talking to as many of the actors involved as possible it attempts to uncover information and true facts. Finally, entertainment involves "dumbing down" so as not to appear boring. This is an approach that favors coverage of confrontation rather than debate, focuses on polarized views rather than rigorous argument, and looks for stories of confrontation between individuals rather than their arguments. In effect, entertainment involves promoting conflict (Harcup 2009). As Morgan et al. (2009) pointed out:

> Many reporters are not in a position to make their own independent assessment of the likely accuracy of scientific statements. They have a tendency to seek conflict and report 'on the one hand, on the other hand', doing so in just a few words and with very short deadlines. It is small wonder that sometimes there are problems.

Regarding political debate, Rosten (1937) was one of the first to argue that journalists "place a premium on conflict" so that "an attack is news." Rosten (1937) went on to warn, "it does not matter how shallow the

grounds, how questionable the motivation ... an attack is news."

We can see elements of the "entertainment approach" in all of the reporting examples given here. There are, for example, many cases of the development of an entertainment slant involving confrontation between passengers and the airline industry, and airline industry and the forecaster.

The ash cloud qualified as "extraordinary circumstances" so that Regulation 261/2004 regarding air passenger rights in case of flight cancellation was argued not to apply by the airlines (Broberg 2011; Bernard 2011). This situation was exaggerated by the frame of financial loss, struggles and desperation, so that the story could be framed by the newspapers as a "row". For example, under the sub-headline,

> As stranded Brits flood home, a row begins over £300 m compensation bill

The Daily Mirror led a double page spread with on 20 April 2010 that began (p. 4),

> HUNDREDS of thousands of stranded British tourists face fresh misery after airlines yesterday vowed to snub their £300 million compensation claims.

Likewise, on the front page of the Business section of The Daily Telegraph on 22 April 2010 there was a report entitled,

> Tour firms and airlines row over stranded passengers.

This began,

> A ROW broke out last night between Britain's holiday companies and airlines over who was doing most to repatriate customers stranded by Iceland's volcano eruption.

The confrontation theme was then applied to rather one-sided arguments against the decision to close airspace. For example, the aforementioned 22 April 2010 front page piece in The Daily Mirror, entitled "Ash test dummies," opened with the statement:

> AVIATION bosses were last night accused of taking far too long to lift the six-day flight ban. The attack came as Transport Secretary Lord Adonis admitted Britain was 'too cautious' in keeping airspace closed. BA boss Willie Walsh said: 'I don't believe the blanket ban was necessary.'

Thus, the primary news values applied during the Eyjafjallajökull air space closure were those that supported entertainment. Stories developed the conflict theme as a focus, including accusations that the closure was "unnecessary" and the response was a "shambles" (see Table 2).

Journalistic exaggeration

There remains the problem of journalistic exaggeration. During the 1989 volcanic crisis at Galeras (Colombia), footage of more spectacular eruptions from other volcanoes were used by the media to portray the actual, reported, eruption (Cardona 1997). Such sensationalist stories helped increase anxiety and confusion to aggravate the crisis at Galeras (Cardona 1997). There is a rather good example of exaggeration from the Eyjafjallajökull event. On 21 April 2010, the day airspace was reopened, the Daily Star published a front page piece entitled,

> Terror as plane hits ash cloud.

The image of a 747 with all four engines on fire was evocative. The image was taken from a TV reconstruction of the Galunggung incident of 1982, but words such as "dramatic pictures as jets get OK to defy volcano" did not make the picture source completely clear. As a result, the newspaper was removed from shops at Gatwick and Manchester airports (Plunkett 2010). The Daily Star published an apology on 17 July 2010 stating that the piece,

> May have wrongly suggested to readers that the photograph depicted a recent event … … … we apologize to readers for any misunderstanding which may have been caused by the use of the image.

Cases of exaggeration and excess are common in the tabloid world (e.g. Watson and Hickman 2010), and is a habit that needs to be borne in mind when making communications.

