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Title of journal article: **Attention to Climate Change in British Newspapers in Three Attention Cycles (1997-2017)**

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Attention to Climate Change in British Newspapers in Three Attention Cycles (1997-2017)

Abstract

Peaks in climate change newspaper coverage have been attributed to key events, such as major international climate change summits, on the basis that these are reported. This approach overlooks the possibility that unreported events have capacity to focus journalists' and editors' attention on climate change. This study considers the extent to which meteorological and political events – derived externally from what is reported in the media itself (some reported, some not) – coincide with attention to climate change in four UK newspapers. We call these events 'news prompts', since they are potential rather than actual news pegs: some are translated into news stories, others are not. The study brings together literatures on agenda-setting, newsroom practices, and the political economy and ideologies of newspapers. We find that the four newspapers we analyse have responded differently to climate-change related events including international policy events and extreme weather. In recent years, The Mail, The Telegraph *and* The Times *have been relatively insensitive to climate change news prompts in comparison to the more left-leaning* Guardian*. As climate change coverage increases, so does sensitivity to climate news prompts. This suggests that the ideology of newspapers and the political economy of media outlets may drive climate coverage as much as routine newsgathering practices.*

Key words: *climate change; newspaper coverage; news prompts; ideology; Britain*

1. Introduction

Environmental politics is dominated by climate change (Connelly et al 2012), one of the most pressing issues of our time. The way in which it is reported in the media massively shapes public understanding of the issue (Anderson 1997). It is, therefore, crucial to understand the way in which the press reports climate change. Climate change coverage is the result of a concatenation of agenda setting (local, domestic and international events and problem indicators), newsroom practices and the ideology and political economy of newspapers. Despite the complex recipe that dictates what ends up being published in newspapers, many climate change stories are related to political, ecological or meteorological events (Lester 2010, Boykoff 2011). Such events can be thought of as news prompts. A news prompt is an event or action that journalists can *but might not necessarily* use in order to make an issue newsworthy. It is similar to a news peg (Greenberg et al 1989), which is an event around

which a story is pinned. However, whereas pegs always exist in tandem with a published story, a prompt might be thought of an event with the potential (which may or may not be realised) to become a news peg. Without a news peg, climate change in its full complexity struggles to gain media attention (Anderson 1997: 54).

Scholars have identified that peaks in climate change coverage coincide with political and meteorological events (Achong and Dodds 2012, Boykoff 2007, Boykoff and Mansfield 2008, Wu 2009, Wagner and Payne 2017, Stoddart et al 2015). Boykoff and Mansfield (2008), for example, associate peaks in climate change coverage in the UK tabloid press with floods (October 2000), George Bush's presidential talk, the European Emissions Trading scheme and a G8 meeting (June 2005); and Al Gore's *Inconvenient Truth*, Richard Branson's green economy pledge and the Stern Review (Autumn of 2006). The first – flooding – we label as a meteorological prompt, whereas the others, due to their political nature we label as political ones. Note that the prompts listed above were reported in the press, but did not appear in every article on climate change with which they coincide. Other prompts, we purport, act as prompts without actually being covered.

Certainly the basis for specifying floods as a reason for increases in climate change coverage has, historically, not been clearly established for the British case, although extreme weather has increased coverage in Germany (Schäfer et al 2014). Only 55 of the 1,200 headline stories that mention flooding across eight British newspapers (2001-2007) also mention climate change (Gavin et al 2011: 427). Despite few articles mentioning both flooding and climate change together, we concede that peculiar weather might focus journalists' and editors' attention on to climate change even when the two are not reported in tandem. Thus, even if flooding was not the *actual* peg around which journalists framed their story, it could certainly be viewed as a news prompt, as the German evidence suggests. Although journalists have, historically, been cautious about relating climate change to extreme weather, this has changed in recent years. Since 2011, the link between extreme weather and climate change is now more commonly referred to in scientific, media and public discourse (Nerlich and Jaspal 2014).

Similar scepticism might be levelled at the alleged relationship between peaks in coverage and the IPCC Fourth Assessment Reports. Only 55 articles across ten British newspapers actually reported on the release and content of these (Hulme 2009). Contrary to many explanations given, a more forensic examination of data reveals that the peaks in coverage in

112 newspapers across the world in April, July and November 2007 do not neatly coincide with the release of the sections of the IPCC reports (Working Group 1 in February, for Working Group 2 in April and for Working Group 3 in May). Until scholars (e.g. Liu et al 2011; Schäfer 2014) started modelling the effect of trigger events on climate coverage in the early 2010s, it was difficult to discern a distinct methodological approach for assigning peaks in coverage to prompts.

Similarly to Liu et al (2011) and Schäfer (2014), we derive a list of news prompts independently from media reporting. Liu et al's (2011) study is based on analysis of US papers, whereas Schäfer (2014) compares Australia, Germany and India. In our article, we focus on the British case. We use our list of externally derived political and meteorological news prompts as independent variables in a mixed effects regression model that has monthly media counts of articles with climate change in the title as the dependent variable. This allows us to address a number of research questions hitherto unexplored in the literature. To what extent do newspapers with different ideologies pick up on news prompts? Do political news prompts increase media coverage more than meteorological news prompts? What are the differences in attention given to international news prompts in the broadsheets compared to a tabloid newspaper? And, given that newspapers have expanded their size dramatically over the last decade, is their sensitivity to news prompts changing over time as journalists hunt for stories to fill news gaps?

