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Media representations of uncertainty about climate change

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MEDIA REPRESENTATIONS OF UNCERTAINTY ABOUT CLIMATE CHANGE

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Abstract

This commentary first explains why it is important to study media representations of uncertainty around climate change. It then surveys the extensive literature on climate change and the media, and within this, the two bodies of scholarship relevant to media representations of uncertainty: i) 'uncertainty' as a dominant frame or discourse in media treatments; and ii) the presence of scepticism, in its various manifestations, in traditional and new media.

The commentary then shows how the four submitted works have added to the existing literature: i) they have deepened understanding of the country differences between a wide variety of 'Anglosphere' countries and non-'Anglosphere' countries. Three of the works stand out for including three of the BRIC countries (Brazil, China and India) who are major emitters and major players in international negotiations; ii) they were the first to apply a taxonomy of scepticism to the content analysis, which gave a more nuanced appreciation of what type of climate scepticism can be found in which part of which newspaper in which country; iii) together they provide very large data sets over a period stretching from 2007 to 2012, which have not been replicated in the academic literature; and iv) one of the studies was the first to compare an uncertainty framing with other dominant frames such as 'disaster' and 'explicit risk'.

A critique is then given of the heavily quantitative approach used in the content analysis found in the works. It argues that a combination of a quantitative and a qualitative approach would have supplied more nuanced results. It revisits articles in the UK print media in 2009/10 and applies a different research method. The results suggest that a newspaper's ideological leaning is an important driver of the treatment of climate science and scientists not just in its opinion pages, but in its news pages too. It concludes by placing this finding and others demonstrated in the submitted works within future priority areas of research identified by other scholars: the global characteristics of climate reporting and the drivers of country differences; the changing nature of sceptical discourse; and the role the media plays in fuelling, or reflecting, the political polarisation around climate change.

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4.1 UK Newspaper Coverage of Climate Change, 2009/2010

List of Accompanying Material (submitted works)

1) Painter, J. (2011) *Poles apart: The international reporting of climate scepticism*. Oxford, England: Reuters Institute for the Study of Journalism (RISJ).

2) Painter, J. and Ashe, T. (2012). Cross-national comparison of the presence of climate scepticism in the print media in six countries, 2007-2010. *Environmental Research Letters*, 7(4), 1-8.

3) Painter, J. (2013). *Climate change in the media: Reporting risk and uncertainty*. Oxford, England: I.B. Tauris and RISJ.

4) Painter J., and Gavin, N. (2015). Climate Scepticism in British newspapers, 2007 – 2011. *Environmental Communication*, forthcoming 2015.

The first and third of these works were single-authored, although some of the country-specific chapters were written by outside researchers, and then added to and edited by myself. The second and fourth were jointly authored. The lead author's role was that of carrying out all the coding, interpreting the results, and writing the bulk of the text. The role of the second authors was mainly that of writing the literature reviews.

Author's Declaration

I declare that all the material contained in this commentary is my own work.

1. Introduction: why study media representations of climate uncertainty?

Several environmental scientists argue we are now living in a new geological epoch called the 'anthropocene' or the 'age of man', in which humans are fundamentally changing the planet's life support systems (Steffen et al., 2007). In 2011, the *Economist* considered the concept sufficiently robust to put it on its front cover (*Economist*, 2011). Human-caused climate changeⁱ is probably the greatest challenge within this epoch. Yet even as scientists become more certain about some aspects of climate change, many uncertain aspects of the science remain (Trenberth, 2010; Pearce, 2014). Significant uncertainty surrounds the timing, pace and severity of possible impacts from a changing climate over the coming decades, and particularly at the local level. The communication of these uncertainties has become a major challenge for the Intergovernmental Panel on Climate Change (IPCC), which has attempted to quantify uncertainty and probability levels around its assessments of such impacts (Mastrandrea et al., 2012).

Public understanding and perception of climate change is surrounded by apparent paradoxes, in part caused by the uncertainties. Even as certain features of the science become more certain, levels of public concern in many developed and some developing countries have been in general decline since the late 2000s (Painter, 2014). Moreover, in some countries, the public has also become more sceptical about some aspects of the science. For example in the UK, the proportion of British people who doubt that the world's climate is changing has increased from 4% in 2005 to 15% in 2010 to 19% in 2013 (Poortinga et al., 2014). Another apparent paradox is that even as more scientists are in general agreement about the reality of climate change and its human drivers, the public perception of climate change as an uncertain phenomenon is increasing and the public view that significant numbers of scientists are in disagreement about the science remains strong (Van der Linden et al., 2014; Patt and Weber, 2014).

One reason why such public attitudes are important is that any transition towards a low-carbon development path, both at an individual or societal level, which could reduce greenhouse gas emissions, is probably more difficult to achieve in a context of significant

public scepticism or uncertainty about the science or about the viability of solutions (Whitmarsh et al., 2011; Engels et al., 2013).

Several studies have shown that uncertainty can be an obstacle to public understanding, engagement or action (Moser and Dilling, 2004; Shuckburgh et al., 2012; Glasgow Media Group, 2012). Partly this is because the language of uncertainty is specialist: it makes distinctions for example, between 'epistemic' uncertainties that are not known in practice, but could in principle be known or reduced, and 'aleatory' uncertainties that can never be known or will not go away. More importantly, the uncertainty intrinsic to the field of scientific enquiry is often misunderstood. In the public mind and the media, uncertainty is often equated to ignorance, and the perception exists that if scientists do not know everything about a topic, then they do not or cannot know anything (certainly) about it at all (Pollack, 2003).

Another way of explaining this is the failure to make the distinction between 'school science', which is a source of solid facts and reliable understanding, and 'research science' where uncertainty is engrained and is often the impetus for further investigation (Painter, 2013). Moreover, although there are many aspects of climate change people can be uncertain or sceptical about, individuals who are uncertain about one aspect examined are likely to be more uncertain on other aspects, a process known as 'uncertainty transfer' (Spence et al., 2012).

Since 1988, a climate sceptic discourse has been evident in the media which challenges the view of mainstream climate scientists and environmental policy advocates, and argues that parts, or all, of the scientific treatment and political interpretation of climate change are uncertain or unreliable. Some scholars argue that organised sceptic groups, or individuals, especially in the UK, USA and Australia, for ideological or other motivations have exploited the uncertainties in the science or amplified them in order to 'sow the seeds of doubt' (Oreskes and Conway, 2010). This, they maintain, has had a major impact on making policy makers and the public less willing to take action.

Sceptics of different types have enjoyed considerable success in getting their voices heard in many parts of the media in some countries, but not others. The extent to which their presence in the media affects public attitudes, levels of concern or willingness to change

behaviour has not been subject to sufficient scrutiny by scholars, although it tends to be assumed by some prominent commentators that the 'disproportionate presence' of sceptics in the media affects public opinion significantly (Abraham and Nuccitelli, 2014). What is more certain is that legacy media continue to play a major role in informing the public and elites about scientific issues, including climate change. Despite the huge revolution in the way people, and particularly younger age groups, consume news due to the advance of social and online media (Newman and Levy, 2013; Ofcom, 2014), for many publics legacy media remain (for the moment) the most popular and trusted way of receiving science news (Painter, 2014). In the UK for example, television is the main source of science information for more than 60% of the population, followed by print at 23%, and online sites at 15% (BIS and Ipsos Mori, 2014). The USA appears to be the only country where in 2014 for the first time, the internet overtook television as the primary source of science news (National Science Board, 2014).

An examination of the role the media play in representing the uncertainties around climate change raises a series of empirical and theoretical questions that can feed into a broader range of issues about journalism than those specific to the area of climate change coverage. In particular this research field can illuminate the drivers of journalistic outputs such as newsroom practice, sources, or structural changes in specialist reporting; the relationship between media ownership, newspaper ideology and editorial outcomes; and media effects on readers or consumers.

2. Mapping the Territory

A large corpus of general work on the media and climate change now exists in the academic literature (Anderson, 2009; Boykoff, 2011; Schmidt et al., 2013). Much of it has been focused on European and North American countries, much of it is based on case studies, and much of it concentrates on print media, although this is now slowly changing (Schäfer and Schlichting, 2014). Within this, there are two discrete but linked bodies of scholarship relevant to the specific issue of media representations of uncertainty about climate change: i) 'uncertainty' as a dominant frame or discourse in media treatments measured by various forms of quantitative or qualitative content analysis; and ii) the presence of scepticism, in its various manifestations, in traditional media, and increasingly in online media such as blogs.