However, the scientist may also be guilty of exaggeration, especially when promoting results. As Woloshin et al. (2009a) pointed out a "combination of strong beliefs and self-interest" among scientists can be "an irresistible recipe for exaggeration." This tendency is likely fueled by the knowledge that public communication, such as interactions with reporters and being mentioned on Twitter, can contribute to scientific impact (Dunwoody 1986; Dunwoody and Peters 1992; Liang et al. 2014). Woloshin and Schwartz (2002), for example, found that medical journal press releases did not routinely highlight study limitations, with data often being presented using formats that exaggerated the perceived importance of findings. In a study of 200 press releases from academic medical centers, Woloshin et al. (2009b) found that (i) 29 % exaggerated the finding's importance, (ii) 26 % contained investigator quotes that overstated research importance, (iii) 24 % investigator quotes that overstated research importance, and (iii) 24 % included the word "significant" without clearly distinguishing statistical significance, thus making "the release ambiguous and liable to over interpretation."

Differing cultures

Dunwoody and Peters (1992) wrote: "when journalists meet with scientists or experts it is likely that something will go wrong." For Dunwoody and Peters (1992) the main disconnects resulted from differences in opinion on how matters of science, technology, and risk should be handled.

Dunwoody and Peters (1992) wrote: "when journalists meet with scientists or experts it is likely that something will go wrong." For Dunwoody and Peters (1992) the main disconnects resulted from differences in opinion on how matters of science, technology and risk should be handled. A study by Peters and Kruger (1987; in German: referenced in Peters 1995) showed that a vast majority (91 %) of German scientists questioned during a survey agreed that they had an obligation to actively transfer knowledge to the public. Science reporting was viewed, by the scientists, as a form of teaching among 76 % of the sample. However, the same study found that 17 % of scientists reported "rather bad", and 51 % "partly good/ partly bad", experiences following contact with journalists. Only 32 % rated contacts as "rather good". Peters (1995) argued that such problems in scientist–journalist interaction were rooted in cultural differences between the two professions. He thus set up a survey to identify the crucial reasons for disagreement during interaction between scientists and journalists. Peters (1995) found that:

- Journalists accept entertainment as a function of mass media more readily than scientists;
- Scientists have little understanding of the journalistic need to attract and fascinate readers by means of certain stylistic elements;
- While journalists have an indifferent attitude towards the goals of scientists, scientists expect the media to support their goals;
- Scientists want media to influence the public more than journalists are prepared to;
- Scientists and journalists disagree about the respective roles and the extent of control both sides should exert over the communication process;

Peters (1995) concluded that, journalists consider scientists "to be passive sources who are used by them to perform the media functions of, for example, informing and entertaining the public." In other words, journalists need to follow news values, and cannot be expected to follow the same communication protocols as apply in science.

Guidelines?

In an ideal world, when dealing with the flow of scientific information and choosing sources, the journalist would follow the guidelines given by Rowan (1999). These guidelines were drafted to help journalists when writing about science and are summarized in Appendix E. However, Rowan's guidelines were written very much for the specialist science reporter, and not for a general story reporter who has to put together a more general and wide-ranging piece under tight time constraint during an unfolding crisis.

Likewise, Miller (1986) provides guidelines for scientists to follow when talking with the media. These are a little more useful, but still are written for a scientist giving an interview for a specialist science piece with a science reporter. Such a science piece interview will likely be subject to different requirements to one made with a journalist seeking quotes for a "crisis" story. For the crisis story interview two main guidelines are:

- Be aware of developing bias and slant, and keep track of developing frames;
- Use words and concise caveats that are appropriate in a tabloid sense, but that cannot easily be exaggerated or turned into "sledgehammer" or blaming headlines.

In regards to the first point, Cassells and Lexchin (2008) argued that auditing or monitoring the quality of reporting in the press, and feeding reviews back to news outlets, may improve the informative value of these stories. Based on these observations, and those of Aspinall (2011), Johnson and Jeunemaitre (2011) and Ferguson (2013), an expanded version of Miller's guidelines are given in Appendix F.

Competition between actors

In terms of the "battle" to gain visibility when a number of issues are at stake, Murdock et al. (2003) identified six sets of actors in environmental risk communication: (i) government and state agencies, (ii) opposition parties, (iii) campaigning groups, (iv) corporations, (v) scientific and expert communities and (vi) the media. All of these groups will be "engaged in a continual contest for position and advantage in the struggle for command of public communication and attention" (Murdock et al. 2003). These are the same actor groups considered here for risk and forecast communication during the Eyjafjallajökull event and we can witness the same "struggle" unfolding (see Table 2). When involved in "competition" during an environmental crisis, Murdock et al. (2003) identified the following stakes and actions that can be implemented to defend those stakes:

1. Gain visibility. Control when and how news about strategic information enters the public domain, while controlling or suppressing potentially damaging publicity.
2. Legitimacy. Ensure that arguments are treated as credible and authoritative.
3. Precedence. Establish the dominate definition of the situation, and command the agenda and terms of debate.
4. Trust. Maintain and if possible enhance trust and support.