Our research is relatively novel for studies on climate change coverage. It contributes to the literature in two main ways. First, it builds on studies of agenda setting that have modelled the effect of triggers on coverage (e.g. Liu et al 2011, Schäfer et al 2014). We consider the effect of problem indicators (that we here call meteorological prompts) and focusing events (political prompts) on coverage (Kingdon 1995). We do not additionally include Kingdon's (1995) 'feedback' effects – which refer to pressure from societal actors like NGOs – because these mostly have an amplification effect on problem indicators and focusing events (see Hannigan 2006:29-33 on the social construction of environmental problems and Section 3). Our key contribution is to add newspapers as a fixed effect in our models, which allows us to see how triggers vary across newspapers with different ideological persuasions. Thus, we bring the agenda-setting literature together with the body of literature on the effect of the ideologies of newspapers on coverage (Carvalho 2005, Dirikx and Gelders 2010, Painter and Gavin 2016). Existing studies on the effect of news prompts have lumped together newspapers with different ideological persuasions. Our focus on four very different UK

newspapers fulfils a plea from O'Donnell and Rice (2008:651) that 'future research should compare environmental coverage by newspapers varying in quality and circulation'. Second, in addition to allowing for differentiation in the predictors of climate coverage across newspapers, we extend existing studies on agenda setting in climate change coverage by drawing together literatures on the specific nature of environmental and climate change reporting, journalistic practices, the political economy of newspapers and newsroom practices. Our hypotheses are derived from these literatures and purport that news prompts do not exist in a vacuum to independently shape coverage.

Before addressing these questions, we review relevant literature on environmental journalism, climate change coverage, newsroom practices, the political economy of newspapers, and British newspapers. Alongside the agenda-setting literature, these literatures shape our hypotheses, which we present before turning to our findings, discussion and conclusions.

2. Environmental journalism and climate change newspaper coverage

According to Hansen (2011) there have been three key phases in the study of climate change coverage. These are: 1) the production of environmental journalism (e.g. Schoenfeld et al 1979); 2) differential coverage of climate change (e.g. Boykoff 2007); and 3) the social and political implications of climate coverage (e.g. Nisbet 2009). In this paper we shed some light on all three. Longitudinal mapping of coverage and its relationship to news prompts improves knowledge of the production and construction of news, as well as its implications for public understanding. Production and consumption of news can be thought of as 'cultural circuits', where interpretations of issues co-evolve across public and private spheres (Carvalho 2010). Our primary emphasis, though, is on *production* of climate change stories rather than consumption.

It is well-known that coverage of the environment has peaks and troughs associated with alarm and realisation of costs, respectively (Downs 1972, Neuzil 2008). Whilst coverage of environmental issues clearly goes in waves (if not cycles), Downs has been criticised for treating the environment as a single issue (Lester 2010). Hiltgartner and Bosk's (1988:5a) public arena model notes how newspaper coverage results from fierce competition for attention among social problems. Kingdon (1995: 406) suggests that issues that are elevated in media agendas have been promoted by 'problem indicators' (e.g. science and the weather), focusing events (e.g. international climate summits) and feedback (e.g. interventions from climate NGOs). Whether climate change gets coverage depends heavily on other issues with

which it competes. Implicitly drawing on Hilgartner and Bosk's work, scholars have noted how one environmental story might elevate another environmental story onto the agenda (Mazur 1998, McGaurr and Lester 2009).

Climate change received little coverage until the 1980s (Boykoff 2011: 44-6), only coming into 'full public view' in 1988 (Boykoff 2011: 48). It was initially framed as a scientific issue drawing on reports and testimonials of scientists like Hansen (NASA) and Schneider (NCAR). Since 1988, it has become increasingly politicised, firstly as a controversial issue, later within the frame of techno-corporatist governance (Carvalho 2007). The overall quality of environmental journalism in the UK and the US has been assessed as 'poor' partly due to unknowledgeable reporters (O'Donnell and Rice 2008). Another reason for this negative assessment might be because the aspirations of environmental journalism – for advocacy and speaking truth to power (Frome 1998) – are stifled by journalistic norms (see section 3).

Boykoff (2011) suggests that there are three main types of climate change stories: ecological / meteorological, political and scientific. Meteorological events like freak weather are often directly associated (by scholars) with rising climate change coverage. In the US, for example, the 1988 peak in coverage was considered directly related to severe forest fires in Yellow Stone National Park and an extraordinarily hot summer (Ungar 1992, Mazur and Lee 1992). Similarly, political events are attributed to peaks in coverage, such as Thatcher's green pledge in 1988, the 1992 UNCED Earth Summit conference and in 2004 the Stern Review (e.g. Boykoff and Boykoff 2007). Scientific reporting is often concentrated around the IPCC reports, which have acted as 'critical discourse moments' that have 'solidified a narrative of consensus' (Carvalho 2005: 55, Carvalho 2010). Although, the IPCC consensus is somewhat challenged, the IPCC was established to feed into policy, so we classify the release of these reports as *political* news prompts.

The objective existence of meteorological and political prompts clearly does seem to be associated with peaks in coverage. However, extant research on the British case has tended to overlook that a news prompt might stimulate coverage without necessarily being the topic of a news report (cf. Hilgartner and Bosk 1988).