The first body of work has concentrated specifically on the various indicators of uncertainty in print articles. Probably the earliest study with this focus was carried out by Stephen Zehr (2000) who looked at the representation of scientific uncertainty around climate change in the US print media from 1986 to 1995. He concluded that uncertainty was constructed in the media by its representation in several different forms, including scientific controversy, new research topics, and 'expansion of the problem domain' as well as more obvious representations such as uncertainty parameters. Corbet and Durfee (2004) added to this work and argued that science is portrayed as uncertain in the media without ever mentioning the word 'uncertain', particularly by the inclusion of competing scientific views. In her study of US newspapers in 2003-4, Antilla (2005) was primarily interested in 'controversial science' where sceptics were mentioned, but she also looked at other uncertainties around the science such as ambiguous cause or effects, climate forecasts or the risk of species extinction.

Other studies have included the uncertainty frame implicitly or explicitly in comparative articles on the relative presence of several different frames or discourses. Ereaut and Segnit (2006) carried out content analysis of three months of climate change coverage in the UK media in 2005-6, and identified twelve 'linguistic repertoires'. One of the main ones, 'alarmism', was particularly linked in the right-leaning press to the lack of scientific proof, whilst one of the indicators of 'optimism' was climate change denial. Nisbet (2009) includes

the frame 'scientific and technical uncertainty' in his typology of the eight main frames which he says are applicable to climate change. This frame defines science-related issues as amongst other things, a 'debate over what is known versus unknown'. (p.5) Doulton and Brown (2009) do not include uncertainty in their seminal study of dominant discourses in 150 press articles in the UK quality press from 1997 to 2007. But it is included as an indicator of the 'rationalism' discourse, one of eight they identify. They write that this discourse includes the view that 'predictions of climate change impacts are very uncertain so it is difficult to know how to prepare adaptation strategies'. (p. 194)

Other scholars such as Olausson (2009) have used critical discourse analysis (CDA) to conclude that the Swedish press are reluctant to display any kind of scientific uncertainty which would undermine the demand for collective action. The Olausson article is one of a number of studies of media representations of uncertainty in Western European countries, which have found that the situation there is different to that in the USA, UK and Australia. Research on the media in France (Brossard et al., 2004), Germany (Weingart et al., 2000; Engels et al., 2013), and Holland (Dirikx and Gelders, 2009) strongly suggests that the media in these countries exhibit less uncertainty about climate science. Likewise, a study comparing Finland to the USA and New Zealand (Dispensa and Brulle, 2003) concluded that there was much larger presence of articles expressing uncertainty about the science in the USA, and argued that the main explanation for this was the presence of the fossil fuel industry there.

Bailey et al. (2014) have applied heavily linguistic approaches to text analysis which use 'epistemic markers' to examine the diverse articulations of uncertainty in the language journalists use over time in their representations of climate science. These markers include inherent uncertainty (predictions or estimates), modal verbs ('could' or 'may'), and 'descriptors' ('probable' or 'likely'). This research method led the authors to conclude that uncertainty language was on the increase in the US print media between 2001 and 2007, and that it was more present in the US media than in the Spanish media. In summary, an important conclusion from the literature is that although different indicators and definitions of the uncertainty frame or discourse have been applied, there are a wide range of indicators of uncertainty other than just the presence of 'contested science' through the voices of sceptics.

The study of the different forms of climate sceptics and scepticism in the media is separate to the more general work on uncertainty, even though their presence in articles is often seen as one indicator of the uncertainty frame or discourse. Indeed, the volume of literature on climate scepticism is considerably more extensive as they have been analysed through many prisms: their links to conservative political ideologies and think tanks (McCright and Dunlap, 2000; Oreskes and Conway, 2010), their organisational structures and tactics (Jaques et al., 2008), their impact on legislation (McCright and Dunlap, 2003), and their psychological appeal (Norgaard, 2006a and 2006b). There is also a lively debate about the most accurate or helpful labelling of scepticism as it is sometimes known differently as ‘contrarianism’ or ‘denialism’ (O’Neill and Boykoff, 2010; Kemp et al., 2010). Scholars such as Lahsen (2013) make a distinction based on the degree of scepticism and call ‘mainstream sceptics’ those who exhibit moderate levels of scepticism in comparison to ‘contrarians’ who are more categorical. Others define ‘contrarians’ more narrowly as those who vocally challenge the climate consensus, and who often rely on substantial financial support from fossil fuel industry organisations and conservative think tanks (McCright, 2007).

An area of research of central importance to the submitted works has been on taxonomies of scepticism, both as they appear in the media and in public attitudes. One commonly-used version is that first put forward by a climate scientist, Stefan Rahmstorf (2004), which has been applied as a framework or a starting point for studies of scepticism in public attitudes (Poortinga et al., 2011; Engels et al., 2013). Rahmstorf’s taxonomy is based on a tripartite distinction between (1) those who question the global warming trend (‘trend sceptics’), (2) those who question the anthropogenic contribution (‘attribution sceptics’), and (3) those who question the timing, scope and negative nature of the impacts (‘impact sceptics’).

This taxonomy has been criticised for concentrating too much on ‘epistemic’ scepticism which relates to the science of climate change, to the exclusion of ‘response’ scepticism which relates to the efficacy of taking action to address climate change (Patt and Weber, 2014; Capstick and Pidgeon, 2014). Some scholars argue that the Rahmstorf taxonomy leaves out another common type of scepticism, namely that of seriously questioning the

scientific consensus embodied in the work of the IPCC (Engels et al., 2013). Others have opted for a wider typology of scepticism which they say is more helpful in capturing the full diversity of its manifestations in the public mind. Based on interviews with members of the Australian public, Hobson and Niemeyer (2013) found five sceptic discourses ranging from 'emphatic negation' to 'noncommittal consent', while the psychoanalyst Sally Weintrobe (2013) distinguished between denialism (broadly, if something cannot be proved beyond doubt then it cannot be true), negation (saying what is, isn't), and disavowal (seeing reality, but minimising its significance and emotional impact).

The key point here is that the differentiation elaborated by a climate scientist does not map easily onto the manifestations of scepticism in the public's mind. The Poortinga et al. research (2011) showed that sceptic arguments are strongly interrelated and not clear-cut, and while they are often rooted in an individual's norms and values, they can be flexible. Some scholars go further in arguing that the concept of scepticism is so 'slippery' as to be of minimal use (Corner, 2013), or that the very terminology is contributing to in-group cohesion, polarisation of the issue, and the creation of a perpetual cycle of disengagement as opposing groups are stereotyped behind fixed labels (Howarth and Sharman, 2014).

The presence of sceptical arguments in the media has been extensively researched, in particular through the ground-breaking work of the US academic Max Boykoff, who questioned parts of the media's tendency to give undue weight to scepticism – a process he ascribed mainly to the journalistic norm of seeking balance, which he critiques as 'balance as bias' (Boykoff and Boykoff 2004; Boykoff, 2007; Boykoff and Mansfield, 2008). Primarily focused on the US and the UK, his work has shown that the timing, nature and volume of sceptic presence in the media are intermittent and varied, but persistent. This can depend on a wide range of variables including country-specific political, economic and cultural contexts, issue attention cycles in the media, the presence of organised scepticism or a fossil fuel industry, the type of media (television, print, or online) and the type of newspaper (left- or right-leaning, tabloid or broadsheet).

There have been relatively few studies focused specifically and in a detailed way on the media presence of sceptics, either in the USA, the UK or elsewhere. Two exceptions are the above-mentioned work by Antilla (2005), and Gavin and Marshall (2011). The former study

is restricted to print media over a twelve-month period in 2003-4, the latter to 22 television news bulletins around the time of the UN's Copenhagen summit on climate change in December 2009. One of the very few cross-country studies with a specific focus on scepticism was carried out by Grundmann and Scott (2014) who analysed print media coverage in four developed countries (France, Germany, the UK and the USA) from 2000 to 2010. Using corpus linguistics, they concluded that all four countries showed a dominance of what they called 'advocates' (meaning followers of mainstream consensus) over 'sceptics', but found that sceptics are much more visible in the USA and France compared to Germany and the UK. The finding of a strong presence of sceptics in France compared to the UK is surprising but may be due in part to the methodology used, the period examined (much of it before the Global Warming Policy Foundation (GWPF) increased its influence in the UK) and the high media visibility in the 2000s of the French media of Claude Allègre, a sceptic and government minister under Lionel Jospin with a background in science.

Finally, the rapid rise of online and new media has prompted more recent research into the presence and nature of climate scepticism on blogs (Sharman, 2014) and on social media such as Twitter (Pearce et al., 2014). This latter work is not focused specifically on uncertainty and scepticism but includes an examination of the extent to which tweets about the first report of the IPCC in 2013 were either supportive of climate science or the need to reduce carbon emissions, neutral, or unsupportive. However, a number of important gaps remain in our understanding of the presence of scepticism in new media, including the ways in which popular sceptical web sites have an impact on the agenda and editorial content of parts of the legacy media (Schäfer, 2012).