Fig. 11 The field of mediated risk communication as modified from the schematic of Murdock et al. (2003). The schematic also follows the organizational structure of risk communication from sources, through transmitters, to receivers, as given by Poumadère and Mays (2003). Within this framework, various stakeholders interact with each other to ultimately provide information to the media through the process of public relation communication (PR), lobbying, advice, information provision and statement of experience or opinion. In this schematic, the transmitters (*blue boxes*) provide information between each other and on into the transmitter, this being the press (*red box*)— information routes into the transmitter are given by *yellow boxes*. The transmitter then passes a representation of risk onto the recipient (*dark blue box*). However, the recipient is not a passive actor in the process, having influence through support, and communication of experience or opinion, to all precedent stakeholders.
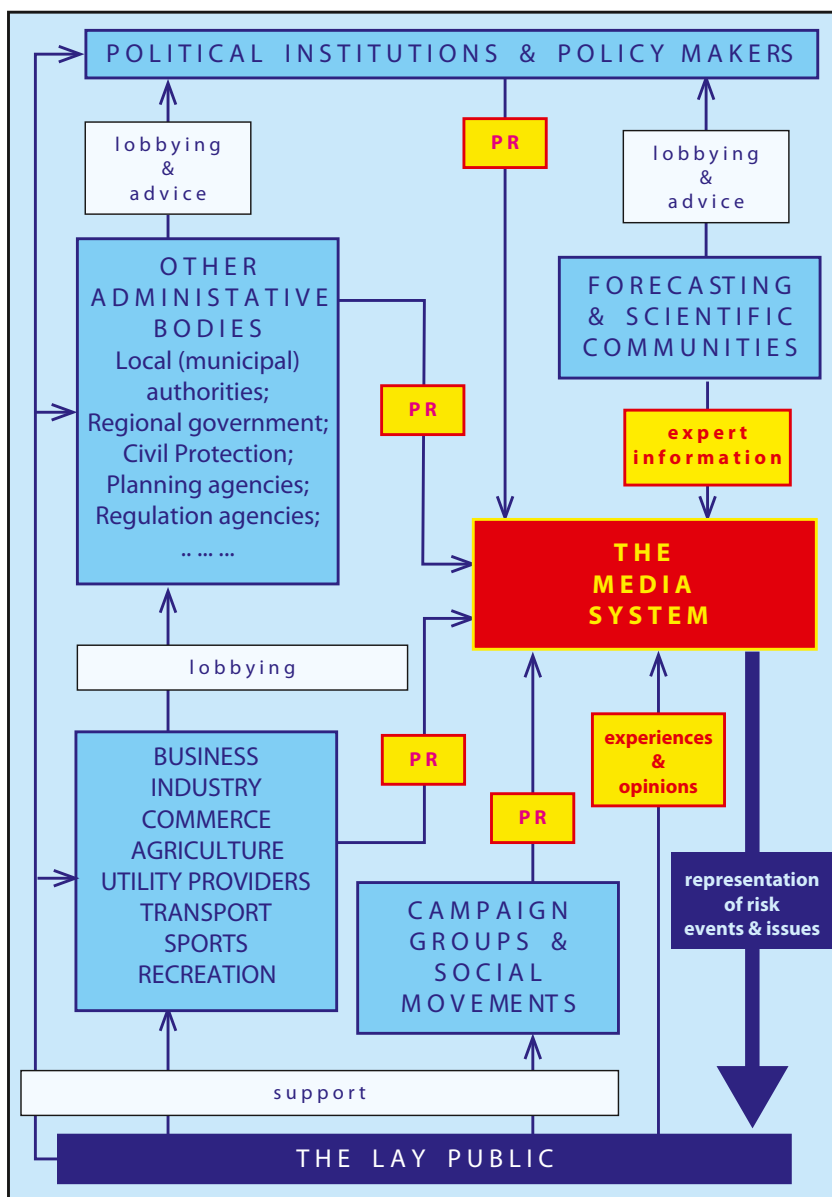
Because the forecaster is only one actor in the democratic communication process, these actions cannot be enforced. However, they can be used to guide forecast communication policy before, during and after an environmental disaster (see Part 2 of this review).