3. Newsroom practices and the political economy of newspapers

Newspaper outlets are influenced by a set of 'stable, patterned sets of expectations and constraints' (Shoemaker and Reese 1996: 102) known as news routines. Routines include

compatibility with a 24-hour media cycle (Galtung and Ruge 1973) and the presence of an established news beat. Such routines dictate that the stories most likely to gain coverage consist of events (rather than issues) or embargoed press releases from official sources. Hard news is derived largely from pre-scheduled or unscheduled 'events', whereas soft news is designed to 'fill a hole' when prescheduled stories are lacking. Generally, events are considered easier to present as 'news' than non-events. Scheduled events are most likely to gain coverage since they provide reporters with time to plan stories (Shoemaker and Reese 1996: 116). Indeed, much environmental coverage has been event-centred (Anderson 1991, Sachsman 1976, Shanahan 1993, Dunwoody and Griffen 1993) and rare but dramatic environmental events are over-reported (Anderson 1997).

Sources with economic and political power are the most able to influence news regimes (Shoemaker and Reese 1996:119). Gandy (1982) attributes this observation to 'information subsidies', which involve elites controlling access to information. A former *Times* correspondent once said ministers are 'specifically targeting me and my colleagues all the time and trying to get us to report the news in the way they want it reported' (in interview with Anderson 1992).

The journalistic norms of personalisation, dramatisation, novelty and balance have been shown to heavily shape newspaper coverage of climate change (Boykoff 2007). In the reporting of climate change, balance has led to a 'short-circuiting of peer reviewed literature' (Boykoff 2011: 60). Balance, which involves paying equal attention to those who do and do not believe in anthropogenic warming, tailed off in the mid-2000s (Carvalho 2007) but has re-emerged in some newspapers such that an 'ideologically divided media culture' (Nisbett and Fahy 2015: 223) continues to shape media coverage of climate change. It has become difficult for moderates to cross the fault-lines of a debate already established as polarised (Nisbet 2014, Nisbet and Fahy 2015). Although environmental journalists have been found to draw on business sources more than environmental ones (Sachsman et al 2010) environmental journalists continue to rate their peers as overly green (Sachsman et al 2006), suggesting enduring tension between objectivity and advocacy (Neuzil and Kovarik 2006).

Journalistic norms operate in a media context in which outlets have increased their output whilst decreasing resources. Such pressures have led to a fall from the 'golden age' of environmental reporting with a higher than ever reliance on information subsidies (Fahy and Nisbet 2010, Sachsman et al 2010). In recent years, *The Guardian* tripled in size, while the

Times and *Mail* doubled (Lewis et al 2008). Consequently, journalism has increasingly become a desk-job rather than an investigative one. Journalists have become multi-skilled as jobs have become rationalised and remaining staff are required to become increasingly efficient. This has led to pressures of information overload (Cottle 1999) and increasing reliance on secondary sources such as PR agencies and news agencies (Davies 2009, Williams and Clifford 2010). It is for these reasons that Davies (2009) refers to journalism as 'churnalism'.

Partly in response to the pressures of producing stories within tight timescales, journalists engage in 'pack journalism' (Frank 2003). This involves large groups of reporters copying one another, sharing information, and sometimes, in the process, omitting to check data (Matusitz and Breen 2012). Simultaneous peaks in coverage associated with major international events are common across papers in many countries since journalists are required to 'set up international co-operation if they do not want to lose a grip on the phenomena they try to explain' (Weaver and Löffelholz 2008:9). Editors will want their newspapers to appear on message by containing a version of major stories (Bennett 1996:375). This appears to be what happens in relation to the reporting of major climate change summits (Luck et al 2016).

Pack journalism leads to similarities in reporting across newspapers and is thought to be detrimental to the quality of stories (Matusitz and Breen 2012). However, it would be wrong to assume that journalists entirely lack agency in generating stories. In their study of two quality and two tabloid newspapers in Flanders, Boesman et al (2014) found that journalists are more likely to break out of the pack when they have a specialised beat and more autonomy. Moreover, because both the ideologies and political economies of British newspapers vary we would expect to find differential responses to news prompts across different newspapers.

4. Newspapers in Britain

Broadly speaking, there are two main types of newspapers in Britain: the quality broadsheets and the mid or low-market tabloids. The broadsheets have a much higher proportion of middle class readers, compared to the tabloids (Tunstall 1996). We focus here on the four papers included in our analysis: *The Times, The Guardian, The Telegraph* and *The Daily Mail*. *The Times* is characterised as a Conservative paper, committed to the establishment

(Carvalho 2007: 226). Until 2001, it heavily contested anthropogenic climate change, legitimising its stories with reference to US 'nay-sayers'. For a while, it accepted the consensus science of the IPCC, but still gave considerably less emphasis to the 2004 assessment report than *The Guardian* (Carvalho 2007: 234-6).

In 2008, O'Donnell and Rice commented that *The Times* 'has recently changed to a more conservative and sensational slant' (p.644). *The Times* has generally adopted a business-as-usual frame, contrasting with the left-leaning *Guardian*, which has given more emphasis to climate mitigation (Carvalho 2007). *The Guardian* is 'the British daily of general circulation that is the furthest to the left of the ideological spectrum, traditionally supporting the Labour Party' (Carvalho 2005: 2), even though it has been sceptical about the current Labour Party leader, Jeremy Corbyn. Unlike the other papers that we analyse, it is owned by a charitable trust and is renowned for strong coverage of environmental issues (Carvalho and Burgess 2005: 1460). Of all the broadsheets, it has the most left-wing readership (Tunstall 1996).

