



# OPPOSING POSITIONS DIVIDING INTERACTIONS AND HOSTILE AFFECT

A MULTI-DIMENSIONAL APPROACH  
TO CLIMATE CHANGE POLARIZATION  
IN THE BLOGOSPHERE

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CHRISTEL VAN ECK



## Propositions

1. Both climate mainstream and climate sceptical bloggers strongly believe that they support the truth on climate change.  
(this thesis)
2. One should not address individuals who do not support the scientific position on climate change by attributing negative identity labels to them.  
(this thesis)
3. Academics studying controversial issues are forced to take a political position.
4. Working 40 hours or more per week does not necessarily increase scientific output.
5. Academics should not self-identify as either qualitative or quantitative researchers, as research questions should guide the scientific endeavor.
6. Young people should make sacrifices for the elderly in the case of COVID-19, whilst the elderly should make sacrifices for young people in the case of climate change.
7. The World Health Organization should recognize burn-out as a societal- instead of merely a work- phenomenon.

Propositions belonging to the thesis, entitled

Opposing Positions, Dividing Interactions, and Hostile Affect: A Multi-Dimensional Approach to Climate Change Polarization in the Blogosphere

Christel van Eck

Wageningen, 28 May 2021

# **Opposing Positions, Dividing Interactions, and Hostile Affect**

A Multi-Dimensional Approach to  
Climate Change Polarization in the Blogosphere

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# Opposing Positions, Dividing Interactions, and Hostile Affect

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“It is precisely the people most likely to filter out opposing views who most need to hear them. Social media make it easier for people to surround themselves (virtually) with the opinions of like-minded others and insulate themselves from competing views. For this reason alone, they are a breeding ground for polarization, and potentially dangerous for both democracy and social peace.”

Cass Sunstein (2017, p.71)

# Prologue

12 January 2021

I am writing this Prologue one week after the United States Capitol was stormed by Trump supporters that believed his false claim that the election was fraudulent. Simultaneously, citizens are denying the severity of the coronavirus, whilst the World Health Organization has declared COVID-19 as a 'public health emergency of international concern'. These events make me realize once again how dangerous polarization truly is.

Similar polarization dynamics as in the aforementioned events are at play around the issue of climate change. On the one hand, there is the climate mainstream that supports the scientific position on climate change. On the other hand, there is a group of climate sceptics that rejects this position. Due to the advent of the internet, these groups are provided with new platforms to express themselves. As a result, existing polarization dynamics are facilitated and accelerated online. Moreover, also new polarization dynamics inherent to the online world are identified.

In the current thesis, I set out to investigate the role of the blogosphere in climate change polarization. Different polarization dynamics are identified. Actors in the climate change blogosphere hold opposing positions, have dividing interactions, and are hostile. I find climate change polarization in the blogosphere and in society at large worrying. Polarization is dangerous as it could ultimately put social stability at risk, might even to the point that people become violent, which is exemplified by the storming of the United States Capitol. The stakes are high around climate change, as the impacts are anticipated to get worse. Therefore, in light of the aforementioned events, I believe that the findings of the current thesis are ever more important. I conclude the current thesis with four recommendations to depolarize the climate change blogosphere.

Christel van Eck

# TABLE OF CONTENTS

## PROLOGUE

7

## CHAPTER 1

GENERAL  
INTRODUCTION

11

## CHAPTER 2

'THE TRUTH IS NOT  
IN THE MIDDLE'

