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Persistence of scepticism in media reporting on climate change: the case of British newspapers

Abstract

This paper explores the persistence of scepticism in British newspapers' narratives around climate change. It is based on 958 news articles collected over three decades (1988-2016) from nine newspapers. The analysis of "general consensus" around climate change and the consensus around both its causes and consequences, shows that scepticism is still present in newspapers' narratives especially in relation to centre-right political orientations. The increasing consensus around both the causes and consequences does not necessarily mean that scepticism has disappeared, but it raises further questions around the modalities through which consequences, and actions to limit their impact, are represented.

Balance norm; climate change; climate polarisation; climate scepticism; media reporting.

Introduction

This paper investigates the persistence of scepticism in media reporting on climate change and if this can be explained by the political orientation of the media. The originality of this work relies on empirically exploring British newspaper reporting from 1988 to 2016 to observe potential changes in scepticism over time, especially in relation to both the attribution of causes and the evaluation of consequences. In fact, some studies highlighted that the journalistic norm of “balance” was no longer applied in climate change reporting given the prevalence of scientific consensus, nevertheless, this might not necessarily correspond to a reconciliation between “sceptics” and “advocates”. Therefore, the research question guiding this work investigates potential shifts from questioning the causes towards other aspects of climate change. The focus on British newspapers relates to the primary role played by Britain in the international politics of climate change and how its news articles are reproduced internationally (Painter and Gavin, 2015). Even though the UK newspaper industry has been challenged by changes in news production such as, for example, a migration of readers to online platforms, it is of a significant size. A report published by Mediatique (2018) shows that both print and online UK newspapers still shape the public debate and policy agenda by reaching most of the UK population. In fact, in 2017, 90% of adults in Great Britain consumed a news brand: 60% read a print newspaper and 75% an online newspaper (NRS, 2017). Even though online platforms have become an interest of social research, they have been mainly used to analyse public understanding of climate science (Koteyko, Nerlich and Hellsten, 2015; Leas et al., 2016). On the one hand, they provide information about users’ perspectives (including non-experts’ points of view, Author, 2018); on the other hand, online debates/web searches that are related to polarised issues, such as climate change (Cody et al., 2015; Pearce et al., 2014; Williams et al., 2015), might reinforce users’ existing biases as they are ideologically driven (Koutra, Bennett and Horvitz, 2015) and influenced by processes of content personalisation

(Liu and Weber, 2014). This might also be valid for newspaper consumers who tend to read newspapers that are in line with their pre-existing values (Feldman et al., 2014). However, UK newspapers were found to represent a plurality of points of view even if, as in the case of climate change, they represent a minority (Boykoff and Mansfield, 2008; Painter and Gavin, 2015). Moreover, throughout the period considered in the present study, research into social media revealed that online debates tended to reproduce traditional media discourse (Veltri & Atanasova, 2015), and that web searches were influenced by information already reported by the traditional media (Gavin, 2010; Gavin & Marshall, 2011; Kirilenko and Stepchenkova, 2014; Lineman et al., 2015). Furthermore, climate experts appeared to be less involved in disseminating information online (Schafer, 2012). Moreover, despite some successful mobilisation campaigns on social media, climate change organisations tended to consider their online communication successful if they attracted news media attention (Schafer, 2012). Finally, some events (e.g. the Climategate scandal related to the release of emails hacked from the University of East Anglia) show that debates which originated online were reproduced by print media. This further supports that the newspapers are more comprehensive in terms of both reporting existing online discourse and introducing issues/content to the public agenda (Hellsten & Vasileiadou, 2015). Therefore, given the existing interconnections between traditional and new media, and the relevant role played by both print and online newspapers in informing public opinion around climate change, the investigation of newspapers' content is valuable in understanding their contribution to public knowledge about the phenomenon.

The first section of this article reviews the literature on media polarisation around climate change. The second section and its related sub-section introduce the methods used for analysing British newspapers. The fourth section and its related sub-sections report the results of three regression analyses aimed at exploring changes in media reporting across three time-blocs, also

considering the political orientation of newspapers. Finally, some considerations and conclusions are drawn.

Study background

One recurrent theme in the debate on news media reporting on climate change is the conflict between “contrarians” and “advocates”, especially in both the USA and the UK (McKnight, 2010; Painter and Ashe, 2012; Painter and Gavin, 2015). The cause of this polarisation is mainly attributed to the space given by the media to contrarian voices even though they represent a minority (Akerlof et al., 2012; Boykoff, 2013; Freudenburg and Muselli, 2010; Rahmstorf, 2012) in comparison to mainstream scientists (Boykoff and Boykoff, 2004; Moser and Dilling, 2004; Tosse, 2013).

When the climate change debate started in 1988, the UK press represented the phenomenon as a multidimensional and collective problem caused by both humans and natural processes. Then, the media representation of climate change shifted towards the uncertainty around both causes and effects (Nerlich and Jaspal, 2014). According to Carvalho (2005, 2007), the increasing politicisation of climate change led conservative narratives to defend government interests, and the progressive ones to oppose government proposals. In contrast, the study conducted by Matthews (2015) between 2000 and 2010 found that the UK press represented climate change as a process in action with tangible effects and future risks/threats. The multiplicity of studies devoted to analysing “conflict frames” adopted by the media produced controversial results. Some studies found that the journalistic principle of “balance” in climate change reporting was a peculiarity of a starting phase (Boykoff and Boykoff 2004), which almost disappeared over time in both the US and the UK (Boykoff, 2007). However, a study of four UK tabloids between 2000 and 2006 (Boykoff and Mansfield, 2008) showed that the balance norm was still characteristic of tabloid reporting. Moreover, Painter and Gavin (2015) showed a larger

representation of sceptical sources in the English context, compared to that reported by Boykoff (2007). Other studies showed that UK newspapers have progressively embraced consensus focusing on “action frames” (Grundmann and Krishnamurthy, 2010; Nerlich, Forsyth and Clarke, 2012). This controversy might be attributed to coding divergences. For example, Rice, Gustafson and Hoffman (2018) suggest that in some cases the "conflict frame" is strictly defined as a division between "supporters" and "deniers" (Takahashi et al., 2017), whereas in other cases, uncertainty and controversy are used as synonyms (Kuha, 2009; Zehr, 2000). However, these contradictory results might be explained by a shift (Hiles and Hinnant, 2014) from reporting disagreement around the causes towards the consequences of climate change and the related intervention needed. Given these premises, the general research question related to potential changes in sceptical narratives of climate change, was articulated into three sub-questions:

Has the overall scientific consensus around climate change increased over time?

This RQ is motivated by those findings that show that the balance norm is no longer prevalent in the context of climate change, because newspapers have embraced scientific consensus (Boykoff, 2007; Boykoff and Boykoff, 2004). However, these studies mainly focus on the existence/causes of climate change. This might indicate that the consensus around the anthropogenic nature of climate change has increased, but also that scepticism might have started to bring into question other aspects of climate change. This point is connected to the second RQ:

Is the representation of scientific consensus related to the anthropogenic nature of climate change?

This RQ explores potential explanations for previous findings related to the increasing consensus around climate change. However, several studies (Boykoff and Mansfield, 2008;

Carvalho, 2005, 2007; Painter and Gavin, 2015) also attributed the differences in media reporting to the partisan nature of climate change and the political orientation of newspapers (Antilla, 2005; Dirikx and Gelders, 2010; Schmidt and Schäfer, 2015).

This supports the third RQ that investigates potential new trajectories of climate change scepticism in relation to the political orientation of newspapers:

Have centre-right newspapers shifted towards questioning the consequences of climate change?

This RQ is motivated by recent studies that found new expressions of scepticism in newspaper reporting related to the impact of climate change, which, if real, might be beneficial (Painter and Ashe, 2012; Painter and Gavin, 2015). This shift might explain an increase of overall scientific consensus in news reporting over time as suggested by some studies (Grundmann and Krishnamurthy, 2010; Nerlich, Forsyth and Clarke, 2012). In fact, the simultaneous increase in adopting scientific consensus frames around causes, and disagreement around consequences might result in a "false" unchanged overall level of consensus.

Methods

A framing analysis of 958 news articles retrieved from nine British newspapers between 1988 and 2016 was conducted. The newspapers were selected in relation to their circulation and presence on the market throughout the period (<https://www.statista.com>). Given the ordinal nature of the variables (measured using a five-point scale), the relation between frame elements and the political orientation of the newspapers (dichotomous variable)/bloc of years (ordinal variable) was investigated through ordinal regression analyses. The choice of this model instead of a linear regression was motivated by the ordinal nature of the dependent variable, which was measured by a five-point scale. Moreover, this choice was further supported by performing a linear regression analysis, which, however, did not aid in interpretation.

The present study operationalises the following three frames:

- i) “general consensus” (five ordered categories: consensus, partial consensus, neutral, partial scepticism and scepticism), which relates to the overall representation of the problem (Table 1);
- ii) “causation” (five ordered categories: anthropogenic, mostly anthropogenic, balanced, mostly natural and natural), which was built upon the “balance frame” developed by Boykoff and Boykoff (2004) to evaluate the consensus around the causes of climate change (Table 1);
- iii) “consequences” (five ordered categories: certain, mostly certain, balanced, mostly uncertain and uncertain), which relates to the recognition of climate change consequences (Table 1).

To observe the prominence of the text that is connected to the consequences in the articles, the position of the first paragraph in which the consequences are discussed (as certain or uncertain) was identified. To determine the position of the text, the ratio between the paragraph in which the consequences are mentioned and the total number of paragraphs was calculated. This made it possible to determine if the paragraph appears either in the first or second half of the text. Moreover, the mention of the consequences in the title was considered.

Around 10% of the entire sample (92 items) was independently coded by a second researcher. Despite the relatively small sub-sample considered, the Krippendorff alpha was calculated following the guidelines provided by De Swert (2012) who suggests coding ten percent of the complete dataset. An inter-coder reliability of .87 per general consensus, .71 per causation, and .85 per balance, was achieved meeting accepted criteria for inter-coder reliability (Hayes and Krippendorff, 2007).ⁱ

Sample criteria

The sample consists of 958 news articles retrieved from nine British newspapers and their Sunday and online versions. Both news and editorials were included to explore the extent to

which the articles reflect editorial lines. Hallin and Mancini (2004, p. 208) present the British press (2004) as a mirror of the divisions in politics. They argue that partisan orientations can be found in news content (see also Curtice, 1999). However, the literature highlights the difficulty in attributing a precise and undisputable political orientation to newspapers (Edwards & Cromwell, 2006). This is why the sample was split into two macro-groups and labelled as "centre-right" (CR) and "centre-left" (CL). The political orientation was attributed to newspapers by adopting the classification provided by YouGov in 2017.