The Telegraph is the most right-wing popular up-market broadsheet. It is known for its strength in reporting foreign affairs (Tunstall 1996). Doulton and Brown (2009) included it in their analysis of climate change coverage in the quality British press because it sits to the right of *The Times*. Similar to *The Times*, climate change has been regarded as low priority by *The Telegraph*. Until 2006, *The Telegraph* primarily argued that other developmental issues were more important than climate change, and that China and India were self-interested states, unwilling to contribute to mitigation efforts. In 2007-9, the emphasis allegedly shifted to reporting about climate change as a pending catastrophe (Douton and Brown 2009). *The Telegraph* continues to feature columns by Christopher Monckton and Christopher Booker, two individuals well known for denying that anthropogenic emissions are contributing to climate change.

The more sensationalist tabloids, including *The Daily Mail*, contrast with their broadsheet counterparts by emphasising domestic (national) conflicts and scandals (Conby 2006). Boykoff (2008: 56) found that the UK populist right-wing tabloids have a tendency to report in terms of 'fear, misery and doom' and were more likely to frame climate change with reference to extreme weather events. Their domestic focus means that they are weak on foreign news. According to Sparks (2000:10), the tabloid news is relatively devoid of politics. Lockwood (2009) found that the British tabloid press was more likely than the broadsheet press to ignore a number of climate change policy moments. The *Mail on Sunday* frequently

features articles by David Rose, who was accused by the Independent Press Standards Organisation in September 2017 of producing fake news in his dismissal of anthropogenic climate change (Grantham Research Institute 2017). The *Daily Mail* is characterised as a 'mid-market leader' and the voice of Middle England (middle aged, middle class) (Tunstall 1996:15). Unlike broadsheets, the tabloids generally tend to lack specialist environmental correspondents (Boykoff 2011: 89). *The Daily Mail* is perhaps an exception in having an 'environmental editor' for its on-line version. In contrast, the print versions of *The Times, The Telegraph and The Guardian* have established environmental editors and correspondents.

The net readership (combining paper, tablet and computer versions) of the four papers for 2014 was 23,449,000 for *The Daily Mail*, 16, 357,000 for *The Daily Telegraph*, 16,314,000 for *The Guardian* and 4,911,000 for *The Times* (Press Gazette 2015).

5. Hypotheses

We take it for granted that the presence of a large number of news prompts (whether focusing events or problem indicators) leads to increased coverage of climate change. However, since newsgathering often involves information subsidies (Gandy 1982) and has a preference to report on scheduled events rather than unscheduled ones (Shoemaker and Reese 1996), we anticipate that political news prompts, that act as focusing events (Kingdon 1995), will be more frequently associated with increases in coverage of climate change than less predictable meteorological prompts (e.g. flooding or forest fires). Extreme weather has not, historically, been reliable predictor of increases in climate coverage. Liu et al (2011) found that it had no effect on coverage in the US, similar to Schäfer et al's (2014) finding for Australia and India. However, in France, which has a similar media culture the UK, extreme weather *was* associated with an increase in coverage. As links between extreme weather and climate change have become more certain in scientific discourse, extreme weather might increasingly become a more important indicator. Nonetheless, we anticipate that newspapers are particularly sensitive to international policy events. Carvalho (2010:7) noted that 'a large part of mainstream media stories about climate change are set in the context of high-profile intergovernmental meetings'. Similarly Luck et al (2016) have found some evidence of pack journalism in relation to the reporting of UNFCC Conferences of the Parties. In the US, international summits and the release of key scientific reports is associated with an increase in climate coverage (Liu et al 2011).

H1. The presence of political news prompts predict peaks in media attention to climate change more than meteorological news prompts, although meteorological prompts have become more important over-time.

Given the different ideologies and foci of newspapers (Tunstall 1996), we anticipate differential responses to news prompts across papers. Since *The Guardian* is left-wing and has historically devoted the most attention to climate change of the four papers under study (Carvalho and Burgess 2005), we hypothesise that:

H2. Meteorological and political news prompts increase attention to climate change more in The Guardian *compared to other newspapers.*

Our third hypothesis draws on the differences between broadsheets and tabloids. The tabloids are well-known for their domestic focus, which perhaps comes at the expense of international stories (Conby 2006, Sparks 2000). We therefore anticipate that:

H3. Broadsheets are significantly more sensitive to news prompts that consist of international policy events than The Daily Mail*, which devotes more attention to domestic issues.*

Since newspapers have grown in size (with larger print editions *and* online versions) and journalists are increasingly pressurised to find stories to fill news holes (Davies 2009, Lewis et al 2008) our final hypothesis is:

H4. Newspapers display increasing sensitivity to meteorological and political prompts in the later waves of coverage (2005-2009, 2010-2017) compared to the earlier wave (1997-2004).

5. Methods

Our dependent variable is the monthly media share of articles mentioning our search term "climate change" in the title published in the *Guardian*, *The Daily Telegraph, The Times* and *The Daily Mail* and their weekend counterparts. This is calculated by dividing the number of articles on climate change in each paper for each month by the total number of articles per month, multiplied by 100. In our results and findings we refer to media share as 'attention to climate change'. For ease of reference, we refer to daily (week-day) and weekend counterparts by the name of the daily edition. Repeated articles were filtered out using the Lexis Nexis filter. Other exclusions included articles in birthday lists, corrections and letters under 100 words. Unlike many studies on climate change coverage, we additionally include Letters to the Editor, since they are just as likely to result from news prompts as routine

newsgathering (Torres da Silva 2012, Richardson 2001:152). We use Lexis Nexis records of *printed* news rather than *online* news.