Journalistic norms  
of climate change  
bloggers

29

## CHAPTER 3

PARALLEL ROUTES  
FROM COPENHAGEN  
TO PARIS

Climate discourse in  
climate sceptic and  
climate activist blogs

53

## CHAPTER 4

CLIMATE CHANGE  
RISK PERCEPTIONS  
OF AUDIENCES IN THE  
CLIMATE CHANGE  
BLOGOSPHERE

73

## CHAPTER 5

ECHO CHAMBER  
EFFECTS IN THE  
CLIMATE CHANGE  
BLOGOSPHERE

95

## CHAPTER 6

ONLINE CLIMATE  
CHANGE  
POLARIZATION

Interactional framing  
analysis of climate  
change blog comments

107

## CHAPTER 7

EMOTIONAL  
LANGUAGE IN THE  
CLIMATE CHANGE  
BLOGO- AND  
TWITTERSPHERE

131

## CHAPTER 8

GENERAL  
DISCUSSION

147

## REFERENCES

173

## SUMMARIES

191

## ABOUT THE AUTHOR

199

## ACKNOWLEDGE- MENTS

205

## SUPPLEMENTAL MATERIALS

211

## CHAPTER 1

# GENERAL INTRODUCTION



66

Many people are weighing in on the 10 year anniversary of 'Climategate' (...) – but I've struggled to think of something actually interesting to say. It's hard because even in ten years almost everything and yet nothing has changed. The social media landscape has changed beyond recognition but yet the fever swamps of dueling blogs and comment threads has just been replaced by troll farms and noise-generating disinformation machines on Facebook and Twitter. The nominally serious 'issues' touched on by the email theft (...) have all been settled in favor of the mainstream by scientists plodding along in normal science mode, incrementally improving the analyses, and yet they are still the most repeated denier talking points.

Gavin Schmidt, blogger of *RealClimate* (17 November 2019)

.....

This 17th of this month marks the tenth anniversary of 'Climategate' – the release of thousands of emails to and from climate scientists who had been (and still are) collaborating and colluding to create a manmade climate crisis that exists in their minds and computer models, but not in the real world. The scandal should have ended climate catastrophism. Instead, it was studiously buried by politicians, scientists, activists and crony capitalists, who will rake in trillions of dollars from the exaggerations and fakery, while exempting themselves from the damage they are inflicting on everyday families.

Kelvin Kemm, guest blogger of *Watts Up With That* (1 November 2019)

99

## 1.1 Introduction

During the 'climategate' episode, climate sceptical bloggers presented the hacked emails of the University of East Anglia as proof that climate change was a hoax, while climate mainstream bloggers actively blogged to correct misinformation (Nerlich, 2010; Schmidt, 2010). Whereas the story started in the climate change blogosphere, the event eventually generated considerable attention in traditional media outlets. Overall, climategate had a significant effect on the general public's beliefs in climate change and trust in scientists (A. Leiserowitz, Maibach, Roser-Renouf, Smith, & Dawson, 2013).

Around 2009, the climate change blogosphere truly came alive, as it was leading the conversation about the 'climategate' controversy. However, already during the mid-90s, climate change blogs started to pop up. Schmidt (2008, p. 208), blogger of mainstream blog *RealClimate*, discusses how 'blogs are one communication tool that can supply more depth than is found in traditional media. They provide a rapid, casual, interactive and occasionally authoritative way of commenting on current issues, new papers or old controversies.' Often in contrast to scientific articles, blogs are open access and an effective medium to enhance the relevance of science in public life (Sajeev, Mintz-Woo, Damert, Brunner, & Eise, 2019; Schmidt, 2008).

Since climategate, the climate change blogosphere has firmly positioned itself in the climate change debate. Climate change bloggers directly and indirectly influence scientific, media, political, and public discourse (H. Farrell & Drezner, 2007; Lewandowsky, Oberauer, & Gignac, 2013). While it is difficult to quantify the impact of the climate change blogosphere, several instances have been documented that show how bloggers made an impact. Next to climategate, one example is that several US congressional hearings were triggered by one sceptical blogger of *Climate Audit*. Another example includes how a plagiarism scandal was revealed on the mainstream blog *Deep Climate*, which ultimately led to the retraction of a peer-reviewed paper (Lewandowsky, Oberauer, et al., 2013). Moreover, mainstream blog *RealClimate* and sceptical blog *Watts Up With That* are both award-winning blogs (Scientific American, 2005; The weblog awards, 2011).

In 2012, Schäfer (2012) estimated that there are approximately 1900 'climate' blogs, 1400 'climate change' blogs, and lastly, 323 'climate science' blogs. However, he also notes that most climate science blogs are actually 'pseudoscience' blogs. Blogs are indeed central to climate sceptics' communication strategy (Lewandowsky, Cook, Fay, & Gignac, 2019). The most successful climate sceptical blog is *Watts Up With That*. On 8 February 2021, the blog reached nearly 439 million hits. Overall, the mainstream scientific perspective is underrepresented in the climate change blogosphere. In fact, a disproportionately large chunk of the blogs is climate sceptical (Schäfer, 2012).