3. Adding to the literature: an overview of the submitted works

The four submitted works study the presence of uncertainty in media representations of climate change, either as a frame or discourse, or as a specific manifestation in the shape of the presence of climate sceptical voices. Although it is not one of the submitted works, the intellectual impulse for the focus on uncertainty stemmed from a 2010 Reuters Institute (RISJ) study, *Summoned by Science* (Painter, 2010). This examined the reporting of climate science in two newspapers in each of twelve countries during the Copenhagen Summit in late 2009. One of its findings was that climate sceptics were barely quoted in the articles surveyed, but when they were, it was only in the Western press. This followed a general pattern of little airtime or print coverage given to sceptics in the media of the developing world.

This finding was one of the prompts for the first submitted work (Painter 2011). This was a longitudinal, comparative and quantitative study of the presence of scepticism in the print media in six countries (Brazil, China, France, India, the United Kingdom and the USA) over two three-month periods in 2007 and 2008-9. Two papers were chosen from each country, which usually consisted of one left-leaning and one right-leaning. A very large number of articles (around 4,000) were examined.

One of the main conclusions from the content analysis was that climate scepticism in the print media was predominately an 'Anglo-Saxon phenomenon', but not an English-speaking one as the English-language newspaper with the largest circulation in the world (*the Times of India*) gave little space to such voices. France, Brazil, China and India had far fewer sceptical voices than the UK and the USA. The study suggested that out of a wide range of factors explaining these differences, the presence of politicians espousing some variation of climate scepticism, the existence of organised interests that feeds sceptical coverage and partisan media receptive to this message all played a significant role. In the USA and the UK climate change has become more of a politicised issue, which politically polarised print media pick up on and reflect.

The large data sets present in this study were examined from a fresh perspective in the second submitted work (Painter and Ashe, 2012). This paper asked whether the US experience of scepticism in the media was replicated in other countries, and if so how. It found that in general, articles expressing scepticism were mostly found in the USA and UK. Drawing on the Rahmstorf typology outlined above, it concluded that trend sceptics were almost exclusively found in the US and UK newspapers, and that those sceptics who challenge the need for robust action to combat climate change had a much stronger presence in the media of the same two countries. It also found there was a strong correspondence between the political leaning of a newspaper and its willingness to quote uncontested sceptical voices in opinion pieces and editorials.

The data sets from the ten UK national newspapers examined in Painter 2011 were expanded to include a later period (November 2010 - February 2011) in the fourth submitted work, Painter and Gavin, 2015. This study was longitudinal and single-country, and focused on the question of whether the presence of climate scepticism remained as prevalent in a period when the level of media interest in climate change and the editorial justification for the inclusion of sceptical voices had both diminished compared to similar periods in 2007 and 2009-10. It found that even though the number of articles about climate change dropped sharply, roughly one in five of them still included or mentioned sceptical voices. It also concluded that sceptical voices were more likely to be included in pieces written by in-house non-specialist columnists than by environment editors or correspondents.

A detailed account of the uncertainties around climate science, which sceptical voices amplify, was set out in chapter 2 of the final submitted work (Painter 2013). This discussion formed the essential background for establishing indicators of the uncertainty frame, which previous studies had shown was a common media discourse about climate change. In this book, three other frames along with uncertainty (namely 'disaster', 'explicit risk' and 'opportunity') were defined and then applied to 350 articles about climate change in 18 newspapers in six different countries with a combined readership of around 15 million. Among the book's conclusions was that the disaster and uncertainty frames were very

common, and found in around 80% of the articles examined. Explicit risk and opportunity framing was much less common.

What was particularly significant was that nearly half of all the articles included a quote from a scientist or scientific report which indicated some manifestation of uncertainty. Also, there was little variation between the six countries in the media treatments of climate change, except for the presence of uncertainty through sceptical voices: Australia had the highest number of articles in the sample with sceptics in them and the highest percentage of articles, followed by the USA and the UK.

The above works added to the existing literature in several significant ways. As mentioned in section 2, the study of climate change in the media has tended to be single-country (particularly the USA and European countries). Three of the four submitted works (Painter 2011, Painter and Ashe 2012, Painter 2013) are longitudinal and strongly comparative, which is a feature of only 10% of this field (Schäfer and Schlichting, 2014). Hansen (2011) has pointed to the need for more comparative material, particularly when the media are becoming more globalised and 'the framing of key environmental issues such as climate change may vary considerably between continents <....>, cultures and even potentially between countries.' This gap is beginning to be filled (Eide et al., 2010; Schmidt et al., 2013). But the submitted works helped in particular to deepen our understanding of the country differences between a wide variety of Anglosphere countries (such as Australia, UK, and the USA) and non-Anglosphere countries (Brazil, China, France, Germany, India and Norway).

Comparisons between developed and developing countries are rare. In particular, as far as I am aware, no other study has included three of the BRIC countries. There have been a small number of case studies of these countries taken individually (see bibliography in Painter, 2014), but no comparative study. The inclusion of BRIC countries is particularly important as they are major emitters of greenhouse gases and increasingly play a very significant role in international negotiations on an agreement on limiting such gases. The way the media in these countries cover climate change, and the drivers of it, shows important differences both within this bloc, and with more developed countries.

A comparative approach allowed an accurate mapping of the relative presence or absence of climate scepticism in the media in different countries, and as Painter 2011 analysed, acted as a starting point for a discussion of the drivers of those differences in terms of factors within media organisations - journalistic norms such as balance, editorial culture (opinion versus objectivity in reporting), influence of proprietors, newspaper ideology - or within wider society (lobbying groups, sceptical politicians, sceptical readers, sceptical scientists, direct experience of a changing climate, or national cultural/political values or traditions), or some combination of the two.

The four submitted works were the first to apply Rahmstorf's three-tier taxonomy of scepticism to media coverage. This gave a more nuanced appreciation of what type of climate scepticism can be found in which part of which newspaper in which country. These distinctions are important for several reasons, and not least because journalists tend to conflate the different types of scepticism. In addition, distinctions between the categories of newspaper article (particularly news versus opinion/editorial) gave important insights into where uncontested scepticism, and what type of scepticism, can be seen most frequently. Although research is scant on the impact of opinion pieces compared to news articles on public attitudes or whether readers make a clear distinction between them, it is clear they are an important ingredient in giving an interpretation of issues in the news (Rosenfeld, 2000; Golan, 2013). A clear differentiation between the two is absent from other studies, such as those by Boykoff (2004, 2007, and 2008).

The submitted works together provide very large data sets over a period stretching from 2007 to 2012, which have not been replicated in other parts of the academic literature. This amount of comparative international data helps both to sketch out significant long-term trends and to refresh other work. The detailed UK data found in Painter and Gavin 2015 updated Boykoff's work on the UK and the USA. It compared the data found in studies published by Boykoff to assess how the pattern of climate scepticism in the media persisted or changed in response to important developments such as 'Climategate',ⁱⁱ the errors in the 2007 IPCC reports and the rise of organised scepticism. Likewise, it updated the work by another highly-cited author on the UK media, Anabela Carvalho (2005, 2007), whose research on the UK examined three newspapers (the *Guardian*, *Independent* and *Times*), but only until 2003.

The inclusion of all ten UK national newspapers in the content analysis of both these studies enlarged the limited scope of titles included in the work by Carvalho and Boykoff, which can be criticised for excluding some high circulation right-leaning newspapers such as the *Telegraph* or *Mail* where scepticism is a strong feature (Ward, 2009). The inclusion of the full political range of titles also allows more insight into the relationship between levels of sceptic commentary and reporting and a newspaper's ideological leanings. The conclusion found in Painter and Gavin 2015 that the ideology of a newspaper maps more consistently onto the presence of sceptical voices in opinion pieces authored by non-specialists, than it does onto climate reporting, shows a more complex relationship between ideology and coverage than in previous studies. However, as we shall see in the following section, a different research method applied to the same articles expands on these findings.

Although as we saw in section 2, the uncertainty framing in media treatments of climate change has been examined in a small number of journal articles, Painter 2013 was the first to compare this framing across the international media to other dominant frames such as 'disaster', and much less common frames such as opportunity and explicit risk. This last trope is increasingly being used by politicians and climate science reports as a helpful framing of the climate challenge for target audiences such as policy makers and some business sectors, and yet it appears from the 2013 study and a later study of the reporting of the 2013/4 IPCC reports (Painter, 2014) that it is hardly being used in the language and reporting of the climate change story.

4. A critique of the submitted works

General observations

The four submitted works are heavily empirical studies, focusing on what newspapers around the world do when they cover climate change, and what might explain their different treatments. None of the studies devote much attention to placing the results firmly within academic theories about the complex relationship between information in the media and the possible impacts it has on public and policy agendas (agenda-setting, gate-keeping theories), or on public attitudes, beliefs and behaviour change (framing, persuasion or media effects theories).