The use of monthly article counts as a measure of media attention is common practice in studies of newspaper coverage. In their studies of climate change media agendas, Schmidt et al (2013) and Schäfer et al (2014) have a dependent variable of monthly counts and Liu et al 2011 use annual ones. We follow these studies in using a monthly measure, but we refine it to use 'attention to climate change' in recognition of the different space constraints across the four very different newspapers in our study.

We do not intend to be dismissive of the significance of online news, nor of the synergies between online and printed versions. Our focus on print news is a methodological necessity. In 1997, online versions of newspapers – where they existed – were only shadow of their current selves, making it difficult to compare them over time. *The Guardian*, for instance, launched on-line news in 1999, but only in 2005 did it begin to closely resemble today's online version. In contrast, the print versions are relatively stable in format from 1997-2009.

We analyse the whole period 1997-2017, but additionally zoom in on three separate cycles (1997-2004, 2005-2009 and 2010-2017). We selected these cycles for several reasons. First, the time period 1997-2009 coincides with the time period used in many other studies of climate change coverage (e.g. Dotson et al 2012, Wagner and Payne 2017), allowing us to make comparisons and discuss the generalisability of our findings in our conclusions. Second, we cover the period from the adoption of the Kyoto Protocol, to the negotiation of the post-Kyoto regime in Copenhagen in 2009, up to the most recent complete year (2017), which represents significant peaks and troughs in coverage.

Moreover, three distinct cycles are analysed separately. This is because the three periods represent distinct epochs in the history of British climate change policy and media attention. The first period was a spell of 'low politics' (Carter 2014: 424), with little political action, low levels of public concern and trivial amounts of media coverage (Figure 1). The second cycle begins in 2005, when the environment was 're-emerging on the agenda of news organisations around the world, accompanied by urgent calls for action' (Lester 2010: 12). Rapidly growing political attention, higher levels of public concern and dramatically rising media coverage occurred simultaneously during this spell of 'consensus politics' (Carter 2014: 325). The post-Copenhagen period is included because it represents a dramatic nose-dive in coverage until 2015, followed by a rapid rise coinciding with the UNFCCC Paris

meeting (see the trend graphs produced by Boykoff et al, 2017) and a turn away from consensus politics.

In addition to presenting trend lines (Figure 1), we perform mixed-effects regression (Table 1). In our models each month represents a case for each of the 21 years 1997-2017 (total n=252). The total number of articles with climate change in the title in the four newspapers for this time period is 6,884. Our independent variables are monthly counts of political and meteorological prompts. We control for newspaper type with random intercepts for each level of time. Since papers have varying degrees of newspaper coverage, we also control for the newspaper in the models and test for interactions with news prompts. More specifically, our independent variables consist of monthly averages of a) the maximum and minimum temperature range at weather stations across the UK; b) the amount of rainfall; c) the number of extreme weather events across the world; d) the number of key international policy making moments and; e) the number UK climate policy milestones. Note that we specifically differentiate between international (c and d) and national (a, b and e) as well as meteorological (a, b, c) and political (d,e) news prompts in order to address our hypotheses.

Our meteorological news prompts come from MET office records (1997-2017) and the EM-DAT International Disasters Database for extreme weather[i]. For our list of international political news prompts, we use the World Resources Institute's list of 'Major milestones in the international climate change regime' (Baumert et al 2005, p. 3) combined with the UNFCCC's timeline of international climate policy events. We also used the Carbon Trust's list of key UK climate policy drivers and updated this with more recent events of similar calibre.

6. Results

Figure 1 shows the trend-lines for total monthly article counts in the four newspapers, 1997-2017. On average, newspaper coverage has risen 1997-2009, after which it dipped until late 2015, and then tailed off again, but with notable peaks and troughs disrupting that general pattern. Coverage in all four papers takes noticeable leaps in all four papers in 2005, 2007, 2009 and 2015. The very dramatic peak in *The Guardian* 2015 is not replicated in the other newspapers. *The Telegraph* seems slow to pick up on the momentum of climate change reporting, and *The Mail* is the biggest laggard. The trend analysis justifies our choice to

model the effect of news prompts on monthly news counts not only for the entire period 1997-2017, but also for the distinct cycles 1997-2004 and 2005-2009 and 2010-2017.

Table 1 reports our mixed-effects regression models. Model 1 shows the full period (1997-2017). We find that rainfall and international policy events coincide with more attention to climate change in the newspapers, and that extreme weather is negatively associated with attention to climate change in the news, lending some support to hypothesis 1. The *Mail,* however, was the least likely of the four papers to report climate change in association with months that had high rainfall, resulting in a negative co-efficient. Although extreme weather, overall, was negatively associated with climate change attention, this is less the case for the *The Mail, The Times and The Telegraph*, each of which were more likely to give attention to climate change during months of extreme weather compared to *The Guardian*. *The Guardian* is the most sensitive to international policy news prompts: the other three papers are significantly less likely than *The Guardian* to give attention to climate change in months when there is a key international policy event, lending some support to H2.