## BOX 1 CLIMATE LABELS FOR THE POLAR OPPOSITES

Actors apply a wide range of labels to both climate change camps or sub-groups within these camps. Climate labels have the potential to maintain or further polarize the debate. Labels can be pejorative, frame the debate as antagonistic, and mask the details of particular points of view as they oversimplify (Howarth & Sharman, 2015; O'Neill & Boykoff, 2010). Consequently, it is unknown whether labels merely reflect reality, or instead, actively construct reality by acting as discursive elements (Howarth & Sharman, 2015; Parmar, 2014). Provided that 'polarization' is a key concept central to the current thesis and one therefore needs labels that represents individuals as polar opposites, I will make use of climate labels. Nevertheless, the labels need to be interpreted with caution. Moreover, applying these labels is solely intended for academic purposes, and not beyond, as long as it is not precisely known whether these labels contribute to a more inclusive dialogue about climate change (Howarth & Sharman, 2015).

The camp that supports the mainstream scientific position is often, and in the current thesis, referred to as **the climate mainstream**. The mainstream label is often associated with climate mainstream science, mainstream climate scientists, or the IPCC. Climate mainstream science here refers to science that indicates a relationship between human-induced fossil fuel emissions and global temperature increases (Howarth & Sharman, 2015). **Climate scientists** are defined as individuals who have a degree in climate science. However, I will use the 'climate mainstream' label also to refer to individuals who do not engage in scientific activities themselves, but nevertheless support the mainstream scientific position. For example, in the current thesis, the climate mainstream also includes **climate activists**, who are defined as actors that actively campaign for climate action. The opposing camp frequently refers to the climate mainstream as 'alarmist', 'warmist', and 'believer'.

The camp that does not support the mainstream scientific position on climate change is often re-

ferred to as 'climate sceptics', 'climate deniers', or 'climate contrarians' (Howarth & Sharman, 2015). O'Neill & Boykoff (2010, p. 151) explain that 'using the language of denialism brings a moralistic tone into the climate debate that we would do well to avoid'. They continue to explain that climate denial could be inappropriately linked to Holocaust denial. Furthermore, they state that 'climate contrarians' challenge the mainstream climate science, often receive funding from fossil fuel industry organizations and conservative think tanks, and are ideologically motivated to challenge climate science. Lastly, skepticism is integral to good scientific practice, which means that only referring to the ones that do not support the mainstream scientific position is unjust (Howarth & Sharman, 2015; O'Neill & Boykoff, 2010).

I do not aim to bring a moralistic tone into the argument of the current thesis. Therefore, I will not use the label 'climate denier'. Moreover, since I do not only refer to actors that receive funding to challenge the climate science, but a greater group of people, the label 'climate contrarian' is not applied. Considering that the group of people that does not support the mainstream scientific position on climate change mostly refer to themselves as **climate sceptics**, I will apply this label. Yet, I acknowledge that this label is misapplied in this context, as in reality all scientists are supposed to be sceptical.

Moreover, there are degrees of skepticism in terms of ideologies and experiences (Corner et al., 2012). Rahmstorf (2003) has identified a taxonomy of a) 'trend sceptics'; the ones who deny the existence of climate change, b) 'attribution sceptics'; the ones that question whether climate change is anthropogenic, and c) 'impact sceptics'; the ones that acknowledge anthropogenic climate change, but believe that the consequences are not dangerous or even beneficial. I acknowledge the existence of sub-groups within the greater group of climate sceptics. However, for the purposes of this research, climate sceptics are not further defined, as the focus is on all forms of skepticism.

That the climate change blogosphere is polarized between the 'climate mainstream' that supports the mainstream scientific position on climate change and 'climate sceptics' that reject this position (Elgesem, Steskal, & Diakopoulos, 2015; Howarth & Sharman, 2015) reflects how climate change has become a polarizing issue at large. The scientific evidence for human influence on the climate system is crystal clear and the need for urgent action is evident (IPCC, 2014). Most studies find a 97% expert consensus on whether humans are responsible for climate change (Anderegg, Prall, Harold, & Schneider, 2010; Cook et al., 2013; Doran & Zimmerman, 2009). However, public opinion in Western countries about the reality and severity of anthropogenic climate change (ACC) is lagging behind this scientific consensus (Whitmarsh & Capstick, 2018).