Social amplification of risk

The social amplification of risk framework (SARF) focuses on the interaction between risks and psychological, social, institutional and cultural processes which generate popular interpretations that may "heighten or attenuate public perceptions of risk and shape risk behavior" (Kasperson 1992). Within

SARF, risk amplification results from communication processes that cause relatively low risk events to become a focus of societal concern. In contrast, the process of risk attenuation causes hazards that are deemed serious by experts to be downplayed (Kasperson et al. 2003). In this process, the mass media plays a pivotal role as a "station" for relaying "signals" which construct public representations of risk (Kasperson et al. 1988); the mass media, being a major agent through which "society learns about the parade of risks and risk events" (Kasperson and Kasperson 1996). In this sense, the newspaper filter sits at the center of a communication system that operates to shape the public perception of an environmental disaster (Fig. 11). Within this framework, newspaper framing will be fundamental in amplifying or attenuating the public perception of risk, the nature of the hazard, the forecast, the

response, event impact and the result of any response. Kasperson and Kasperson (1996) argued that a particularly important element in shaping group and individual views of risk was:

> The extent of media coverage; the volume of information provided; the ways in which the risk is framed; interpretations of messages concerning the risk; and the symbols, metaphors, and discourse enlisted in depicting and characterizing the risk.

The way in which the event, forecast and response are framed by the media will thus influence the way in which the public understands risk and hazard. As a result, SARF highlights the need to understand, track and, if necessary, guide the media filter. Kasperson and Kasperson (1996) point out, for example, that the media have roles "as entertainers, risk watchdogs, gatekeepers and agenda setters" and will "cover risks selectively, according those that are rare or dramatic—that is, that have 'story value'—disproportionate coverage."

Following a study of reporting of the risks presented by genetically modified foods in the UK, Frewer et al. (2002) thus concluded that SARF was "a useful framework for beginning to explain the potential impact on risk perception of a risk event, particularly if that event is presented to the public as a new hazard occurring in a crisis context." Frewer et al. (2002) suggested that, because risk amplification is likely greater for a novel hazard not yet presented to the public in crisis context (e.g., a volcanic eruption impacting a distant population), compared with a more established hazard with which the public is familiar (e.g., weather), media reporting sometimes has amplification effects and sometimes not. They thus suggested that a proactive risk communication strategy was to "provide people with the opportunity to formulate an informed view about the risk, which is less likely to be influenced by risk information presented in a 'crisis' context."

Kasperson et al. (2004) provide a relevant example from an analysis of signals related to the siting of the nuclear waste repository at Yucca Mountain (Nevada, USA). Based on an analysis of content appearing in editorials, headlines and cartoons in *Las Vegas Review Journal*, Kasperson et al. (2004) concluded that the "overwhelming stream of messages, symbols and imagery concerning the nuclear waste repository focused on the unfairness and exploitation of the siting process and the view that political expediency reigns over objective science."

The media may thus exaggerate certain issues over others to amplify, or attenuate, a given environmental hazard, risk or disaster. During the Eyjafjallajökull eruption, there was a definite juxtaposition between the risk posed by ash in air traffic routes and the messages appearing in the newspapers. On one side, there was the very real risk posed to air traffic operations by volcanic ash and the inherent uncertainty in forecasts. On the other, there was attenuation of the risk through prominent publication of headlines, messages and imagery challenging the closure decision and focusing on the business and social losses that the closure caused.

Conclusions

During environmental disasters, newspapers have to oversimplify complex arguments. To meet news value and journalistic needs, items will be selected, shorted and rephrased. This filtering process will be guided by the agenda of the news agency (e.g. Moeller 2006; Miles and Morse 2007; Porlezza et al. 2012; Alexander 2014). In addition, the newspaper must sell. Rosten (1937) noted that "NO newspaper prints all the news." Not only would such a task be impossible, but the newspaper is neither a "chronology, an almanac, nor a history." Instead, the newspaper is "a business enterprise selling a commodity, and it must interest its customers in that commodity. The commodity is news" (Rosten 1937). The newspaper is thus not a passive medium for distributing scientific data, messages and forecasts. However, once in newspaper print, information and data are likely to become fact; thus becoming a valid data base on which readers can draw so as to shape an opinion or conclusion (e.g. Bradshaw & Rohumaa 2011). This point is made well by Cassells et al. (2003) who pointed out, for communications regarding new prescription drugs, "patients routinely cite the media, after physicians and pharmacists, as a key source of information on new drugs," even though information presented may be incomplete or lacking in quality.