<Table 1, about here>

Model 2 (Table 1), present the results for 1997-2004. In this period, extreme weather continues to be negatively associated with newspapers attention to climate change, although the effect is less pronounced for *The Mail* and *The Times*, as indicated by positives co-efficients for the interaction terms of newspapers*extreme weather. International policy events are not significant during this period of time, but UK policy events coincide with media attention to climate change.

Model 3 is the mixed effects model for 2005-2009. In this period, extreme weather shifts from being negatively associated with newspaper attention to climate change, to being positively associated, with the most notable effect in *The Guardian*. Compared to *The Guardian*, this effect is significantly weaker in the other three papers. None of the other variables are significant for this period.

Model 4 shows the same model for the period 2010-2017. In this final model and most recent period, both extreme weather and international policy events are significantly associated with media attention to climate change. However, *The Guardian* is more sensitive to the news prompts of both extreme weather and international policy events than the other newspapers.

A comparison of the models for the periods 1997-2004, 2005-2009 and 2010-2017 offers support to hypothesis 4. There was little effect of news prompts on trends in coverage in the first period (UK policy moments, barely significant) and second period (only extreme weather is significant), and the most in the third period (extreme weather *and* international policy moments are significant).

In addition, we ran the models without the interaction effects, but with newspapers added as a fixed effect. In each of the three time periods, and the entirety of 1997-2017, we find that *The Guardian* gives significantly more attention to climate change than the other three newspapers (consistently, p=0.00).

It is important to point out that the effect sizes are not trivial, even though the coefficients have relatively small values. On average, newspapers' attention to climate change over the 1008 data points analysed across the four newspapers is 0.25%. This suggests that newspapers, overall, give very little attention to climate change. The lowest rate of newspapers' attention is 0.0% (for more than several months across all newspapers at one point or another) and the highest is 3.52% (in *The Guardian* in May 2015). That one international policy event increases newspapers attention by 0.58% in the period 2010-17 is therefore a marked increase. The effects for weather are smaller (0.04 for 2005-2009 and 0.08 for 2010-2017), but still show a doubling between the 2005-2009 and 2010-2017 waves that is not insignificant.

7. Discussion

Our findings talk to the three substantive areas of research on climate change coverage: production, coverage and social and political implications. Existing theoretical *and* empirical studies of environmental journalism suggest that political and meteorological events, at least to some extent, dictate coverage. This is corroborated by studies of agenda-setting (Liu 2011, Schäfer et al 2014). If it were the case that climate change coverage was subject to the whims of pack journalism, we would expect to find similar coverage across all newspapers because all events would be equally reported. While journalistic norms apply to environmental journalists as much as to journalists in other fields (Boykoff and Boykoff 2007), the different trend-lines for coverage (Figure 1), and the varying co-efficients across newspapers in our statistical models (Table 1), indicate that there is something different going on from pack journalism, even for international events which are underreported in all papers compared to

The Guardian. Given that coverage differs in quantity and reacts differently to prompts across the newspapers, it has become clear that climate change coverage is not only the result of events. There is more going on here than agenda-setting. Attention to climate change might also, therefore, be the result of newspapers' ideologies (which generate more nuanced journalistic norms associated with different publications) and political economies.

Overall, we found some support for all of our hypotheses. First we showed that political events more routinely and regularly trigger more climate change coverage than meteorological events (H1). We argue that this is because political events fit more easily into 24-hour news cycles. Additionally, they are predictable since they are more often scheduled (Shoemaker and Reese 1996), and are likely to be preceded by, accompanied by and/or followed up with press releases from governmental sources. Since the majority of stories reported in the press these days derive from such sources (see Lewis et al 2008), perhaps this is no surprise. The effect size of 0.53 is quite dramatic given that the four newspaper across the years studied devote on average only 0.26% of their stories to climate change.

True to what we would expect, given the ideological tendencies of the newspapers we studied, *The Guardian* gave the most attention to climate change, followed, in order, by *The Times, The Telegraph* and *The Mail* (Figure 1). Although we did not test it statistically, it is apparent that the order of coverage would correlate neatly with an ordinal scale of left-right position for each of these newspapers. The closer to the left the newspaper is, the higher the amount of attention to climate change. We anticipated that *The Guardian* would be the most sensitive to news prompts, given its sympathetic outlook on environmental issues (H2) and this is confirmed by our models. Not only did *The Guardian* give more attention to climate change in comparison to the other newspapers, it also, particularly in the latter period, displayed more sensitivity to climate news prompts. In support of H3, it certainly seems that *The Daily Mail*, has less coverage of international policy events compared to *The Guardian*. It consistently has the highest negative co-efficient of the three papers, although it is less distinct from *The Telegraph* and *The Times* than we had anticipated. Even *The Telegraph,* well known for its strong coverage of foreign affairs (Tunstall 1996) gives significantly less attention to climate change than *The Guardian.*

Finally, given the pressures journalists face to 'churn' out newspaper reports (Davies 2009), we anticipated that all papers (aggregated) would be more sensitive to climate change news prompts in the third wave of coverage (2010-2017) compared to the first wave (1997-2009).