In tandem with the ongoing climate change debate, online media have changed the media landscape (Painter, Kristiansen, & Schäfer, 2018; Schäfer, 2012). Since the advent of online media, academic scholarship has been concerned with the question whether the internet has the potential to become an extension of the traditional public sphere and whether this potential has been realized (Dahlgren, 2005; Rauchfleisch & Kovic, 2016). While some scholars are optimistic about the internet's potential, academic scholarship has repeatedly expressed concerns about the potentially polarizing effect of online media (Dahlgren, 2005; Jamieson & Cappella, 2008; Sunstein, 2017).

There is some evidence of climate change polarization in the blogosphere (see e.g., Brüggeman, Elgesem, Bienzeisler, Dedecek Gertz, & Walter, 2020; Elgesem et al., 2015). However, academic scholarship conceptualizes climate change polarization differently. Therefore, it is unknown what the precise role is of the blogosphere in climate change polarization. Research into the role of the blogosphere in climate change polarization could contribute, however, to our understanding of online polarization dynamics (Kligler-Vilenchik, Baden, & Yarchi, 2020; Yarchi, Baden, & Kligler-Vilenchik, 2020). More specifically, such research provides insight into how the platform structure and communication practices in the blogosphere contribute to climate change polarization. Consequently, it could shed light on how the blogosphere could potentially obstruct and delay collective action on climate change. Therefore, the main research question of the current thesis is as follows:

### *What is the role of the blogosphere in positional, interactional, and affective climate change polarization?*

The current thesis takes a multi-dimensional approach to climate change polarization, by investigating positional, interactive, and affective climate change polarization. Moreover, this multi-dimensional approach requires a mixed methods research design, which is accordingly employed.

In the current thesis, climate change blogs are defined as websites that primarily and frequently produce content about climate change with dated entries in a reverse chrono-

logical order and possibly a comment section. Moreover, climate change bloggers are defined as people who regularly edit or write blog posts on climate change blogs; climate change commenters<sup>1</sup> as people who post comments below climate change blog posts in comment threads; and lastly, climate change blog audiences as people who consume climate change blogs by reading the blog posts and/or comments. Finally, Raith (2009, p. 291) defines the blogosphere as 'the perceived network that joins all weblogs on the Internet together in one community'. Accordingly, in the current thesis, the climate change blogosphere is defined as the perceived network that joins all climate change blogs on the internet together in one community along with those bloggers, commenters, and audiences. Please see Box 1 in which I explain the climate labels that I am using.

The following section will explain the theoretical framework of the current thesis, in which a multi-dimensional approach to climate change polarization is introduced. Section 1.3 will discuss the knowledge gaps and sub-questions. Section 1.4 will outline the methodological approach of the current thesis. Finally, an overview of the conducted research studies will be presented.

## 1.2 Theoretical Framework

At the end of this section, the theoretical framework of the current thesis is introduced, i.e. positional, interactional, and affective climate change polarization. However, first I discuss general theory on group polarization, climate change polarization, and online polarization dynamics.

### Group polarization

Social psychologists have analyzed the effects of talking in groups for decades. Before the 1970s, research mostly focused on the 'risky shift' phenomenon, which explains that groups collectively take more risky decisions than individual members on their own (Isenberg, 1986; Myers, 1975, 1976; Stoner, 1959). After the 1970s, social psychologists explored an empirical generalization of this theory, which has led to the 'group polarization hypothesis' (Myers, 1975). According to Myers (1975, p.700), this hypothesis entails: 'the average of group members' responses following group discussions will generally be more extreme in the same direction as the average of individual pregroup preferences'.

Extensive evidence is found for two principal underlying mechanisms explaining group polarization (Sunstein, 1999). First, *social comparison* theory posits that individuals are motivated to present themselves as more favorable than the average tendency of other people. When all individuals of a group engage in this comparison process, the average of the group members' responses will shift into a direction of greater perceived social value. Second, *persuasive arguments* theory (or social/informational influence theory) posits

<sup>1</sup> In Chapter 6, climate change commenters are referred to as 'users'.

that group members shift their position based on the possession and expression of novel persuasive arguments during a group discussion (Isenberg, 1986). When group members are already moving towards a certain direction, they are most likely to provide a disproportionate number of persuasive arguments that support this direction (Sunstein, 2017). Isenberg (1986) discussed how a debate amongst social psychologists emerged about whether social comparison theory or persuasive arguments are underlying mechanisms of group polarization. Finally, he concluded that both theories are mediating processes that operate simultaneously.