The keywords "climate change", "global warming" or "greenhouse effect" (Carvalho, 2007) were used to retrieve the news articles from the Nexis/Lexis database. Only those articles containing keywords-related terms ("climate/climatic", "warm/warming", and "greenhouse/greenhouse effect") in the headline were retained. Once letters and duplicates were removed, the remaining 9789 items were grouped into three blocs of ten years (with the last bloc consisting of 9 years) (see Table 3). The rationale for comparing three ten-year blocs related to the necessity of coding a reasonable number of articles that might still be representative of the entire bloc-population. The first bloc starts with the IPCC institution and the emergence of the climate change issue in public debate and it ends with the definition of the Kyoto Protocol. Therefore, both the end of the first bloc and the start of the second bloc correspond to an historical moment for climate change discourse due to the establishment of binding targets for the reduction of greenhouse gases (Carvalho, 2007). Moreover, the literature highlights that in 2006/2007 optimism (in terms of the potential benefits deriving from climate change) disappears from more conservative UK newspapers (replaced by catastrophe discourse) (Doulton and Brown, 2009). Finally, the Paris Conference (December 2015) is an historical shift in climate discourses in relation to the definition of responsibilities and binding and tailored targets (Kinley, 2017).

These shifts, documented in the literature as drivers for change in climate discourses, delineate the time-periods that make it possible to observe potential differences across the three blocs.

The final sample was generated as NItems/NSample and chronologically extracted (Boykoff and Boykoff, 2004). This made it possible to respect the fluctuation in the number of articles over the entire period (the sample was larger in years with higher news coverage, see Table 3). The sample reflects the real disproportion between the number of articles published by CL and CR-leaning newspapers.

General consensus around climate change

The analysis aimed to understand what degree of “general consensus” (ordinal dependent variable) news articles tend to adopt in relation to their political orientation and their membership in a specific bloc of years. The negative log-log link function was considered appropriate, also given that the Pearson and Deviance goodness-of-fit measures of this model showed non-significant levels (positive skewness=2.17) (Winship and Mare, 1984). Table 4 shows that the three blocs of years do not have a statistically significant effect on the different degrees of consensus. In contrast, the proportional odds model shows a positive effect for predictor political orientation CR ($\beta=.979$, $p<.001$). Therefore, holding blocs of years constant, the odds of a CR article to tend to scepticism rather than consensus is 2.7 times higher than CL articles. To answer the first RQ, related to the “general consensus” of newspapers’ narratives, there is no significant effect of blocs of years on potential shifts in scientific consensus. However, in addition to a higher probability of consensus/neutral categories than scepticism, the higher probability of both “partial consensus” and “partial scepticism” compared to “complete scepticism” indicates that there is a general scientific consensus around the causes or existence of the problem, but some articles either deny or are uncertain around the consequences of climate change or the need for intervention.

The distribution of the different degrees of consensus adopted by the newspapers in relation to their political orientation (Figure 1) shows that in both cases consensus/partial consensus prevails (with a dramatic gap between the two groups), but scepticism/partial scepticism is a peculiarity of the CR-leaning newspapers. This suggests that both groups tend to give more space to “consensus”. However, in the CR newspapers, almost the half of the articles either adopts a sceptical, partially sceptical or neutral frame to approach the problem.

Anthropogenic causes of climate change

To explore the effects of the political orientation of newspapers and blocs of years on the consensus around causes, the choice of an ordinal regression was appropriate in relation to the ordinal nature of the dependent variable (Winship and Mare, 1984).

Table 5 shows that only the first bloc of years (1988-1997) has a significant effect on the causation frame. Holding the political orientation constant and given its estimate value ($\beta=1.525$), the odds for the first bloc being in a natural causation category increase by 4.6 times in comparison to the third bloc. In this case, the log-ordered model shows a negative, but not significant effect for predictor political orientation CR ($\beta=-.429$; $p>.05$).

To answer RQ2, this result supports an increasing tendency to recognise the anthropogenic causes of the problem in the third bloc regardless of the newspapers’ political orientation. However, observing the distribution of the categories related to causation over the three blocs (Figure 2), half of the CR sample represents anthropogenic causes, and the remaining half is split into not considering the causes (29%), representing climate change as natural/mostly natural phenomenon, and balancing the natural and anthropogenic causes. In the third bloc, the recognition of anthropogenic causes slightly increases, supporting a growing recognition of human-induced climate change. In contrast, in the CL-leaning group (Figure 3) the attribution of climate change to natural causes represents a negligible percentage that tends to disappear over time. There is also a slight decrease in representing anthropogenic causes and an increase

in not mentioning the causes anymore. This might be explained by the fact that climate change has been progressively recognised as “human-induced” and there is no need to debate the causes anymore (Grundmann and Krishnamurthy, 2010; Nerlich et al., 2012).

Consequences of climate change

The analysis of the effects of political orientation and blocs of years on consensus around consequences shows statistically significant differences between CL and CR-leaning newspapers. The ordinal regression model based on negative log-log-link function appears to fit the data (positive skewness=2.22), given values higher than .05 for the Pearson and Deviance goodness-of-fit measures. Observing the distribution of consensus around consequences over time in relation to political orientation (Figure 4),ⁱⁱ an increasing adoption of all the categories included in this frame over time is observed for the CR newspapers. However, both certain and mostly certain consequences prevail over the entire period. In contrast, the adoption of certainty is higher for the CR-leaning newspapers with a decrease in the third bloc, and a slight increase in adopting uncertainty frames. Table 6 shows that the first bloc of years has a significant effect on the consequences frame. The odds for the first bloc being in a higher uncertainty category increase by five times in comparison to the third bloc, indicating a higher probability of uncertainty in the first period. Moreover, the model shows a positive effect for predictor political orientation CR ($\beta=1.61$; $p<.01$), indicating that, holding the bloc of years variable constant, the odds of a CR article to tend to uncertainty rather than certainty are five times higher than the odds of an article with CL orientation.

These results indicate that even though certainty prevails across the three blocs, there is a higher probability of representing uncertainty in the first period, and that CR-leaning newspapers are more likely to represent uncertainty around consequences compared to their counterparts.