Extreme weather and international policy events certainly had this effect (Table 1), even though the effect size is relatively small for extreme weather. There were peaks in climate change coverage in 2009, with many stories about the Copenhagen UNFCCC conference (COP15) and Climategate (Bowe et al 2014, Leiserowitz et al 2014, Nerlich 2010) as well as in 2015 around the time of the Paris COP. This fact both counters and accentuates our own findings. On the one hand, coverage of climate change decreased for a while, which goes against what we might expect given 'churnalism' (Davies 2009). This might be partly explained by the prominence given to other issues since 2010, particularly the economy. Unfortunately we have not had the space to give full exploration to climate change's competition with other issues. On the other hand we note that climate change coverage increased again in the context of the Paris UNFCCC talks (2015), which lends support to our underlying thesis that international climate policy events lead to increased coverage of climate change.

We note that our findings may be applicable to climate change coverage in other countries. A peak in coverage in 2007 has been found not only in the UK, but also in Australia (McGuarr and Lester 2009), China (Wu 2009), the US (Boykoff, 2011), Chile (Dotson et al 2012), Ireland (Wagner and Payne 2015), Canada (Achong and Dodds 2012) and other countries. It is plausible that the release of the IPCC Fourth Assessment Report contributed to that peak. However, most extant work examines trends at a scale of one-year, rather than monthly, making it difficult to associate peaks and troughs with actual events. Moreover, only a small handful of studies have discussed trends in climate change coverage among left and right wing papers separately. These include Dotson et al (2012) on the Chilean case and Dirikx and Gelders (2010) on the Dutch and French cases. Dotson et al (2012) found that the left-wing paper *La Nacion* reported a larger number of articles in more variety than the right-wing *El Mercurio.* It is plausible, therefore, that our findings distinguishing sensitivity to news prompts across different newspapers might hold across countries, particularly those in similar media regimes.

Other studies have noted the importance of newspaper reporting for setting the political agenda and raising public awareness and understanding. Although it is beyond the scope of this article to measure the effect of climate change coverage on public understanding, it is concerning that, among the newspapers studied, it is the two with the highest circulation – *The Mail* and *The Times* – which give the least attention to climate change and which are

among the least responsive to news prompts. Although awareness does not straightforwardly translate into action, vast swathes of the population are only reading about a small minority of climate change news prompts. Even when prompts that would make convenient news pegs exist, climate change continues to miss out on a place in the newspapers.

8. Conclusion

In this article, we make a substantive contribution to the literature on climate change reporting in two ways. First, we objectively assess the effects of news prompts on media coverage. This allows us to take into account that some events might trigger news coverage without being reported. Second, we examine newspapers separately, which has facilitated a comparison of the differential take up of news prompts across left- and right-wing newspapers.

Our findings illustrate that climate change coverage in newspapers in Britain is shaped by a range of factors beyond those usually considered in the agenda-setting literature. These extend beyond the occurrence of events, and may be related to news room practices, and the ideological cultures and political economy of newspapers. We find that media attention to climate change increases more substantially when there are political events (over meteorological ones), that *The Guardian*'s coverage best mirrors the occurrence of climate-related events, that the *Mail* most constantly underreports on climate change policy and that newspapers are more sensitive to news prompts in a more volatile media attention cycle. We also note that extreme weather is becoming an increasingly important predictor of attention to climate change over time, even though the effect sizes are relatively small.

We suggest that our research agenda can be built upon in four ways: 1) comparing across countries; 2) using a broader range of media than written newspaper articles; 3) factoring in word share and/or page location of climate reports and 4) analysing how climate change coverage interplays with coverage on other issues. First, existing research on coverage of climate change – including this study – might be accused of 'methodological nationalism' (Eskjaer 2013, p. 64, citing Beck's 2006 concept). Given that peaks in coverage are identified across multiple countries simultaneously, future research might want to investigate the impact of regional news systems (Eskjaer 2013) international news agencies, and/or the interconnections and network links among journalists in multiple countries.

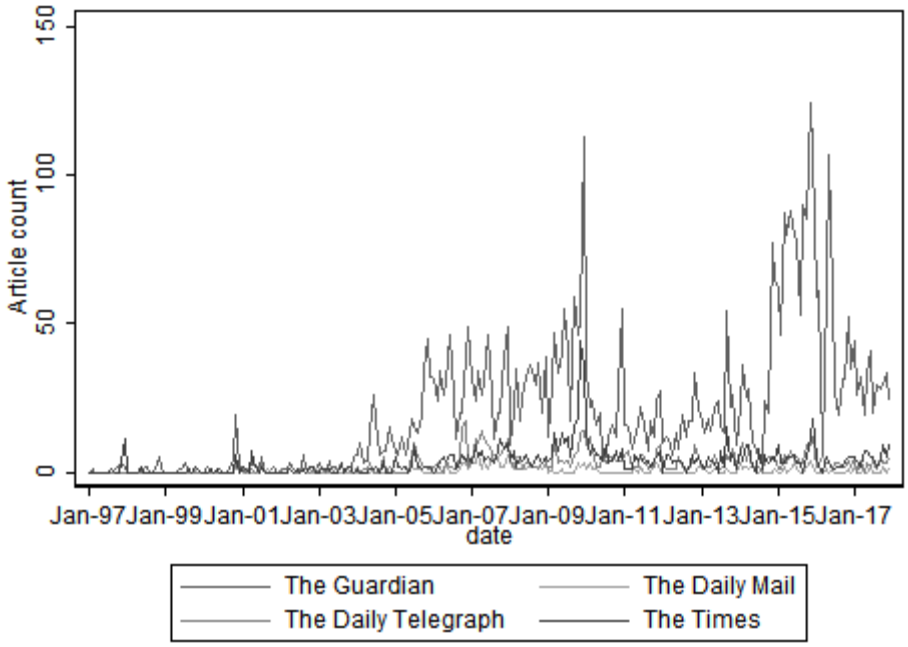
Second, building on Wozniak et al (2012), the analysis of climate change media coverage in general *and* of news prompts in particular, would benefit not only from multi-level analysis, but also multi-modal analysis, analysing both text *and* images (see Di Fransesco and Young 2011). We might, for instance, consider whether more photogenic events act as more potent news prompts than their less photogenic counterparts. Given the different nature of newspapers, we might additionally ask whether the tabloid press is particularly sensitive to prompts that are accompanied by shocking images.