Stories will be framed to catch the attention of the reader (Höijer et al. 2006). To gain the reader's attention, the media will also amplify concerns, negative effects and rows, while sensationalizing risks (Better Regulation Commission 2006). As Goldin (2009) pointed out,

> A dramatic account of how one boy committed suicide while on an anti-depressant is far more appealing to an editor's eyes (and more likely to capture readers' interest) than a carefully laid out account of scientific studies on anti-depressant drugs and their effects on teens.

This review has focused on how the newspaper presents an environmental disaster; not on how it affects the views of the readers. In terms of media presentation of health risk Schwitzer (2011) argues that,

> Because one of the gaps in the literature is an evaluation of how Americans receive, perceive, comprehend, and act on stories that include information about benefits and

harms of health care interventions a (recommended) evaluation project would be to present such stories to a random sample of Americans and follow them over time to see if they affect their behavior or well-being and how.

A follow-up review-based study, along the lines of that recommend by Schwitzer (2011), is required if we are to understand how long-term exposure to volcano news during an ongoing crisis effects the readers perception of the event, the response, the responders, the forecasts and those behind the forecasts.

Appendix A

Owner, Editor and Reporter Agenda

Bias introduced by the political, business, economic, social and/or cultural agenda of the media source is a well-known effect and has a long history. For example, in setting up of the New-England Galaxy in 1817, Buckingham (1852a) wrote,

> Soon after my first introduction to Mr. Knapp, I mentioned to him a project I had for some time entertained—namely, an attempt to publish a weekly paper to be chiefly of a literary and miscellaneous character, eschewing entirely all political partisanship. Mr. Knapp suggested the expediency of adding to the paper a department devoted to the service of the numerous societies of Freemasons, and, as I was not then a member of the Freemasons, he offered to conduct that department.

Later, of the Boston Courier set up in 1824, Buckingham (1852b) wrote,

> In politics it was proposed to be entirely independent of any attachment to either of the great parties of the time. Early associations had attached me to the Federalists, and my political sympathies, so far as there had been occasion or opportunity for their indulgence, had been exercised in favor of that party. Though the party had then ceased to exist as a distinct organization, regard for the men who had been its oracles and leaders, and my entire confidence in their political and moral integrity,

had not been diminished or weakened by the disastrous position into which they had fallen. The prominent feature intended to be exhibited in the character of the Courier was uncompromising adherence to what I believed to be the great and overwhelming interest of the country, namely, protection of infant manufacturers of cotton and woolen cloths, and to all agricultural, mechanical and manufacturing products, against foreign competition. In short, to uphold and advocate all measures that could tend to develop the natural resources of the country, and to encourage and support the operations of American labor, ingenuity, and industry. *This object was the constant and almost daily task of the editor and his correspondents*.

Emphasis added here to the final line. Buckingham clearly outlines a policy for his two newspapers that supports an inclination towards the arguments, and needs of clearly identified political groups and business interests. That is, biased reporting is implicit in the political and business interest roles that the owner intended these two newspapers to play.

Appendix B

News Values

A potential item for publication in a newspaper must generally fall into one of several categories if it is to be selected as a news story. These "news values" are listed by Harcup (2009) as being,

- The power elite:
  Stories concerning powerful individuals, organizations or institutions.
- Celebrity:
  Stories concerning the famous.
- Entertainment:
  Stories concerning sex, show business, human interest, animals, an unfolding drama or stories offering opportunity for humorous treatment, entertaining photographs or witty headlines.
- Surprise:
  Stories with an element of surprise
- Bad news:
  Stories with negative overtones, such as conflict, tragedy, chaos, confusion or suffering.
- Good news:
  Stories with positive overtones such as rescues and cures.

- Magnitude:

    Stories perceived as sufficiently significant either in terms of numbers of people involved or potential impact.
- Relevance:

    Stories about issues, individuals, groups, businesses, industries, places, regions and nations perceived to be relevant to the audience.
- Follow-ups:

    Stories about subjects already in the news.
- Media agenda:

    Stories that set, or fit with, the agenda of the news agency.