Moreover, all four studies relied heavily on a quantitative approach, which yields large data sets full of interesting information, but does not locate the texts or data in their political, social or cultural context. As we discuss below, researchers who use Critical Discourse Analysis place a much greater emphasis on placing the text in such a context. But they too have been criticised by academics such as Greg Philo (2007), who argue that a text-only analysis can fail to take account of the wider context in which the words are being used, and their actual meaning and the manner in which they are being employed can be obscured. Using examples from media treatments of the Middle East conflict, industrial disputes and racism, he shows that the three processes of production, content and audience reception of news messages, and the way they 'circulate', all need to be analysed together to give such a context. In the specific area of climate change communication, an approach which goes beyond the simple analysis of text and includes the three processes would clearly help to give more insight into the way the media might influence how people engage with climate change.

With this in mind, the main argument is put forward in this section that some combination of a quantitative approach (which gives a solid base for what actually appears in the media), and a qualitative approach (which gives a more contextualised and interpretative approach of the data or frames) can supply a more nuanced answer to some of the key research questions about media treatments of climate change, including uncertainty.

Frames and Framing

Although one of the works (Painter 2013) uses the concept of 'frames' to interpret 'dominant messages', there is little discussion of framing theory. Reference is made to the 'vast literature' available on this, including the authors Robert Entman and Matthew Nisbet. A summary of the importance of frames is given which explains that they provide 'a perspective from which a reader or viewer can interpret a problem by stressing some aspects of it or by ignoring or downplaying other aspects' (p.46), but there is no prolonged exposition of the nature and advantages of using frames to analyse texts.

This section of the book could have benefited from more discussion about the importance of framing as a way of making sense of a text. For example, Michael Schudson (2011) gives a helpful introductory explanation of why framing is a more helpful concept than bias for analysing newspaper articles, because whereas the latter involves a journalist colouring an article to advance a particular political or ideological aim, framing is the 'principle of selection, emphasis and presentation <....> about what exists, what happens and what matters'. (p.28) This is essentially the same concept of framing described by Gamson and Modigliani (1987) as a 'central organising idea or story line that provides meaning to an unfolding strip of events'. (p.143) The weakness of these general definitions is that they do not make it clear enough how frames can be defined and then 'operationalised' when applied to the content analysis of texts or images.

Entman (1993) provides a more useful analysis of framing as it pertains to selection and salience, which are of particular relevance to the discussion of the relative presence of the four frames used in Painter 2013. He writes that 'to frame is to *select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation* for the item described'. (p. 52, emphasis in original) In similar fashion, Nisbet (2009) goes beyond the idea of framing as a central organising idea when he writes that, 'frames are interpretative storylines that set a specific train of thought in motion, communicating why an issue might be a problem, who or what might be responsible for it, and what should be done about it.' (p. 15)

In the 2013 book, we concentrated on what elements of certain frames were present in each story, and their relative weighting, in order to get some insight into what messages about climate change readers might be receiving when they look at different articles. But as the above writers suggest, some framing theory states that a reader is not just left with a 'dominant message', but with a set of moral conditions and implicit or explicit solutions. Mention should also have been made that it is an under-researched area how different publics (policymakers, politicians, business sectors, or the lay public) accept or reject frames such as uncertainty or risk to create meaning or use them as a basis for action (Nisbet, 2009; Hansen, 2011).

Some caveats are appropriate here. As Scheufele (1999) has argued, frame analysis is neither a fully-fledged theoretical paradigm, nor offers a coherent methodological approach. Framing is also used differently in different disciplines other than media studies (such as psychology, sociology and geography). Scheufele says that partly because of vague conceptualisations, 'the term *framing* has been used frequently to label similar but distinctly different approaches'. (p. 103) However, different approaches have been usefully identified by Matthes and Kohring (2008) and divided into five types: a hermeneutic approach, a linguistic approach, a manual holistic approach, a computer-assisted approach, and a deductive approach. The first provides an interpretative account of media texts linking up frames with broader cultural elements, whereas the second concentrates on linguistic elements of the text that signify a frame.

An example of the first approach is Olausson (2009), of the second Bailey et al. (2014). Grundmann and Scott (2014) applied the 'computer-assisted' approach (which maps frames by searching for words or word combinations in texts). The 'manual holistic' approach involves *a priori* frame definition which is then applied to content analysis, large samples and a broad range of frame types. A typical example of this approach is found in Dirikx and Gelders (2009).

The frame analysis favoured in Painter 2013 most approximates to 'manual holistic', as we defined the four frames we were interested in prior to doing the content analysis, and then applied them to large samples. It may not matter to a general reader that it was not made clear which type of frame analysis was being followed, but the above typology does usefully

introduce the idea of different research methods and the possible advantages and disadvantages of each. In particular, a helpful distinction could have been made between the mostly quantitative approach adopted in all four studies and qualitative approaches such as CDA.

Olausson (2009) chose CDA because of its 'constructionist, socio-cognitive and critical epistemological pillars', and applied a wide range of analytical tools such as overarching themes and topics, the choice of words and language, and the presence of implicit and redundant information, amongst others. (pp. 424-5) Olausson quotes another prominent scholar in this field, Anabela Carvalho (2005), who also favoured CDA as her method of interpretation, where the main instrument for testing results is 'logic and credibility of argumentation, backed up by quotes from the texts'. (p. 1461)

There is insufficient space here to enter into a full critique of CDA except to say that it is a portmanteau term, incorporating the elements quoted above and the text's relation to social or political contexts (Gavin and Marshall 2011, p. 1036). Unlike a manual holistic approach, CDA does have the advantage of not applying any predefined features or measurements and of giving more in-depth analysis of how climate change or other issues are portrayed in the media. However, it can have the downside of being so 'intense' that it usually only allows for a small amount of material to be analysed. (Dirikx and Gelders 2010, p. 197) Quantitative content analysis on the other hand, can supply much larger data sets and therefore in some cases, more robust conclusions. A focus on semiotic analysis such as that used by Bailey et al. (2014) may be helpful in assessing the language of journalists but not as useful as other methods for measuring the (relative) presence of dominant frames or discourses.

In the 2013 book, the focus was on examining the indicators that previous authors (described in section 2 above) had used to assess the presence of the uncertainty frame, and then to include them in the coding sheet. It was not the aim to discuss the various theories and practices around the framing method they were following. However, a more qualitative or interpretative approach combined with a quantitative approach could have provided more robust answers to some of the questions being tested. One minor example of this is the question of when 'uncertainty' was registered as a present, salient or dominant

frame. For example, the results captured in our coding sheet provided the important finding that the uncertainty frame was present in 90% of the articles covering the first IPCC report in 2007. (Painter 2013, p. 68) However, it included ‘increasing certainty’ and other variants of that sub-theme as an indicator of uncertainty. A more interpretative approach going beyond counting the simple presence of indicators would have assessed the full context in which this indicator appeared, and may have led to the conclusion that some articles were better categorised as a ‘settled science’ frame than an uncertainty frame. The distinction is important as IPCC authors are keen to stress that they are more and more certain about some aspects of climate change, even though some level of uncertainty remains.

The prior selection of frames also ran the risk of omitting other frames which may be more present than the ones chosen. It may not be sufficiently robust to include the option of ‘none of these frames’ on the coding sheet, as the temptation for coders may be to ‘force’ each article into one of the pre-determined frames. It is of significance here that other researchers applying frame analysis have used more than four frames.

Measuring sceptic presence

A similar criticism can be applied to the basic research method applied in the three submitted works about the presence of sceptics (Painter 2011, Painter and Ashe 2012, Painter and Gavin 2015). The content analysis involved counting instances of certain features in the text, and did not employ any qualitative assessment. It should be stressed that a quantitative approach can be very useful and is a very common approach in the research carried out on media portrayals of climate change. A recent meta-analysis of this research field showed that of 133 articles published since 1957 in this area, around 48% used a quantitative research method, 45% a qualitative one, and the remainder a combination of the two (Schäfer and Schlichting, 2014). However, as we shall now argue, the chosen research method was suitable for answering some questions, but not others.

The print articles were examined for whether they ‘contained’ types of sceptical voices, which included direct and indirect quotes of individual sceptics, mentions of them where

they were not quoted but named, and generic quotes (such as ‘sceptics say that...’). Opinion pieces written by sceptics and opinion pieces or editorials quoting or mentioning them were also included in the samples.ⁱⁱⁱ The presence of sceptical voices was also divided by category of article. The argument for this approach, outlined in Appendix 3 of Painter 2011, was that it was ‘fit for purpose’ in addressing the research questions, and in particular identifying cross-national differences in the presence or type of sceptical voices, any quantitative increase between periods, and in which sections of newspapers sceptical voices are most likely to be found. The unusually large data sets added numerical robustness to the measurement of the presence of sceptical voices over time and by country. This is a helpful indicator of how much credibility journalists and editors assign to them over different periods, and arguably, of how much traction they have gained in the public sphere in different countries. Taken over a long enough period, it also provides a helpful insight into their ‘stickability’.