The third extension to our work, factoring in word share and/or page location of articles is important, since a front page feature might be said to be more significant than a short by-line on, say, page 24. However, this would need to be preceded by qualitative work that first assesses how people select articles to read. If emphasis is given to the consumption of news, then focus groups on reactions to stories with different types of pictures would be instructive.

Finally, given that climate change competes with other issues for media attention, it is important to conduct analysis that factors in how coverage on climate changes interacts with that on other issues (Hiltgarner and Bosk 1988). In conclusion, our work is an important step in considering the differential impact of political and meteorological news prompts on newspapers that have varying ideological persuasions.

Figures

Figure 1: Trends in coverage of climate change or global warming (1997-2017)


Article count
0
50
100
150
Jan-97
Jan-99
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
Jan-17
date
The Guardian
The Daily Mail
The Daily Telegraph
The Times

Tables

Table 1. Mixed effects model estimates: The effect of news prompts on 'attention to climate change' in four UK newspapers

	Model 1 (1997-2017)	*Model2 (1997-2004)*	*Model 3 (2005-2009)*	*Model 4 (2010-2017)*
		N=252 monthly counts		
Fixed Effects	*Estimate (s.e.)*	*Estimate (s.e.)*	*Estimate (s.e.)*	*Estimate (s.e.)*
Constant γ_{00}	0.49 (0.25)	0.08 (0.10)	0.66 (0.40)	-0.29 (0.40)
Max-min temperature range	0.04 (0.03)	0.01 (0.01)	-0.01 (0.04)	0.02 (0.04)
Rain mm	0.00 (0.00)**	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Extreme weather	-0.01 (0.00)***	-0.00 (0.00)*	0.04 (0.01) ***	0.08 (0.01)***
International policy	0.46 (0.09)***	0.08 (0.07)	0.08 (0.12)	0.53 (0.12***)
UK policy	-0.06 (0.09)	0.09 (0.04)*	-0.10 (0.08)	Omitted
***Newspaper (r.c*=Guardian)**				
Mail	-0.47 (0.34)	-0.07 (0.14)	-0.61 (0.58)	0.33 (0.55)
Tele	-0.39 (0.34)	-0.05 (0.14)	-0.70 (0.58)	0.46 (0.55)
Times	-0.45 (0.34)	-0.10 (0.14)	-0.85 (0.58)	0.41 (0.55)
Newspaper Interaction Effects				
*(Mail) * temperature range*	-0.04 (0.03)	-0.01 (0.01)	0.01 (0.06)	-0.02 (0.05)
*(Tele) * temperature range*	-0.04 (0.03)	-0.01 (0.01)	0.03 (0.06)	-0.03 (0.05)
*(Times) * temperature range*	-0.03 (0.03)	-0.01 (0.01)	0.02 (0.06)	-0.02 (0.05)
*(Mail) * Rain mm*	0.00 (0.00) *	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
*(Tele) * Rain mm*	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
*(Times) * Rain mm*	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
*(Mail) * Extreme weather*	0.01 (0.00)***	0.00 (0.00)*	-0.05 (0.01)***	-0.08 (0.01)***
*(Tele) * Extreme weather*	0.01 (0.00)**	0.00 (0.00)	-0.05 (0.01)***	-0.07 (0.01***)
*(Times) * Extreme weather*	0.01 (0.00)**	0.00 (0.00)*	-0.03 (0.01)**	-0.08 (0.01***)
*(Mail) * International policy*	-0.45 (0.12)***	-0.07 (0.10)	-0.07 (0.15)	-0.53 (0.17)**
*(Tele) * International policy*	-0.39 (0.12)**	-0.04 (0.10)	-0.02 (0.15)	-0.48 (0.17)**
*(Times) * International policy*	-0.37 (0.12)**	-0.07 (0.10)	-0.03 (0.15)	-0.45 (0.17)**
*(Mail) * UK policy*	0.07 (0.12)	-0.08 (0.05)	0.10 (0.10)	omitted
*(Tele) * UK policy*	0.04 (0.12)	-0.07 (0.05)	0.05 (0.10)	omitted
*(Times) * UK policy*	0.08 (0.12)	-0.05 (0.05)	0.07 (0.10)	omitted
Random Effects: Time				
Between-month var $\sigma^2_{constant}$	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Within-month var $\sigma^2_{residual}$	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
LogLikelihood	3968.24	1859.12	1023.35	1496.23

Notes: Significance levels: *p ≤ 0.05; **p ≤ 0.01; *** p ≤ 0.001; r.c. = reference category *The Guardian*

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