Figure 5 shows the percentage values relative to the adoption of different categories included in the consequences frame by the two groups. It shows that 72% of articles belonging to CL-

leaning newspapers refer to certain or mostly certain consequences; whereas in the case of CR-leaning newspapers half of the sample is split between uncertain/mostly uncertain consequences (24%), balanced reporting (11%), or does not consider the consequences (16%). This result supports that conservative newspapers tend to give more space to sceptical positions compared to their marginal weight in the scientific debate not only in relation to the causes (Boykoff and Boykoff, 2004; Carvalho, 2007), but also to the consequences. However, the uncertainty/negation of consequences does not significantly increase across the blocs.

Finally, observing the position of the paragraphs related to consequences in the text, the mention of consequences as certain appears in around the first third of the article for the CL (on average included in the sixth paragraph) and the first quarter of the CR (on average included in the tenth paragraph). However, while the CL keeps this value constant across the three blocs, the CR tends to move the discussion of the consequences as certain to the middle of the article (from the sixth paragraph on average in the first bloc towards the twelfth paragraph in the third bloc). In contrast, when uncertainty prevails the articles tend to shift the discussion of consequences in the first half of the text (from the twelfth paragraph on average in the first two blocs towards the eighth paragraph in the third). This suggests that across the three blocs the CR tends to incorporate a discussion of real consequences in the middle of the article, whereas it gives prominence to paragraphs related to the uncertainty of consequences in the third bloc. In both groups, there is a tendency to mention the consequences in the title when discussing the consequences in the text (55% of cases for the CL and 53% for the CR). For the CR the percentage of articles that include the consequences in the title if they discuss uncertainty in the first half of the text is slightly higher compared to discussing them in the second half (44% in the first and 33% in the second half). However, this is also valid when discussing certain consequences. In fact, 57% of the items that mention certain consequences in the first half of the article and 48% of the mentions in the second half also contain the consequences in the

title. This suggests that the titles tend to direct attention to the consequences (either certain or uncertain). However, the literature highlights that the prominence of the information increases if it is presented between the first 5 or 10 paragraphs of a story (Fico, Richardson and Edwards, 2004). Given that in the third bloc the CR articles give more chances of visibility to uncertain consequences, and a shift towards the twelfth paragraph when considering certain consequences, this might suggest an increasing relevance given to the uncertainty of consequences.

Discussion

CR articles showed a higher tendency to adopt sceptical frames rather than consensus compared to their counterparts. This supports the literature relating to the existence of two contrasting narratives rooted in the political nature of the problem (Feldman et al., 2014; Hart and Nisbet, 2012; Jamieson and Hardy, 2014; Hmielowski et al. 2013; Zhao, Rolfe-Redding and Kotcher, 2016). At the same time, it also shows that the CL group is not “immune” from reporting scepticism. However, the distribution of the consensus frame showed a “balance” for the CR-leaning group, given that half of the sample adopts consensus/partial consensus; and the second half ranges from sceptical to neutral positions. The sceptical/partially sceptical frames alone represent more than 30% of the sample. A plausible explanation for the use of uncertainty/conflicts might be connected to a potential attempt to increase “confusion” in the public understanding of the phenomenon. This is also supported by the “over-representation” of scepticism, given that sceptical opinions represent a minority in climate science (Boykoff, 2013; Freudenburg and Muselli, 2010; Rahmstorf, 2012; Tosse, 2013). Despite an overall stability of “general consensus” throughout the period, the odds of an article using either “partial consensus” or “partial scepticism” instead of “scepticism” suggest a higher probability of representing both “uncertainty around” and “denial of” consequences/need for action. In fact, the definition of “partial consensus” included consensus around both the existence and

causes of the phenomenon and uncertainty around consequences or intervention; whereas “partial scepticism” included consensus around both the existence and causes of the phenomenon, and denial of consequences or intervention. This indicates that, despite a significant probability of the right group being more sceptical compared to the centre-left, consensus is prevalent. However, beyond a complete denial of the problem (a peculiarity of the CR), some articles specifically question climate change consequences or intervention on it. This result indicates a shift in questioning different aspects of climate change over time (Hiles and Hinnant, 2014). This is confirmed by the analysis of both causation and consequence frames. To answer RQ2, the decrease in attributing natural causes to climate change for the CR and the increase in not mentioning the causes anymore for the CL indicate an increasing recognition of “human-induced” climate change, and no need to debate the causes anymore (Grundmann and Krishnamurthy, 2010; Nerlich et al., 2012). Therefore, an evolution from questioning the causes of the phenomenon (first bloc) towards recognising its anthropogenic nature (third bloc) was observed, regardless of the political orientation of the newspapers. This is in line with those findings that already highlighted an increasing consensus in climate narratives around the existence of the phenomenon and its causes (Boykoff, 2007; Gibson, Craig and Harper, 2015; Grundmann and Scott, 2014; Jang and Hart, 2015). However, given that the overall consensus has not changed over time, the explanation should be sought in an evolution towards questioning other aspects (e.g. intervention), as supported by the analysis of the consequences frame. Accordingly, to answer RQ3, related to an increase in questioning the consequences of the phenomenon, the model showed no significant changes in reporting certainty around consequences over time. In contrast, a decrease of uncertainty/denial is suggested. However, as in the case of “general consensus”, the results confirm a significant difference between the CL and CL-leaning newspapers. In fact, the CL-leaning newspapers tend to represent the consequences as certain or mostly certain. In contrast, half of the CR-