However, there were clearly a number of limitations to this method. The most important is that it did not apply any qualitative assessment to establish any dominant discourse in each article. As we have seen, different scholars have adopted different research methods to test the presence of uncertainty or sceptical discourses or frames, but they share the same characteristic of moving beyond a simple tallying up of the frequency of words, comments or phrases.

One notable example of this can be found in the work by Max Boykoff (2004, 2007 and 2008). He divides each article into various categories which can broadly be reduced to three, namely the ‘consensus view’ (climate change is real and human-caused), the ‘falsely balanced view’ (we don’t know if climate change is real, or if humans are a cause), and the ‘dismissive view’ (climate change is not happening, or there is no role for humans).^{iv} As Boykoff (2008) himself writes about his research method, ‘importance was placed on labelling of those quoted, terminology, framing techniques, salience of elements in the text, tone and tenor, and relationships between clusters of messages. This more interpretative approach more capably captures subtle factors that shape representational practices’. (p.4) In other words, he is using a more qualitative than quantitative method.

As discussed above, other scholars have relied wholly on qualitative content analysis such as CDA or a focus on linguistics. However, a new and interesting method to test the relative presence of different frames, including uncertainty, has been recently developed by researchers at Exeter University (O'Neill et al., 2014), which combines a rigorous analysis of the text/images found in news reports and a solid contextualisation of these reports in a socio-political frame narrative.

The method draws on Entman (1993) for setting out the indicators for each frame (and for having a valid, rigorous and repeatable definition of what a frame is). They identify ten dominant frames in the media reporting of the 2013/14 IPCC reports, and include five indicators of these frames: problem definition, typical sources quoted, common themes or storylines, metaphors/phrases, and visual imagery. The last of these is particularly important to the way readers or viewers engage with the information they are being given, but it is seldom included in content analysis. Different types of imagery can play an important role in increasing the sense of importance of the issue of climate change (saliency), or in promoting feelings of being able to do something about it (efficacy) (O'Neill and Nicholson-Cole, 2009; O'Neill et al., 2013).

This approach shares with CDA a research method which gives more context to the presence of uncertainty than merely counting the presence of sceptical voices, or offers a wider range of ways to assess dominant discourses. The importance of 'context-sensitive' content analysis has been highlighted by Krippendorff (2012), who stresses that 'context-insensitive' methods such as statistical analysis run the risk of 'disembodying observations, unitising complex and contiguous events, and taking single words out of their contexts of use'. (p. 46) In the specific area of climate change media analysis, Boykoff (2013) also speaks of the dangers of lack of context when he warns against assembling a taxonomy of scepticism and then tracing the amount of media coverage of different sceptics. He writes that 'this approach risks under considering context and excessively focusing on individual personalities at the expense of political, economic, social and cultural forces'. (p.7)

An overreliance on quantitative techniques is particularly relevant to addressing one of the research questions in three of the submitted works, which is the relationship between the presence of sceptical voices and the political leaning or ideology of different newspapers.

One of the key conclusions from this research was that there is a strong correspondence between right-wing newspapers and their willingness to quote or use uncontested sceptical voices in opinion pieces and editorials.^v So for example in the UK, the numbers of such voices are high in the right-leaning *Express*, *Telegraph* and *Sun*, but much lower in the left-leaning *Independent*, *Guardian* and *Mirror*. (Painter and Gavin 2015, p.14)

However, a major omission in the content analysis was the extent to which the presence of sceptics in news articles in newspapers of left-leaning and right-leaning tendencies was similar to their presence in opinion pieces and editorials. In other words, the coding did not capture the extent to which in the news reporting the mention of sceptics was balanced with voices representing mainstream views on climate change, or were included in order to be refuted. The method runs similar risks to simply counting the relative presence of candidates from different political parties in order to measure possible bias, without taking into consideration the possibility that the coverage included a candidate making a mess of a speech or being pelted with eggs.

Indeed, just counting the sceptical voices led to the counter-intuitive finding that there was a higher presence of such voices in all articles in left-leaning or liberal newspapers (in five countries) than in the more right-leaning ones. (Painter and Ashe 2012, p.5) Likewise within the UK, when articles were examined from three three-month periods between 2007 and 2011, the left-leaning *Guardian* had the same percentage of articles with sceptics in them as the right-leaning *Times*, and the right-leaning *Sun* the same as the left-leaning *Independent*. (Painter and Gavin 2015, p. 20) This contributed to the conclusion that the ideological orientation of newspapers mapped most consistently onto the presence of uncontested sceptical voices in opinion pieces.

One minor exception to this research method was a limited exercise carried out with the *Daily* and *Sunday Telegraph* in a three-month period in 2009/10 which suggested from a small sample (20 articles) that in the news reporting there was a strong presence of countervailing mainstream voices, which contrasted with the opinion columns in the same newspaper group. (Painter 2011, p.103) In similar fashion, a small sample of the news reports by the *Telegraph* and *Sun* environment correspondents in a three-month period in

2010/11 found that there were very few mentions of sceptics. (Painter and Gavin 2015, p. 21)

The above discussion strongly suggests that more robust insights into the relationship between political ideology and newspaper coverage of climate change could be gained by i) including news reports in any examination of the presence of contested or uncontested scepticism; ii) using a larger sample of news reports across left-leaning and right-leaning newspapers; and most importantly iii) expanding the research method to include more context and more variables than simply counting the presence of sceptical voices, in order to gain a better sense of the dominant discourses.

Re-examining the articles

With this in mind, a re-examination was carried out of the news reports which included sceptics in four British newspapers in the three-month period 19 November 2009 to 18 February 2010. This period included the coverage of the formation of the GWPF, 'Climategate', the UN's Copenhagen summit, the questioning of some of the IPCC results, and the behaviour of the IPCC chair, Rajendra Pachauri. Two left-leaning and two right-leaning newspapers were examined, which gave a total of 89 news articles broken down into: *Mirror/Sunday Mirror* (8 articles); *Guardian/Observer* (35); *Mail/Mail on Sunday* (18); *Daily Telegraph/Sunday Telegraph* (28).^{vi} A new coding sheet was applied which was principally aimed at testing the hypothesis that left-wing newspapers were more likely to be supportive of mainstream science and scientists, and more dismissive of sceptical arguments, and that the reverse was true of right-wing newspapers. Each article was assigned to one of three categories or discourses:

- 1) Strongly dismissive or critical of any of the following: mainstream climate science, the behaviour of scientists at the Climatic Research Unit at the University of East Anglia, the IPCC and its chair, Rajendra Pachauri, and the Copenhagen summit; and/or strongly supportive of sceptical arguments.
- 2) Neither strongly dismissive nor supportive of any of the above.
- 3) Strongly supportive of any of the above; and/or strongly critical of sceptical arguments.

To include more context and variables than in our prior coding, the following indicators were assessed in each of the 89 articles: the presence of sceptics in the headline and/or first paragraph (to measure salience); the number of named individual sceptics quoted directly or indirectly; the presence of generic quotes of sceptics; the number of individual representatives of mainstream science or reports quoted directly or indirectly; the presence of generic quotes about mainstream science or views; an overall assessment of the general tone or tenor of each article according to the three categories above, backed up by the balance between sceptical and mainstream arguments and examples of language, quotes or headlines to support the assignment to one of the categories.

The advantage of such an approach compared to the research method in the submitted works is that it focused more on sceptical arguments than on individual sceptics; it included an assessment of where in an article the quote from a sceptic appeared, how often were they quoted, and the strength of any rebuttal; and it evaluated the language, quotes and overall tone of each article. As such it contained some quantitative elements to support an interpretative or qualitative assessment of the dominant discourse of each article.