In addition, Sunstein (2017) adds a third principal underlying mechanism for group polarization, which stresses the links between *confidence*, *extremism*, and *corroboration by others*. He explains that most individuals do not have strong opinions and are inclined to position themselves in the middle. However, when individuals gain confidence about their viewpoints, they become more extreme in their convictions. When these individuals are supported in their viewpoints by their peers, they become even more extreme. Thus, if like-minded people deliberate with one another, this group of people is likely to become more extreme in their viewpoints, possibly even to the point that they become radicalized. Please note that the term 'extreme' in the current thesis is different from 'extremism'. Extreme here refers to a more extreme point in the direction indicated by individuals pre-existing views, whereas extremism is defined as a state that is inseparable from hostile acts against the other group (Berger, 2018). Having said that, extreme polarization may lead to extremism.

In contrast, the basic assumption about group discussions is that it likely leads to better outcomes. However, the question is whether deliberation is truly producing improvements to society, when in reality other factors (e.g. social mechanisms) are guiding the discussion (i.e. resulting in group polarization) (Sunstein, 1999). In some cases, polarization is considered a positive development, as it is a sign that society has a broad range of ideas. Moreover, extreme polarization could give rise to civil movements that effectuate change (e.g. Black Lives Matter). However, polarization is generally considered as a negative development. The extreme directions that groups move into during processes of group polarization are rarely desirable for society at large, and, even for the individuals belonging to these particular groups (e.g. the rise of Nazism). Extreme polarization could put social stability at risk and is therefore largely perceived as a threat to democracy (Sunstein, 2017).

In the context of climate change, previous research showed how a range of climate sceptical viewpoints that would engender climate inaction lacks merit (see for an example in the blogosphere Harvey et al., 2018; see for an overview of arguments SkepticalScience, 2020). Nevertheless, if climate sceptics deliberate with one another about these viewpoints that lack merit, they can become more extreme in their viewpoints. Consequently, they could potentially form a danger to society as they engender climate inaction, while immediate responses to climate change are necessary (IPCC, 2014). In contrast, climate mainstream groups can deliberate with one another and become more extreme in their viewpoints.

As a result, these climate mainstream groups could effectuate collective climate action, which in the end might be more beneficial for society. In the remainder of this thesis, climate change polarization is understood as a matter of opposition between climate sceptics and the climate mainstream.

### Multi-dimensionality of climate change polarization

Polarization is a multi-dimensional phenomenon (DiMaggio, Evans, & Bryson, 1996). DiMaggio et al. (1996, p.693) explain that polarization is both a state and a process. They argue: 'Polarization as a state refers to the extent to which opinions on an issue are opposed in relation to some theoretical maximum. Polarization as a process refers to the increase in such opposition over time'.

That polarization is a multi-dimensional phenomenon is exemplified by research on 'climate change polarization', which all starts from different ontological and epistemological premises. Accordingly, climate change polarization is operationalized differently across several academic fields. First of all, academics investigate individuals' climate change preferences across different parameters, e.g. by investigating individuals' climate change risk perceptions (see e.g. Kahan, Jenkins-Smith, Tarantola, Silva, & Braman, 2015; Kahan et al., 2012), attitudes (see e.g. Corner, Whitmarsh, & Xenias, 2012; Newman, Nisbet, & Nisbet, 2018; Zhou, 2016), beliefs (see e.g. Cook & Lewandowsky, 2016; Ross, Rouse, & Mobley, 2019), ideologies (see e.g. Dunlap, McCright, & Yarosh, 2016; Fisher, Waggle, & Leifeld, 2013), climate concern (see e.g. Aasen, 2017), and deployed frames (see e.g. Bolsen & Shapiro, 2018; Moernaut, Mast, Temmerman, & Broersma, 2020). Second, academics apply different theories to analyze climate change polarization, e.g. theories stemming from social psychology, political theory, and communication theory. Third and last, academics employ different methods to analyze individuals' climate change preferences, e.g. by conducting experiments (see e.g. Cook & Lewandowsky, 2016; Corner et al., 2012; Kahan et al., 2015; Zhou, 2016), surveys (see e.g. Newman et al., 2018; Ross et al., 2019), US Congress testimonies about climate change (see e.g. Fisher et al., 2013), quantitative content analyses (see e.g. Moernaut et al., 2020), and making use of available opinion polling data (see e.g. Aasen, 2017; Dunlap et al., 2016; Kahan et al., 2012). Thus, climate change polarization holds different meanings in different academic contexts.