leaning articles range from uncertain/mostly uncertain consequences, balanced reporting, and not reporting the consequences, suggesting a polarisation and a tendency for conservative newspapers to give more space to sceptical positions (Boykoff and Boykoff, 2004; Carvalho, 2007). This is further supported by a tendency of the CR in the third bloc to give visibility to the uncertainty around the consequences by positioning the discussion in the first half of the articles. Finally, interpreting these findings in light of the “general consensus”, which indicated a higher probability of questioning either consequences or intervention compared to the denial of climate change as a whole, further research around the shift of sceptical strategies towards questioning the need for action against climate change is needed. These results are in line with previous theoretical explanations provided by the literature. Accordingly, they suggest the complex and controversial nature of media reporting of climate change, which in turn can be influenced by specific political orientations (Rice et al., 2018). In fact, if the analysis was limited to “scepticism around causes and consequences” without distinguishing between the political orientations of newspapers, it would have resulted in newspapers increasingly adopting consensus-oriented narratives. Instead, analysis of general consensus revealed that sceptical strategies have evolved over time by shifting the focus towards other aspects. Therefore, the emergence of “impact sceptics” (Painter and Ashe, 2012; Painter and Gavin, 2015) might have produced a shift in recognising climate change, towards questioning not only the entity of consequences (potentially beneficial, or by contrast, out of human control), but also the intervention needed. This might be also explained by the media focus on the political dimension of the phenomenon (Jaspal, Nerlich and van Vuuren, 2016; Ric, Boykoff and Pielke Jr., 2011), which relates to the strategies of intervention proposed by different political forces. At first glance, the lack of an increase in questioning the consequences might appear in contrast with the pioneering role of the UK in implementing a national climate risk assessment (included in the Climate Change Act, 2008), a UK National Adaptation Programme (DEFRA,

2013) and the establishment of the UK Climate Impacts Programme in 1997. However, the integration of adaptation into climate policies might support a shift towards questioning the political intervention rather than the consequences per se. This is further supported by an interest shown by UK media in adopting “action frames” when reporting on climate change (Grundmann and Krishnamurthy, 2010; Nerlich, Forsyth and Clarke, 2012) and, therefore, a politically-oriented perspective. The quantitative approach confines the analysis to a descriptive level. However, this limit might be overcome in future research by adopting mixed approaches that can show the nuances of scepticism in media reporting on climate change.

Conclusion

The increasing consensus around both causes and consequences over time does not mean that scepticism has disappeared. Analysis of the overall consensus around climate change shows that sceptical arguments are still present in the debate, suggesting an “inverse disproportion”. In fact, sceptics represent a negligible component of the scientific debate. Despite a persistence of contrasting narratives rooted in the political nature of the problem, this study also highlighted that the CL group is not “immune” from reporting scepticism. Further research might shed light on the potential effects produced by the penetration of scepticism even in newspapers that tend to support scientific consensus.

Moreover, these findings raise questions around the representation of actions needed to limit climate change impact. This requires further research in terms of qualitatively analysing the news articles to identify how climate change consequences are represented by newspapers, and the related actions invoked. This represents a limit of this work that, in defining the “consequences frame”, assumed that the recognition/denial of consequences was associated with a demand/rejection of action. In fact, the certainty of consequences might not necessarily imply that intervention is needed, if, for example, these consequences are represented either as “out of human control” or beneficial. Nevertheless, CR narratives are still more oriented to

scepticism compared to their counterparts and despite an overall consensus around scientific advances. Therefore, this study suggests that scepticism concerns not so much the consequences per se, as the (non)intervention needed to deal with them. Accordingly, this paper showed that there is a need to isolate potentially different “targets” of scepticism, e.g. by isolating and exploring scepticism around intervention.

Finally, in contrast to what happens in other contexts, this study suggests a prevalence of CL reporting on climate change in comparison to their counterparts. In fact, studies in the USA showed that the coverage of climate change was higher in conservative cable news. This higher coverage was also found to be dismissive (Feldam et al., 2012), and associated with both incidental mentions of the phenomenon and several unrelated stories (Ahern and Forme, 2016). As noted, the present study focuses on news that mentions climate change-related keywords in the headlines, hence, excludes those pieces that could incidentally mention the problem when discussing different issues. However, this potential difference between contexts and media deserves to be further explored by studies on media trends in climate change coverage.

In conclusion, it should be acknowledged that this study does not make a distinction between news and opinion pieces, and this might influence the results, as suggested by Brüggemann and Engesser (2017). However, the aim of this paper was to analyse how newspapers construct climate change narratives, and this includes opinion, editorial, and comment articles.

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General consensus frame

1. Consensus frame: general recognition of scientific consensus around causes, entity, consequences and need for intervention

Example: "A survey [...] reveals a consensus that reductions of 40 per cent in carbon dioxide emissions are [...] feasible [...]. [This] would be the first step in bringing global warming to a halt" (Fagan, 1990).

2. Partial consensus: recognition of scientific consensus about causes and existence, uncertainty about entity of consequences/types of actions to be taken

Example: "[The report] focuses on the costs associated with keeping warming below 2 degrees C [...]. That number [...] may be changed or deleted altogether in Berlin" (Associated Press, 2014).

3. Neutral frame: No specific position expressed

Example: "The report [...] concludes that the heating [...] is between 0.3C and 0.6C, which is compatible with greenhouse warming models but might as easily be explained by climatic variation" (Hawkes, 1990).

4. Partial scepticism: recognition of scientific consensus around causes or existence, negation of consequences, no intervention is needed

Example: "there are only theories as to why the Earth has warmed so much slower in the past 15 years [...]. The models may have been wrong" (The Times, 2013).

5. Sceptical frame: Presentation of the problem as controversial in all regards, a conflict between different parties

Example: "One of the enduring myths of our time is that [...] global warming is supported by 'the world's top 2,500 climate scientists'" (Booker, 2009).

Causation frame

1. Anthropogenic: anthropogenic global warming exists, clearly distinct from natural variations

Example: "'There is widespread evidence of anthropogenic warming" (Connor, 2006).