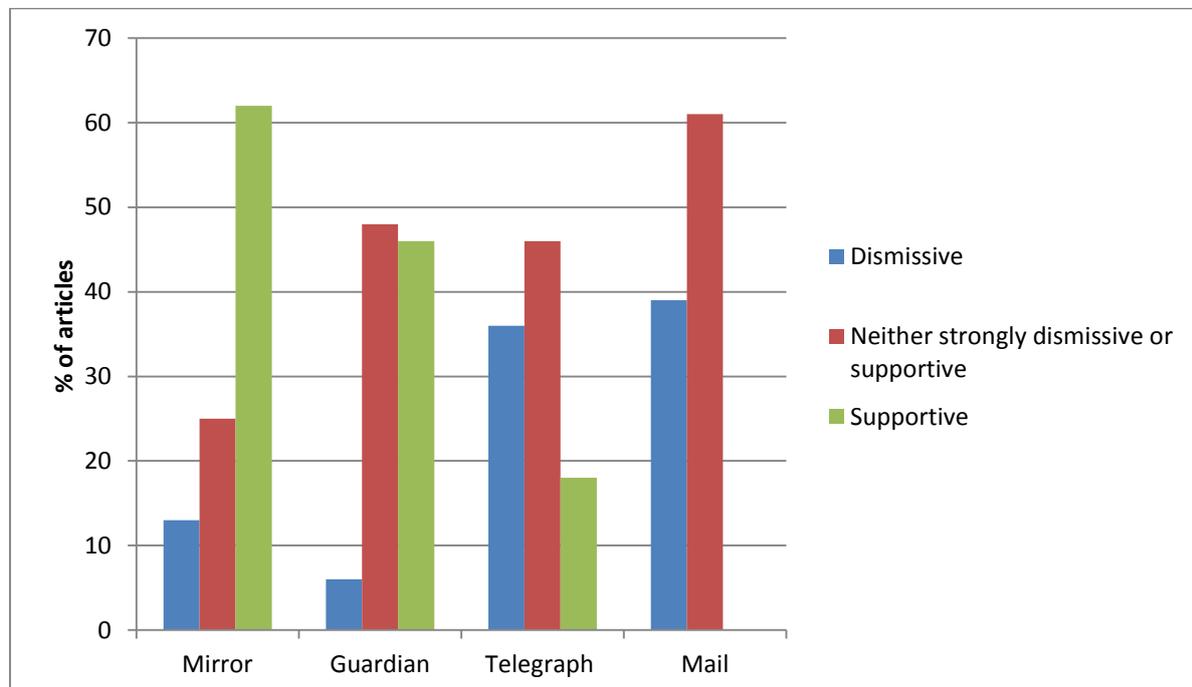
The new coding sheets and the results of this new method can be found in Appendix 1. The key finding is that the two left-leaning newspapers, the *Mirror* and the *Guardian*, emerged as strongly supportive of mainstream science and scientists in their news articles, whereas the right-leaning *Mail* was strongly dismissive of them. The *Telegraph* came in-between. (See Figure 4.1) It is particularly significant that the *Guardian* only carried two articles (out of 35 articles examined) critical of mainstream scientists which were written by the science writer Fred Pearce (2010) as part of a long series analysing 'Climategate'. In essence, these two articles criticised the professional conduct of the scientists rather than the science itself. Equally significant is the finding that none of the 18 articles in the *Mail* were supportive of mainstream science or scientists (although 11 were neither dismissive nor supportive).

For its part, the *Telegraph* showed the most equal distribution of discourses, although there was a slight tendency towards being dismissive (10 articles versus 5 which were supportive). It is of note here that of the 7 news articles in the *Sunday Telegraph* in this period, 6 were

strongly dismissive, which suggests a more ideologically-driven treatment of the subject than in its sister paper, the *Daily Telegraph*. It is also of note that of the 10 articles included in the sample written by the then *Daily Telegraph* environment correspondent, Louise Gray, only one was dismissive, three were supportive, and the rest were neither supportive nor dismissive. This stands in contrast to the reporting of the journalist David Rose on the *Mail on Sunday*. Two of his three articles were strongly dismissive, and one was neither dismissive nor supportive.

From Painter and Gavin 2015 (p.15) we know that for the same three-month period, there was a correspondence between political leaning and uncontested sceptical voices in opinion pieces and editorials. For the *Guardian*, only 2 out of 15 such articles (13%) included uncontested sceptical voices. The figure for the *Mirror* was 1 out of 4 (25%), whereas the figures for the right-wing newspapers, the *Mail* and *Telegraph*, were significantly higher at 42% (5 out of 12) and 48% (13 out of 27). The additional data now suggest that there is also a strong correspondence between political ideology and treatments in news articles too.

Figure 4.1 Dominant discourses in news articles in four UK newspapers, 2009-2010



These results suggest that in the UK a newspaper's ideological leaning is an important driver of the treatment of climate science and scientists not just in its opinion pages, but in its news pages too. This conclusion needs to be tested with a larger sample of newspapers

over a longer period, but it does point to weaknesses in the research method of three of the submitted works. The quantitative approach did prove useful for testing some hypotheses, such as cross-country comparisons in the presence or type of sceptical voices, and a comparative analysis of their presence between periods. However, the approach did not adequately capture the dominant framing or discourse of an article; this in part was a function of the extent to which the news articles included sceptical voices which were strongly contested elsewhere in the article. A combination of a quantitative and qualitative approach gives stronger conclusions about the closer relationship between a newspaper's ideological leaning and the representation of different aspects of the climate change 'story'.

The extent to which ideology is a key determinant of treatment of climate change is an important area of study, but articles about this relationship are sparse. The exception is in the UK where Carvalho and Burgess (2005) and Carvalho (2007) looked at media representations of scientific knowledge on climate change in the *Guardian*, *Independent* and the *Times* between 1985 and 2003, and concluded that the newspapers' treatments did reflect their ideological positions. Crudely summarised, the *Guardian* conveyed an image of scientific knowledge that emphasized the risks associated with climate change, the *Independent* exhibited roughly the same tendency, whereas the *Times* often emphasised the uncertainties, and gave space to sceptics. As regards policy options, the *Guardian* and *Independent* favoured more state intervention, whereas the *Times* adopted a more liberal, market-oriented view of potential solutions.

Also in the UK, a study by Ereaut and Segnit (2006) in general supported another observation in Carvalho's work that the tone different newspapers use was in part a reflection of a newspaper's ideology. Again, in crude terms, the left-wing press used a more dramatic tone to illustrate the risks, whereas the right-wing press showed a lower degree of dramatisation, a lower representation of the risks and a questioning of doomsday scenarios.

In one of the very few studies on the role of ideology outside the UK, Dirikx and Gelders (2010) built on these authors' work to examine the French and Dutch press. They tested the link between a newspaper's ideological leanings and i) treatments of scientific uncertainty, ii) the tone of an article ('dramatisation') and iii) mitigation policies. They found that in the Netherlands newspaper ideology was not related to climate change coverage, while in

France it was related to some key aspects, namely the presentation of the necessity of taking action against climate change and the tone of climate change coverage.

The Dirikx and Gelders study (2010) raises some important questions relevant to our updated findings about the UK press, and suggests areas of future research. The first is to probe further into the different subject areas within the climate change 'master-story' where a newspaper's ideology is most likely to have an impact on its treatment: for example, this could be scientific uncertainty (including the presence of sceptics), the behaviour of scientists or policy solutions. But it may not have an impact on other areas: research has shown for example, that there was no uniform or straightforward patterning of coverage along political or partisan lines in the print media's coverage of the UK floods from 2001 to 2007 (Gavin et al., 2011). The second is the tone it may adopt: for example, dramatic representations, sober assessments of the science, or ridicule of different players. And the third is the factors which explain country differences. Dirikx and Gelders (2010) suggest that ideology plays more of a role in countries such as the UK and France because of the greater discussion about climate change in the political field in these countries and the more competitive media landscapes there, which is historically related to the political field. (p. 203)

This important hypothesis needs to be tested, not least because many observers would argue that with the exception of Claude Allègre, the French political classes have shown much more unanimity on the climate change issue than the British. (Painter 2011, p. 78) More research into other countries, such as the USA and Australia (strong sceptic presence) and Germany (little sceptic presence), would shed light onto the relative weighting of newspaper ideology as a driver of media treatments compared to a range of the other possible factors both within newspaper organisations such as journalistic norms (e.g. of balance), and in wider society, and particularly the national characteristics of the political arena.

5. Conclusions

As outlined in section 3, the submitted works advanced our understanding of media portrayals of scepticism and uncertainty in several important ways. The discussion also points to future areas of research on uncertainty which chimes with broader overviews of future directions for the general research field of climate change in the media (Anderson, 2009; Hansen 2011; Schäfer and Schlichting, 2014; Olausson and Berglez, 2014). All four overviews agree that more comparative work is needed on the global characteristics of climate reporting and the drivers of country differences (which should include Eastern European countries like Poland where climate scepticism is strong). In addition, more up-to-date data is needed on the persistent presence of sceptical discourse, and how it may be changing to become more policy-orientated than science-focused (Hickman, 2013).

However, as suggested by the discussion in section 4, an equally fertile area for research is to revisit the relationship between the ideology of newspapers and climate change coverage. As Carvalho (2007) complained several years ago, the 'role of ideology in media representations <...> is still blatantly under-researched'. (p.225) The suggestion that British newspapers' ideological leaning could impinge on aspects of its news reporting would not be surprising if the topic being investigated was economic policy, foreign affairs, immigration, or many other politically-contested issues. Journalism which promotes political views has historically been a feature of the British print media, and as Hampton (2008) has argued, outside of Reuters and the BBC, British journalists throughout the 20th century were less influenced by American-style objectivity than by such concepts as accuracy and truth, fair play, and independence. The wider role that ideology (defined broadly as a structure rather than an individual belief) plays in the hierarchy of influences over the media and journalists has also been amply examined (Shoemaker and Reese, 1996, chapter 9).