Moreover, due to the rise of online media, academics have been enabled to employ novel methods to analyze polarization. As a result, the concept of polarization has become even more blurry (Kligler-Vilenchik et al., 2020; Yarchi et al., 2020). Therefore, based on the platform structure and communication practices of online media, Yarchi, Baden, & Kligler-Vilenchik (2020) recently reconceptualized 'political polarization'. Respectively, they focus on positional polarization, interactional polarization, and affective polarization, each as aspects of political polarization. The following section introduces theory on positional, interactional, and affective polarization and ultimately presents the theoretical framework of the current thesis.

### Positional, interactional, and affective climate change polarization

The advent of online media has changed the media landscape dramatically (Painter et al., 2018; Schäfer, 2012). A greater variety of people can now voice their opinion about climate change (Moser, 2016) and audiences can customize their own media diet to a greater extent (Manovich, 2009). The quantity of information about climate change is increasing, while the quality is decreasing. Moreover, scientists play a limited role online (Schäfer, 2012). Consequently, the advent of online media affects the quality of debate about climate change.

On the one hand, academics are positive about the advent of online media. The internet provides opportunities for minorities to voice their opinion about climate change. Therefore, the level of deliberation is potentially higher, since online media promote 'the development of understanding, knowledge, and positions that would otherwise be invisible, silenced, or squelched in general debate' (Sunstein, 2017, p.86-87). Moreover, online media provide opportunities for science- and societal communication about climate change. Scientists have new channels through which they can communicate and exchange their scientific work. Another example is that NGOs benefit from online media by utilizing its potential. The user engagement features of online media can enhance engagement with the issue (Schäfer, 2012). For example, comment sections could provide users with a space for deliberation about climate change (Collins & Nerlich, 2015). However, on the other hand, academics are concerned about the advent of online media, as online media facilitate and accelerate existing polarization dynamics. Moreover, also new polarization dynamics inherent to the online world are identified.

### Interactional polarization

Like-minded people are connecting with each other online without being exposed to contrary views (Sunstein, 2017). Individuals' tendency to associate with like-minded others is called 'homophily' (Tarbush & Teytelboym, 2012). Yarchi, Baden, & Kligler-Vilenchik (2020, p.4) define these 'processes whereby participants in a debate increasingly interact with like-minded individuals, while disengaging from interactions with others who hold opposing viewpoints' as interactional polarization. This definition is focusing on both the existence of homophilic interaction patterns and absence of heterophilic interaction patterns. However, I posit that this definition is too narrow, as heterophilic interactions in which participants are increasingly contrasting others who hold opposing climate change viewpoints is also a form of interactional polarization. More specifically, Yarchi, Baden, & Kligler-Vilenchik's (2020) definition does not cover participants' discursive interactions where they contrast others who hold opposing viewpoints by reaffirming or upgrading their own issue framing (Dewulf & Bouwen, 2012).

### Positional polarization

Individuals have a tendency to selectively accept information that confirms their preexisting beliefs, whilst avoiding information that undermines these beliefs, which is called 'confirmation bias' (Del Vicario, Scala, Caldarelli, Stanley, & Quattrociocchi, 2017; McPherson,



Smith-Lovin, & Cook, 2001). Moreover, algorithms customize users' timelines in such ways that they only see content that is in line with their positions, which is called a 'filter bubble' (Flaxman, Goel, & Rao, 2016). Thus, due to homophily, confirmation bias, and filter bubbles, individuals could potentially only get exposed to views that are consistent with their own beliefs and shielded away from views that are opposed to these beliefs. If that is the case, they are trapped in an 'echo chamber'. Due to the constant repetition of views that confirm individuals' beliefs and the lack of challenging ideas, individuals' beliefs are reinforced and groups can become more extreme in their viewpoints (Jasny, Waggle, & Fisher, 2015). Consequently, online groups can become fragmented and subsequently polarized (Sunstein, 2017). Yarchi, Baden, & Kligler-Vilenchik (2020, p.5) define these 'increases in antagonistic and extreme political preferences' as positional polarization.