Appendix C

Blame experience of a forecaster recorded by Cialdini (2007)

Cialdini (2007) describes an experience of being phoned by a TV weatherman who asked

    Why do they blame me?

According to Cialdini (2007, p. 188) the forecaster said,

    I mean, it's crazy isn't it? Everybody knows that I just report the weather, that I don't order it, right? So how come I get so much flak when the weather's bad? During the floods last year I got hate mail! One guy threatened to shoot me if it didn't stop raining. Christ, I'm still looking over my shoulder for that one … … … They have to know that I'm not responsible.

Appendix D

Common sources of news stories used during the 2010 Eyjafjallajökull air space closure

Harcup (2009) lists 75 common sources of news stories. Here, I have extracted, from Harcup's list, those used during Eyjafjallajökull by the newspapers analyzed here. Entries in parentheses are new sources that I have had to add to Harcup's original listing. The list of Harcup (2009) begins with "academic journals". However, following content analysis of the newspapers considered here, this is a source I cannot find in any of the newspapers analyzed. I also cannot find, and thus include, three other of Harcup's sources: "news releases", "press conferences" or "universities."

News story sources during Eyjafjallajökull:

Adverts	Letters
Airports	Motoring organizations
(Airlines)	Ministers of Parliament (MPs+MEPs)
Armed forces	News agencies
Blogs	Official reports
Charities	Other media (including internet)
Colleagues	People (stranded passengers)
Companies	Political parties
Consumer groups	Pressure groups
Cuttings/diary (archived events)	Professional bodies
Entertainment industry (celebrities)	Readers/users
Eyes and ears	Regulatory bodies
Government departments	Schools
Government news network	Sports organizations
Health authorities	Transport companies
Leaks	(Travel/holiday industry)

Appendix E

Summary of guidelines given by Rowan (1999) to help journalists when writing about science

To help audiences think like scientists about science news, journalists should find out:

- What evidence, reasoning or testing supports a finding.
- What bothers, frustrates or impresses scientists about their finding.
- What parts of the puzzle remain unsolved.
- What are the best objections.
- What has to happen before the finding is viewed as established knowledge.
- What people can do to learn more.

To provide balance and accuracy in science news, reporters should:

- Learn whether a claim is widely supported by scientists.
- Find out if scientists being interviewed endorse this consensus.
- Ask whether there are important variants on the consensus view.
- Frame conflicting findings as puzzles, noting the strengths and weaknesses of key puzzle-solving efforts.

While,

- Explaining counterintuitive scientific notions by:
- Identifying lay theories that make the scientific findings seem implausible.
- Acknowledging the understandability of lay views.
- Demonstrating the lay views' limitations and the greater adequacy of the orthodox scientific theories.

Appendix F

Summary of guidelines given by Miller (1986) to help scientists communicate to the media

The following guidelines are modified from a summary prepared by Miller (1986) following a discussion between science writers and scientists at a seminar organized by the Public Information Committee of the Society of Neuroscience during May 1976. Miller (1986) writes that, although the guidelines are orientated toward the medical sciences, "they are generally applicable to problems scientists face in dealing with media." Miller (1986) added that information providers should consider themselves as providing information to a public that requires it. They thus must remember that they are doing a service for the scientific community as a whole.

Guidelines:

- Control the interview.
    By considering in advance what needs to be said, and what does not need to be said, the interview can be controlled.
- Avoiding criticism from colleagues (and giving credit to colleagues).
    Cover the subject objectively. Care should be made not to focus on, or over sell, one's own perspective and work. Due credit must be given to other workers and perspectives. There is not much space in a newspaper for lengthy citations and acknowledgements, so any such credit should be succinct, global and appropriate.
- Deliver simple exposition.
    Remember that the science writer needs to explain things simply and clearly so that the newspaper reader can understand them. Thus, statements should be made unambiguously in everyday language: "the less translation the interviewer has to do", the less opportunity there is for errors and distortion in the resulting report.
- Off-the-record and background information.
    You are always free to advise the interviewer what should be "off the record" or "for background information only." In most cases, it is a firm rule of journalism that