What is more interesting is the extent to which ideologically-driven coverage is affecting UK media treatments of 'objective' science. Expressed crudely, some now argue that a number of right-wing British newspapers consider climate change to be primarily an issue of politics, rather than of science, and stand accused of taking the view that their coverage of the

science need not be constrained by considerations of whether information is inaccurate or misleading (Ward and Hicks, 2013).

There have been several academic studies of media treatments of other scientific topics at the centre of the science-policy interface such as nuclear energy in the USA (Gamson and Modigliani, 1989), food and medical biotechnology in Europe and the USA (Dahinden, 2002; Nisbet and Lewenstein, 2002), and the MMR vaccine in the UK (Lewis and Speers, 2003). However, the focus of these studies has tended not to be on the different news treatments given to these topics by newspapers of different persuasions. A more obvious parallel with climate change is the coverage of the links between smoking and cancer, where a powerful group of scientists, tobacco lobby groups, and right-wing think tanks were keen to use the media to present the science as unsettled. For example, research shows that in the early 1990s the print media in the USA went on presenting the evidence on passive smoking as controversial long after scientific consensus was reached (Kennedy and Bero, 1999).

Oreskes and Conway (2010) argue that it was not just the 'obviously right-wing outlets' like the *Washington Times* in the USA who reported the false claims, but the liberal or 'prestige' press as well. (p.243) Indeed, they assert that a wide spectrum of the media has been complicit in treating a long list of settled science issues, including passive smoking, acid rain, ozone depletion and climate change, as scientific controversies. This, they say, is largely a product of journalists being hounded by experts, often linked to free market think tanks, who demand equal time and space in the media. (p. 214) But they also make the case that it was a small group of scientists, driven by free market ideology and anti-communist values, who were behind this 'merchandising of doubt'.

Free market ideology may explain some of the differentiation in the media treatment of climate change. Right-leaning papers often see mitigation policies as a threat to consumerism, the hegemony of the market or individual liberties, and consequently downplay or disparage them, whereas left-leaning ones flag non-market, interventionist and international approaches (Carvalho and Burgess, 2005; Gavin et al., 2011) But this does not in itself explain why ideology should 'migrate' from the coverage of the solutions to coverage of the science, and particularly the treatment of uncertainty and the presence or

absence of sceptical voices questioning the science. More examination of why and how this 'migration' takes place is needed.

Cues from political elites may be helpful in explaining the timing and nature of the polarisation of the climate change 'master-story', including the scientific aspects of it. As the work by Hallin (1994) on the US media's coverage of the Vietnam War showed, the behaviour of the media was closely linked to the degree of consensus amongst the political elites. When consensus was strong, the media played an essentially passive role, but as soon as political elites were divided, the media became more active and more diverse in its points of view. There is some evidence for thinking that after a period of broad cross-party consensus in the UK until 2010, growing criticism from a vocal and organised political right has turned climate change into an increasingly partisan issue, and weakened the current government's mitigation programme (Carter, 2014).

It is of relevance here that the coverage of the IPCC's 2013/4 reports was markedly different between right and left-leaning media in the UK and the USA in the treatment not just of the policy options to deal with climate change, but of the underlying science too (and particularly, the climate 'pause') (Painter, 2014). So an increase in polarised treatments in the media may be related to the increasing polarisation of climate change amongst political elites. More data from earlier periods of more political consensus would be needed to make the case.

The example of the USA is helpful here as the relationship between partisanship and selectively framed media portrayals is better understood (Nisbet, 2009). There is strong evidence from polling data that over the past few years, Americans have become more polarised along party political lines (Dunlap and McCright, 2008 and 2011). More Republicans now question the science and dismiss the urgency of the problem, whilst an increasing majority of Democrats accept the science and express concern. Party competition on the issue has become more partisan and divisive, which has been a main obstacle to progress on any policy front. Some research suggests this polarisation increased significantly in the late 1990s after a barrage of media coverage (Krosnick et al., 2000), although we also know that media coverage is not as significant as other factors (such as elite cues) in shifting public concern about climate change in the USA in the 2000s (Brulle et

al., 2012). More research is clearly needed in the UK to gain a better understanding of the specific role that the media play in reflecting or causing the polarisation of attitudes over time.

There is now a considerable body of literature from the fields of psychology and other disciplines that political polarisation around climate change, particularly in Anglosphere countries, is largely a reflection of the fact that disagreements are more likely to be about values (cultural, political and social) than about the basic science, even though the science may be a proxy for these value-based disputes (Hulme, 2009; Corner et al., 2014). As Kahan and other researchers in the Cultural Cognition project (Kahan et al., 2011) have shown, individuals tend to align their beliefs about disputed issues (such as climate change, the death penalty or gun control) to the values which define their cultural identities. So climate scepticism is rooted in people's core values and worldviews. Political affiliation and environmental values are the strongest correlates of uncertainty about climate change, with a consistent association between scepticism and political conservatism (Poortinga et al., 2004; Whitmarsh, 2011; McCright and Dunlap, 2011).

With this in mind, it may be that commonly-held cultural values at the national level are playing an important role in explaining country differences both in media treatments of uncertainty and in wider society. How much are journalists reflecting such values in their treatment of scepticism? How significant is it that in Germany, where scepticism is not strong in public opinion, the precautionary principle is embedded in its culture (Engels et al., 2013)? Brazil, another non-sceptic country, often appears near the top of lists of countries where concern for the environment and climate change is highest, perhaps due to the presence of the world's largest rainforest (Gallup, 2011; Ipsos-MORI, 2013 and 2014). In France a stronger tradition of respect for science and a more rationalist culture than in the UK may help to explain the relative lack of scepticism amongst its elites (Painter 2011, pp. 78-9). In the USA, libertarian, anti-state values drive the general responses of Tea Party supporters, where climate scepticism is most embedded. Indeed, climate change has been added to a list of other issues like opposition to gun control, abortion and higher taxes which defines what it means to be a Republican (Nisbet, 2009).

It is important for several reasons to get a better grasp of the role the media may be playing in some countries in fuelling, or reflecting, the political polarisation of climate change, which to an important extent revolves around the issue of uncertainty. One of them is that polarisation is an obstacle to better public understanding. Another is that it can stand in the way of policy solutions. As Mike Hulme (2012) has eloquently written of the dangers of the ‘duelling narratives of the two sides’,

‘<..> this binary framing is wrong. There are plural and multiple positions, not just about the policy implications of climate change knowledge but also about the scientific assessment of climate risk itself. <...> But why does the rest of the world allow these American cultural politics to skew the wider global debate about climate change in this way?

Why are interested parties in other settings — particularly Anglophone ones it seems — so willing to engage in adversarial combat over climate science as a means of seeking dominance in the policy debate?

To continue the combative metaphors, it is as though the world has chosen to resolve complex policy disputes through a set-piece duel — and everyone needs to decide which of these two heavily armed proxy warriors they are supporting.’ (p. 223)

i Many studies use the term ‘global warming’ as synonymous with ‘climate change’. We recognise the difference in meaning between the terms and the different effects they can have on audiences, but for consistency we use the latter term.

ii This refers to the time in November 2009 when emails were stolen from computers at the Climatic Research Unit at the University of East Anglia in the UK.

iii A fuller description of the research method can be found in Painter 2011 ch.4, Painter and Ashe 2012 p. 3, and Painter and Gavin 2015 pp. 8-12. An example of the basic coding sheet can be found in Painter 2011, Appendix 2.

iv Boykoff outlines four categories, but the first ‘man-made global warming accounts for all climate changes’ is seldom expounded.

v By ‘uncontested’ we meant articles where the sceptical voices or opinions are left unchallenged, or in other words where there is no mainstream climate science point of view within the article which acts as a clear balancing force.

vi Hereafter abridged to the Mirror, Guardian, Mail, Telegraph respectively.