### Affective polarization

Finally, concerns are raised about that users are potentially more uncivil online, as they can operate anonymously from behind their computers (Walter, Brüggemann, & Engesser, 2018). Incivility negatively affects the quality of deliberation about climate change (Collins & Nerlich, 2015). Yarchi, Baden, & Kligler-Vilenchik (2020, p.5) define 'rising hostility in political talk toward opposing political groupings' as affective polarization. However, in line with academic scholarship that applies affective polarization (see e.g., Iyengar, Sood, & Lelkes, 2012; Rogowski & Sutherland, 2016), I posit that this definition lacks a focus on affect, emotions, and non-discursive expressions (e.g. affective evaluations of political candidates).

### Theoretical framework

In line with Yarchi et al.'s (2020) reconceptualization of political polarization, the current thesis defines 'climate change polarization' as a multi-dimensional phenomenon comprising positional, interactional, and affective climate change polarization, please see Figure 1. The framework is (a) tailored to the context of climate change; (b) focusing both on processes and states of polarization (DiMaggio et al., 1996); and (c) covering a comprehensive view of polarization:

#### 1. Positional climate change polarization

Extreme climate change opposition or increasingly opposing climate change positions;

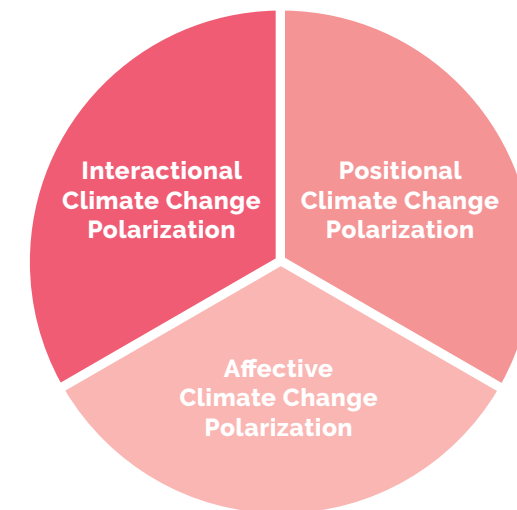
#### 2. Interactional climate change polarization

Interactions in which participants are either disengaged from or increasingly contrasting others who hold opposing climate change positions;

#### 3. Affective climate change polarization

Extreme or increasingly affective or emotional evaluations that reflect hostility toward opposing climate change groupings.

**FIGURE 1 A MULTI-DIMENSIONAL APPROACH TO CLIMATE CHANGE POLARIZATION**



## 1.3 Knowledge gaps and research sub-questions

Already a vast amount of research is conducted that focuses on the climate change blogosphere. A great deal of this research also focused on climate change polarization, while not all research specifically refers to the concept of polarization. In the following text, literature is discussed that focuses on positional, interactional, and affective climate change polarization in the blogosphere. Accordingly, knowledge gaps are identified, and research sub-questions are formulated.

### Positional climate change polarization in the blogosphere

Most research on the blogosphere focused on – what is in the current thesis defined as – positional climate change polarization. Previous research showed that climate sceptics and the climate mainstream discuss different topics (Elgesem et al., 2015; Luck & Ginanti, 2013), frame climate change differently (Bekkers, Van Buuren, Edwards, & Fenger, 2018; Harvey et al., 2018; Nerlich, 2010; Poberezhskaya, 2018; Sharman, 2014), and construct different discourses (Brüggeman et al., 2020; Fløttum, Gjesdal, Gjerstad, Koteyko, & Salway, 2014; Nerlich, 2010). In addition, Matthews (2015) analyzed how climate sceptical commenters discussed their background. Further, by investigating climate blog visitors, Lewandowsky, Oberauer, & Gignac (2013) showed that endorsement of free markets and conspiracy theories predicts the rejection of climate science. Moreover, Lewandowsky et al. (2019) demonstrated how audiences' beliefs in climate change are partially shaped by their interactions with content of blog posts and blog comments. Thus, evidence is found that reflects and explains extreme climate change opposition or increasingly opposing climate change positions in the blogosphere.