such statements are "never publicly attributed." But, this should be reconfirmed before making the statement.
- Preparing a written statement.
    Preparing a clear and simple written summary, ideally in newspaper format, can help the writer produce an accurate story.
- Interest and implications.
    Reporters are not free of control, so the question needs to be posed: what control do they have over creation of misleading or sensational headlines resulting from the story?
- Letters.
    A report may result in letters to the newspaper, potentially from the interviewee, the content of which can be used to correct misunderstandings and provide guidance.
- Brevity.
    Competition for page space is intense, so statements need to be made up of succinct factual statements presented simply without technical detail or ambiguity.
- Cuts: Caution about claims.
    Severe cuts will need to be made to fit space requirements, so statements that claim too much if subsequent qualifications are needed must be avoided.
- Racing the clock.
    Writers work against immediate deadlines, so they need immediate answers. They do not have time for extensive research, revisions or referral to text books or scientific journals.
- Checking what is attributed to you.
    Often, writers need a direct quote, and it may be possible to get the writer to agree in advance to check the accuracy of direct quotes. *But*, writers will not do this if time is too short for such a check. In such a situation extreme caution must be taken in the wording of statements made.
- A personal relationship.
    By observing the media, reliable writers can be identified; and unreliable writers avoided or treated with extreme caution.
- Supplying frank criticism.
    "Be candid; while trying to be perfectly fair, do not hesitate to point out that a claim made by a colleague is controversial and to suggest a good representative of the other side of the controversy" (Miller, p. 247, 1986).

Guidelines of Aspinall (2011)

Following Aspinall's (2011) observations of L'Aquila problem, we may add:

- When providing assessments and forecasts, be aware of legal implications.

- Provide evidence in writing.
- Stay within your domain of expertise.
- Give evidence that is robust under peer review and defensible in law.
- Avoid sloppy argument and casual errors.

Johnson and Jeunemaitre (2011)

Following Johnson and Jeunemaitre (2011), I add

- Recourse to results from academic research papers are not necessarily the most appropriate means for aiding with strategic management decisions, or in communicating an understanding of the decision making process.

Summation

Recommendations given here are similar to those given for football (soccer) managers when communicating with the press by Sir Alex Ferguson. The football manager has much more frequent, potentially daily, dealings with the press than the scientist; and thus has much more experience with relationships with, and giving interviews to, the press. As Liang et al. (2014) argue:

> For many researchers, communicating with the public about research results rarely entails more than a press release through their institution's public relations division, and possibly a follow-up interview with a journalist. Only a minority of scientists have been actively engaged in communicating science through popular media outlets.

However, one could argue that the football manager's responsibility is similar to that of the forecaster, being summed up as a need to be accountable for actions, decisions, mistakes, performance and result (Ferguson 2013). Thus, much can be learnt from such hardened actors. In terms of the examples of press dealings given by Ferguson (2013), a summation of points to keep in mind when talking with an interviewer is:

- Control the conversation as much as possible.
- Prepare yourself well prior to an interview or press conference.
- Be wary of specific agendas a journalist may be pursuing.
- Do not "make a fool of yourself by answering stupidly."
- Say nothing that will open you up to legal action, complaint or criticism from colleagues or other interested parties.

- Be aware that answers and quotes can be taken out of context, reworded, re-arranged, abbreviated, selected and/or re-interpreted to support a particular agenda.
- *Do not* make off the record remarks.
- Track the press for inaccuracies.
- Employ a press officer or "someone who knows the media and can act quickly on stories."
- Do not refuse to give an interview, it gives a bad impression and can help build a negative frame against the actor.

Ferguson (2013) adds to be cautious when answering short questions, such as "why were you so bad?" While long questions gave him time to prepare his answer, a "pithy enquiry" can cause elongation of response; with Ferguson (2013) adding, "you stretch it out while you're trying to think." This may cause the interviewee to say too much, muddy the key point, stray off (or loose the) point, or to give out unintended, potentially bad and harmful information. As Ferguson (2013) sums up, "don't give them a headline."

In terms of off the record remarks, a read of Watson and Hickman (2012) confirms that confidential comments should be totally avoided, because they will likely be used. Ferguson (2013) claims that off the record "doesn't exist anymore". To sell the newspaper, the journalist will be looking for an eye-catching headline and a good news story containing conflict, bad news and/or entertainment. Thus, it is important not to unwittingly give out information that will allow construction of negative frame for the forecast and of the forecaster.

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