2. Mostly anthropogenic: both sides are presented, but the emphasis is on the anthropogenic nature of global warming, distinct from natural fluctuations

Example: "60 per cent of methane originates from human activity, the rest coming from wetlands and other natural sources" (AFP & Plummer, 2016).

3. Balanced: balanced account of both anthropogenic and natural global warming

Example: "If a man [...] shows me a graph and says it proves that the planet is getting warmer because of the effects of man-made carbon emissions, I tend to believe him. [If] another man [...] says that [...] climate change is caused by sunspots, not CO₂, then I'm swayed by him, too" (Redford, 2009).

4. Mostly natural: both sides are presented, but the emphasis is on the natural fluctuations as cause of global warming

Example: "A survey of meteorologists and geologists showed that [...] only 19 per cent thought that man-made causes were responsible" (Hartston, 1997).

5. Natural: natural fluctuations as cause of global warming

Example: "[The] tsunamis [will] remind the world that natural disasters are [...] acts of nature that have no human cause" (Clark, 2005).

Consequences frame

1. Certainty: the consequences of climate change exist, and they will affect the "status quo"

Example: "Without urgent and decisive action, it is going to have a damaging impact on every one of us" (Blair, 2007).

2. Mostly certain: uncertainty around the entity of consequences, but emphasis on their existence

"the world will warm [...], there's still a level of uncertainty about how much" (Zolfagharifard, 2014).

3. Balanced: balanced account of debates surrounding the existence/entity of the consequences of climate change

Example: "the Met Office projected that as greenhouse gas emissions increase the world's temperature will be 0.54 degrees warmer than the long-term average by 2016. Now its new experimental computer model [...], shows that rises will be 20 per cent less than feared" (Webb and Smith, 2013).

4. Mostly uncertain: uncertainty around the entity of the consequences, but emphasis on the dubious nature of the claim that the consequences of climate change will be negative

Example: "overall rising carbon dioxide levels could be beneficial" (Beall, 2016).

5. Uncertainty: the consequences of climate change are not predictable/not exist

Example: "There is no proof that global warming on an alarming scale is actually happening" (Phillips, 2006).

Table 1. Variables included in the frames adopted to explore newspapers' articles

Newspaper	Political alignment	N Items
Daily Mail	CR	81
Daily Mirror	CL	15
The Daily Express	CR	18
The Sun	CR	5
The Times	CR	74
The Daily Telegraph	CR	76
The Guardian	CL	411
The Observer	CL	45
The Independent	CL	233

Table 2. Newspapers included in the study

Years	Items	Sample*	Items centre-right	Items centre-left
1988-1997	396	197	36	161
1998-2007	1933	389	88	301
2008-2016	7460	372	112	260
Total	9789	958	236	722

*95% confidence level and 5% margin error. The confidence levels are calculated according to the normal distribution

Table 3. Sample of articles per bloc of years and political orientation

Dependent Variables	B	Std. Error	Odds Ratio
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Consensus	.611*	.095	1.84
Partial consensus	2.557*	.195	12.90
Neutral	3.622*	.295	37.41
Partial scepticism	4.605*	.409	99.98
Scepticism	Ref.		
Independent Variables	B	Std. Error	Odds Ratio
1988-1997	-.489	.264	0.61
1998-2007	-.006	.144	0.99
2008-2016	Ref.		
Centre/right	.979*	.234	2.66
Centre/left	Ref.		
Model Fit: chi-square=117.181 (p=0.000); Goodness of Fit: Person chi-square=22.205 (p=.074); Deviance chi-square=21.649 (p=.086); Nagelkerke=.184			
*p<0.001			

Table 4. Political Orientation and bloc of years effects on consensus (N article =958)

Dependent Variables	B	Std. Error	Odds ratio
Anthropogenic	2.893*	.293	18.0
Mostly Anthropogenic	3.649*	.346	38.4
Balance	5.884*	.795	359.2
Mostly natural	8.177*	1.449	3558.2
Natural	Ref.		
Independent Variables	B	Std. Error	Odds ratio
Centre/right	-.429	.901	0.7
Centre/left	Ref.		
1988-1997	1.525*	.510	4.6
1998-2007	-.717	1.052	0.5
2008-2016	Ref.		
Model Fit: chi-square=85.042 (p=0.000); Goodness of Fit: Person chi-square=18.290 (p=.194); Deviance chi-sqaure=19.654 (p=.141); Nagelkerke= .196			
*p<0.001			

Table 5. Political Orientation and bloc of years' effects on causation (N=746)

Dependent Variables	B	Std. Error	Odds Ratio
Certainty	2.095*	.194	8.13
Mostly certain	3.332*	.289	27.99
Balance	4.487*	.437	88.85
Mostly uncertain	5.589*	.611	267.47
Uncertain	Ref.		
Independent Variables	B	Std. Error	Odds Ratio
1988-1997	1.633*	.222	5.12

1998-2007	.255	.356	1.29
2008-2016	Ref.		
Centre/right	1.610*	.278	5
Centre/left	Ref.		
Model Fit: chi-square=232.308 (p=0.000); Goodness of Fit: Person chi-square=16.965 (p=.258); Deviance chi-square=16.461 (p=.286); Nagelkerke= .303			
*p<0.001			

Table 6. Political Orientation and bloc of years' effects on consequences (N=758)