Appendix 1 Coding sheets for UK Newspaper Coverage of Climate Change, 2009/2010

Newspaper	Date	Presence of sceptics (h/l)	First para	Named individual sceptics quoted directly or indirectly	How many	Sceptics quoted generically	Named individual reps of mainstream science or reports quoted directly or indirectly, or countervailing voice (CRU)	how many times	generic	General tone – scepticism dominant	Equal coverage	Mainstream dominant	Strong Language indicators?	Settled science or uncertain science
Mirror	28-Nov	n	n	y	1	n	n	x	y	n	y	n	x	x
Mirror	02-Dec	n	y	n	x	y	y	1	n	n	n	y	y 'muddled and confused'	
Mirror	04-Dec	y	y	n	x	y	y	2	y	n	n	y	x	Q and A refuting sceptics
Mirror	05-Dec	y	y	n	x	y	y	2	y	n	n	y	y flat earthers	quote on settled
Mirror	09-Dec	n	n	n	x	y	y	2	y	n	n	y	n	quote on settled
Mirror	23-Jan	n	n	n	x	y	n	x	y	n	n	y	x	x
Mirror	12-Feb	n	y	n	n	y	n	x	n	n	y	n	x	x
Mirror	12-Feb	y	y	y	1	n	n	x	n	y	n	n	x	uncertain
Mail	21-Nov	n	n	n	x	y	y	1	n	n	y	n	'global warming con'	uncertain - CRU
Mail	23-Nov	y	n	n	x	n	y	1	n	n	y	n	x	CRU
Mail on Sunday	29-Nov	n	n	y	1	n	x	x	x	n	y	n	x	CRU
Mail on Sunday	06-Dec	n	n	y	1	y	y	1	n	n	y	n	x	CRU
Mail on Sunday	07-Dec	n	n	y	1	y	y	2	y	n	y	n	x	x
Mail	13-Dec	y	n	y	6	y	y	3	y	y	x	n	x	CRU
Mail	17-Dec	n	n	y	2	n	y	1	n	n	y	n	x	x
Mail	09-Jan	n	n	y	1	y	n	x	x	n	y	n	x	uncertainty

Mail on Sunday	10-Jan	n	y	y	1	y	n	x	y	y	n	n	x	uncertainty
Mail	11-Jan	n	y	y	2	y	n	x	y	y	n	n	x	uncertainty
Mail	18-Jan	n	n	y	1	n	n	x	n	y	n	n	x	uncertainty
Mail	22-Jan	n	n	y	1	n	y	1	n	y	n	n	Great lie'	uncertainty
Mail	29-Jan	y	n	y	1	n	y	1	n	n	y	n	x	CRU
Mail	29-Jan	n	n	y	2	y	n	x	n	y	n	n	x	CRU
Mail	01-Feb		n	y	1	y	y	1	n	n	y	n	x	Amazon
Mail	05-Feb	n	y	n	x	y	y	1	y	n	y	n	x	
Mail on Sunday	07-Feb	n	n	y	1	y	n	x	n	y	n	n	x	CRU
Mail on Sunday	14-Feb	n	n	y	1	y	y	1	y	n	y	n	n	
Telegraph	20-Nov	n	y	y	1	n	y	1	n	n	y	n	fraudulent piece of scaremongering'	Ad v flying
Telegraph	21-Nov	y	n	y	1	n	n	x	n	y	n	n		Ad (feature) for Nigel Lawson
Telegraph	24-Nov	n	y	y	1	y	y	4	y	n	y	n		CRU
Telegraph	28-Nov	n	n	y	4	y	y	3	y	n	y	n	"the greatest act of scientific fraud in history"	CRU
S. Telegraph	29-Nov	y	y	y	2	y	y	1	y	y	n	n	these guys have an attitude'	CRU (grandfather hero)
Telegraph	30-Nov	n	n	y	1	n	y	2	n	n	y	n	biased reporting and censorship'	BBC/CRU
Telegraph	30-Nov	y	y	n	x	y	y	1	n	n	n	y	Yeo quote	Griffin to Chagen
Telegraph	02-Dec	y	y	y	1	n	n	x	n	y	n	n	Abbott quotes strong	Abbott
Telegraph	04-Dec	n	y	y	1	y	y	1	y	n	y	n		CRU
Telegraph	04-Dec	y	y	n	x	y	y	1	y	n	n	y	climate saboteurs	Miliband v sceptics
S. Telegraph	06-Dec	y	y	y	1	y	y	1	y	y	n	n	gravy train'	
Telegraph	07-Dec	n	n	y	1	n	y	3	y	n	y	n		Policy

Telegraph	08-Dec	y	y	n	x	y	y	2	y	n	n	y		UN v sceptics
Telegraph	09-Dec	y	y	y	6	y	y	1	n	y	n	n		Sceptics conference
Telegraph	11-Dec	n	n	y	1	y	y	2	y	n	y	n		Hot temps
Telegraph	12-Dec	n	n	y	1	n	n	x	n	n	y	n	gift'	
S. Telegraph	13-Dec	n	y	y	1	y	n	x	n	y	n	n		CRU
S. Telegraph	20-Dec	n	y	y	2	n	n	x	n	y	n	n	tone v Pachauri	Pachauri deal
S. Telegraph	20-Dec	n	n	y	1	n	n	x	n	y (*)	n	n		Chagen outcome
S. Telegraph	17-Jan	n	n	y	2	n	y	2	n	n	y	n		Pachauri deal
Telegraph	23-Jan	n	y	n	x	y	y	1	n	n	n	y	quote v sceptics	CRU
Telegraph	25-Jan	y	y	y	1	n	n	x	y	n	y	n		China sceptic
Telegraph	28-Jan	n	n	y	1	n	y	1	n	n	y	n		CRU
S. Telegraph	31-Jan	n	n	y	1	y	n	x	n	y	n	n		IPCC-glaciers
Telegraph	06-Feb	n	n	n	x	y	y	1	y	n	y	n		King
Telegraph	10-Feb	n	n	n	x	y	n	x	n	n	y	n		Lords
Telegraph	13-Feb	y	y	n	x	y	y	1	y	n	n	y	Russian roulette with planet	rebuttal of sceptics
Telegraph	19-Feb	n	y	y	3	y	y	2	y	y	n	n		Questioning mainstream science
Guardian	23-Nov	y	y	n	x	y	y	1	y	n	n	y		anti-sceptic
Guardian	24-Nov	y	y	y	7	y	y	2	y	n	n	y		sceptics will not make a difference
Guardian	24-Nov	n	n	n	x	y	y	6	y	n	n	y		CRU - view of cc scientists paramount
Guardian	28-Nov	n	n	n	x	y	n	x	n	n	y	n		CRU
Observer	29-Nov	n	y	y	1	n	y	7	n	n	n	y		Balance v Griffin
Guardian	30-Nov	n	y	y	1	n	n	x	n	n	y	n		Griffin quotes but h/l
Guardian	02-Dec	n	n	y	1	n	n	x	y	n	y	n		Abbott
Guardian	04-Dec	y	y	y	2	y	y	2	y	n	n	y		Miliband v saboteurs

Guardian	05-Dec	y	y	y	2	y	y	6	y	n	n	y		Attack on sceptics
Guardian	05-Dec	y	y	y	11	n	n	x	y	n	y	n		List of sceptics but counter-arguments given
Guardian	05-Dec	y	y	y	5	y	y	2	y	n	n	y	oddball coalition	Analysis of sceptics
Observer	06-Dec	n	n	n	x	y	y	3	y	n	n	y		Anti-deniers making a campaign
Guardian	07-Dec	n	n	y	1	y	n	x	n	n	y	n		Media presence
Guardian	07-Dec	n	n	y	1	y	y	5	y	n	n	y		Chagen
Guardian	12-Dec	y	y	y	1	n	y	1	n	n	y	n		Monckton jibe
Guardian	05-Jan	y	y	n	x	y	y	2	y	n	n	y		In defence of Pachauri
Guardian	12-Jan	n	y	n	x	y	y	1	y	n	n	y		Latif v Mail
Guardian	23-Jan	n	n	y	1	n	y	1		n	y	n		US coal baron v Kennedy
Guardian	27-Jan	n	y	n	x	y	y	3	n	n	y	n		Beddington
Guardian	31-Jan	y	y	n	x	y	y	2	n	n	n	y	war on sceptics	Miliband on attack
Guardian	01-Feb	n	n	n	x	y	y	2	n	n	y	n		Pachauri
Guardian	02-Feb	n	y	y	1	y	y	3	y	n	y	n		Pearce intro
Guardian	02-Feb	n	n	y	1	y	y	3	y	n	y	n		Pearce 1
Guardian	03-Feb	y	n	n	x	y	y	7	n	y	n	n	Thrust v practice of peer-review	Pearce 2
Guardian	04-Feb	n	y	y	1	y	y	5	n	y	n	n	thrust v FOI Requests	Pearce 3
Guardian	04-Feb	n	y	y	2	y	y	3	y	n	n	y	Thrust v sceptics targetting researchers	Pearce
Guardian	04-Feb	n	n	n	x	y	y	1	n	n	n	y		Defence of Mann
Guardian	04-Feb	y	y	y	4	y	y	3	n	n	y	n		Pearce 4
Guardian	05-Feb	n	y	y	4	y	y	2	y	n	y	n		CRU

Guardian	05-Feb	n	n	n	x	y	y	2	y	n	n	y		Pearce 5 - strong endorsement of science even though practice dodgy
Observer	07-Feb	y	y	y	1	n	y	1	n	n	y	n		Peiser versus McKie
Observer	07-Feb	y	y	y	2	y	y	1	n	n	y	n		Sceptic opinion in Tories
Guardian	12-Feb	n	n	y	1	y	y	1	n	n	y	n		CRU
Guardian	13-Feb	y	y	y	1	y	n	x	n	n	y	n		anti-science but as weirdo
Observer	14-Feb	y	y	y	1	y	y	1	n	n	n	y	v GWPF	

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