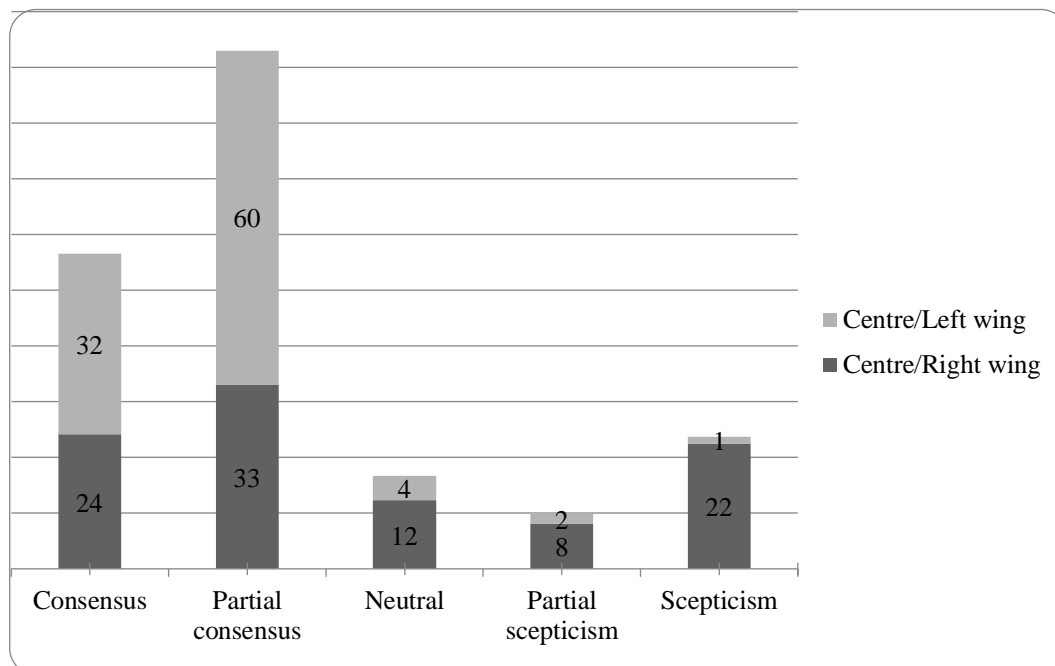


Figure 1. Percentage of general consensus frames adopted to describe climate change

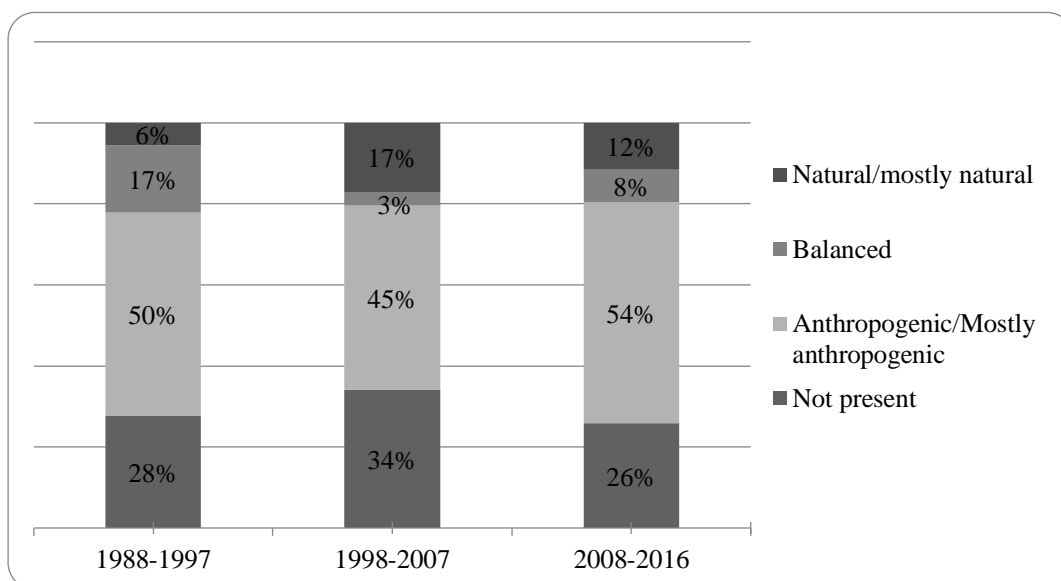


Figure 2. Centre/right-leaning news articles' distribution of causation frame over the three blocs of years (percentage values calculated on the total amount of frames adopted by the group per bloc of years)

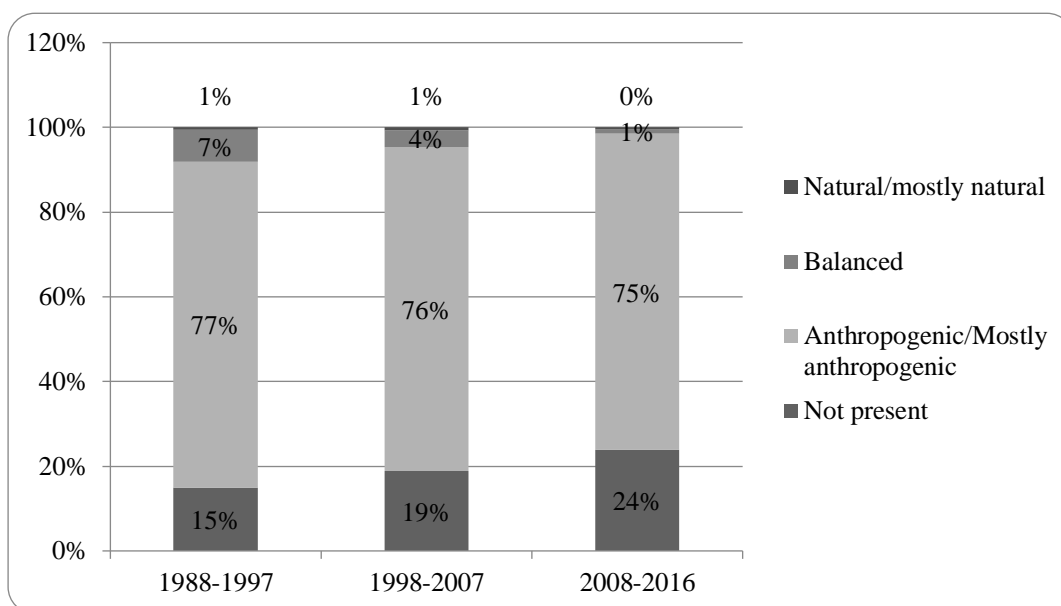


Figure 3. Centre/left-leaning news articles' distribution of causation frame over the three blocs of years (percentage values calculated on the total amount of frames adopted by the group per bloc of years)

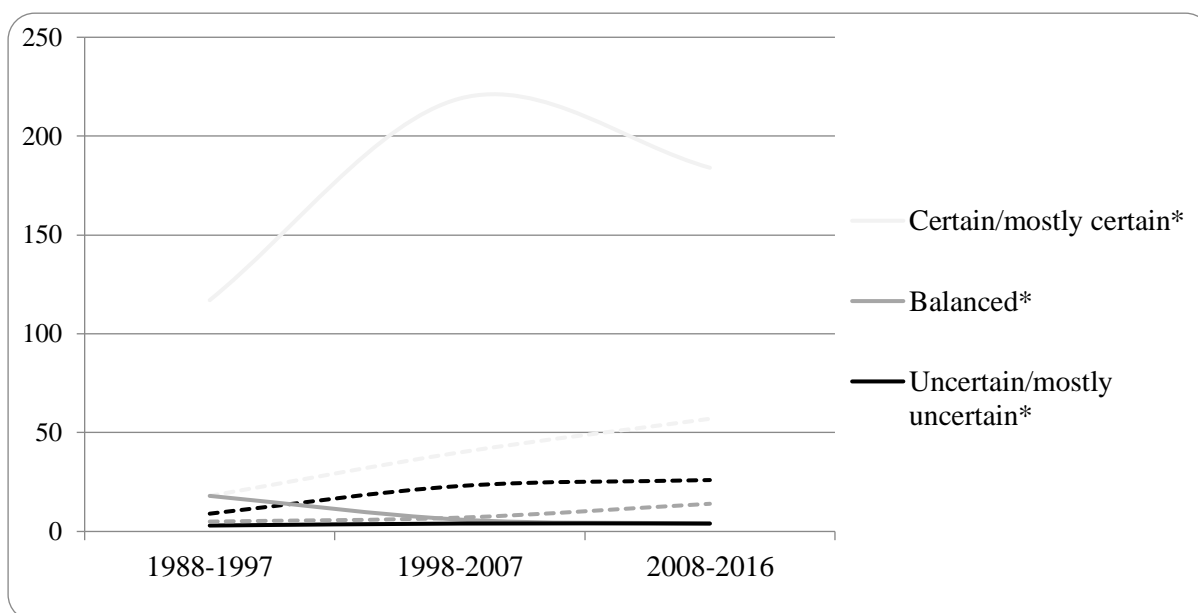


Figure 4. Consequences frame distribution over time

*The continuous line refers to centre/left-leaning newspapers; the dashed line to centre/right-leaning

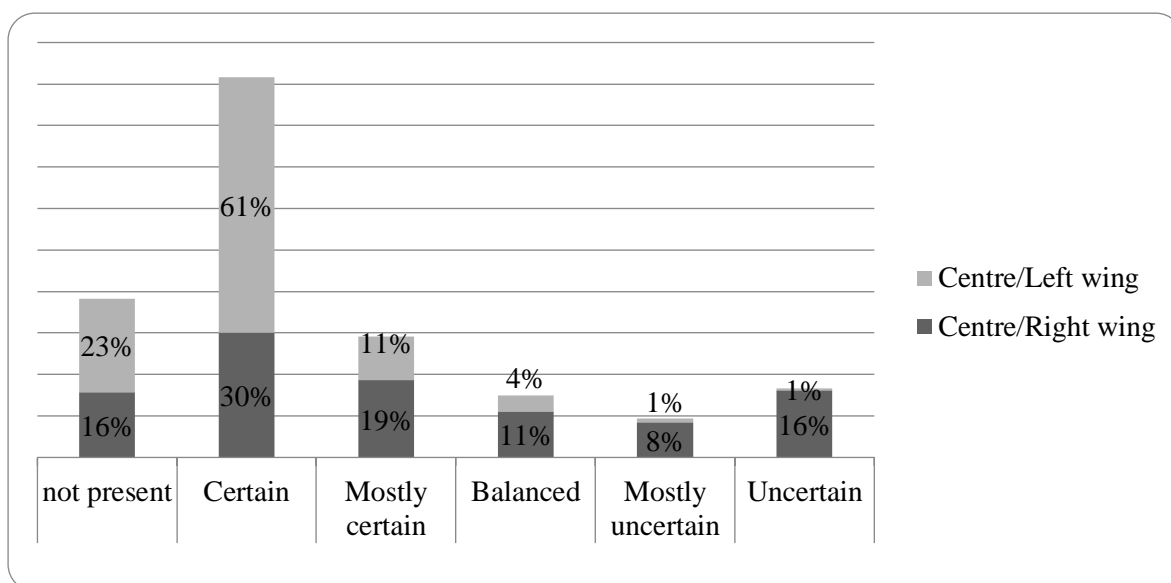


Figure 5. Distribution of categories adopted to describe climate change consequences

ⁱ Krippendorff's alpha measured the inter-rater reliability by considering the ordinal nature of the variables. For the causation frame, the lower value depends on the fact that often articles do not refer to causation explicitly but mention either "man-made climate change" or human activities (e.g. industrial production). This point was discussed and clarified by the two coders.

ⁱⁱ The "not present" category is not included in this figure.