However, there is a lack of research that investigates the journalistic norms of climate change bloggers, discourses of climate sceptic and climate activist blogs over time, and the socio-psychological factors that explain audience members' climate change risk perceptions. Investigating the journalistic norms of bloggers could provide insight into whether and how the climate change positions of climate change bloggers are reflected in their journalistic norms, which shape the selection and composition of climate change blog posts. Moreover, analyzing discourses of climate sceptic and climate activist blogs could reveal how bloggers produce divergent discourses that reflect their extreme opposing climate change positions and how these change over time. Lastly, studying the socio-psychological factors that explain audience members' climate change risk perceptions could shed light on which factors potentially explain audience members' extreme climate change positions. Thus, more research is needed that focuses on positional climate change polarization in the blogosphere. Therefore, sub-question 1 reads as follows:

***What is the role of bloggers' journalistic norms and discourses, and audiences' climate change risk perceptions in positional climate change polarization?***

#### **Interactional climate change polarization in the blogosphere**

Academic scholarship that focused on – what is in the current thesis defined as – interactional climate change polarization showed that there is one climate sceptical community or network (Elgesem et al., 2015; Sharman, 2014) and several acceptor communities (Elgesem et al., 2015) in the climate change blogosphere. Moreover, these bloggers predominantly hyperlink to sources they agree with (Elgesem, 2019). Thus, some evidence is found for interactional climate change polarization in the blogosphere.

However, research that focuses on audiences' blog consumption and commenters' discursive interactions is lacking. Investigating audiences' blog consumption could shed light on whether audience members primarily consume content of like-minded blogs, while being disengaged from blogs that hold opposing climate change positions. Moreover, analyzing commenters' discursive interactions could provide useful insight into whether and how commenters increasingly contrast others who hold opposing climate change positions. Thus, more research is needed that focuses on interactional climate change polarization in the blogosphere. Therefore, sub-question 2 reads as follows:

***How is interactional climate change polarization enacted in audiences' blog consumption patterns and commenters' discursive interactions?***

#### **Affective climate change polarization in the blogosphere**

Finally, previous research that focused on – what is in the current thesis defined as – affective climate change polarization in the blogosphere showed how climate sceptics and the climate mainstream both produce hoax discourses, by negatively labelling the other

side and making indirect allegations of untruthfulness (Brüggeman et al., 2020). Similarly, research showed how name calling was a distinct feature of climate sceptical and mainstream discourse (Elgesem et al., 2015). Thus, evidence is found for extreme affective and emotional evaluations that reflect hostility toward opposing climate change groupings.

However, research that analyzes how climate sceptic and climate activist bloggers specifically portray the other side in their blog posts, whether climate change blog commenters deploy negative identity frames, and what kind of emotional language is used in the climate change blogo- and Twittersphere is lacking. Research that analyzes whether climate sceptic and climate activist bloggers portray each other as heroes, villains, or victims is important, because it contributes to our understanding of whether bloggers portray each other and opposing groups in general in a hostile manner. Research on whether commenters deploy negative identity frames to commenters with opposing climate change views could provide insight into whether hostility is present in comment threads. Moreover, research that investigates the emotional language used in the climate change blogo- and Twittersphere could shed light on whether the emotional language potentially reflects hostility between climate sceptical and climate mainstream bloggers. Therefore, sub-question 3 reads as follows:

***What is the role of bloggers' discourses and emotional language, and commenters' discursive interactions in affective climate change polarization?***

Overall, as I take a multi-dimensional approach to climate change polarization, I will also draw from a variety of theories in the field of communication, politics, and social psychology that all provide alternative and complementary explanations for climate change polarization. Please see Table 1 for an overview of the theoretical lenses applied in the current thesis. In Chapters 2-5 and 7, climate change polarization is conceptualized as a state (i.e. the extent of opposition), whereas Chapter 6 conceptualizes climate change polarization as a process (i.e. increase in opposition over time) (DiMaggio et al., 1996).

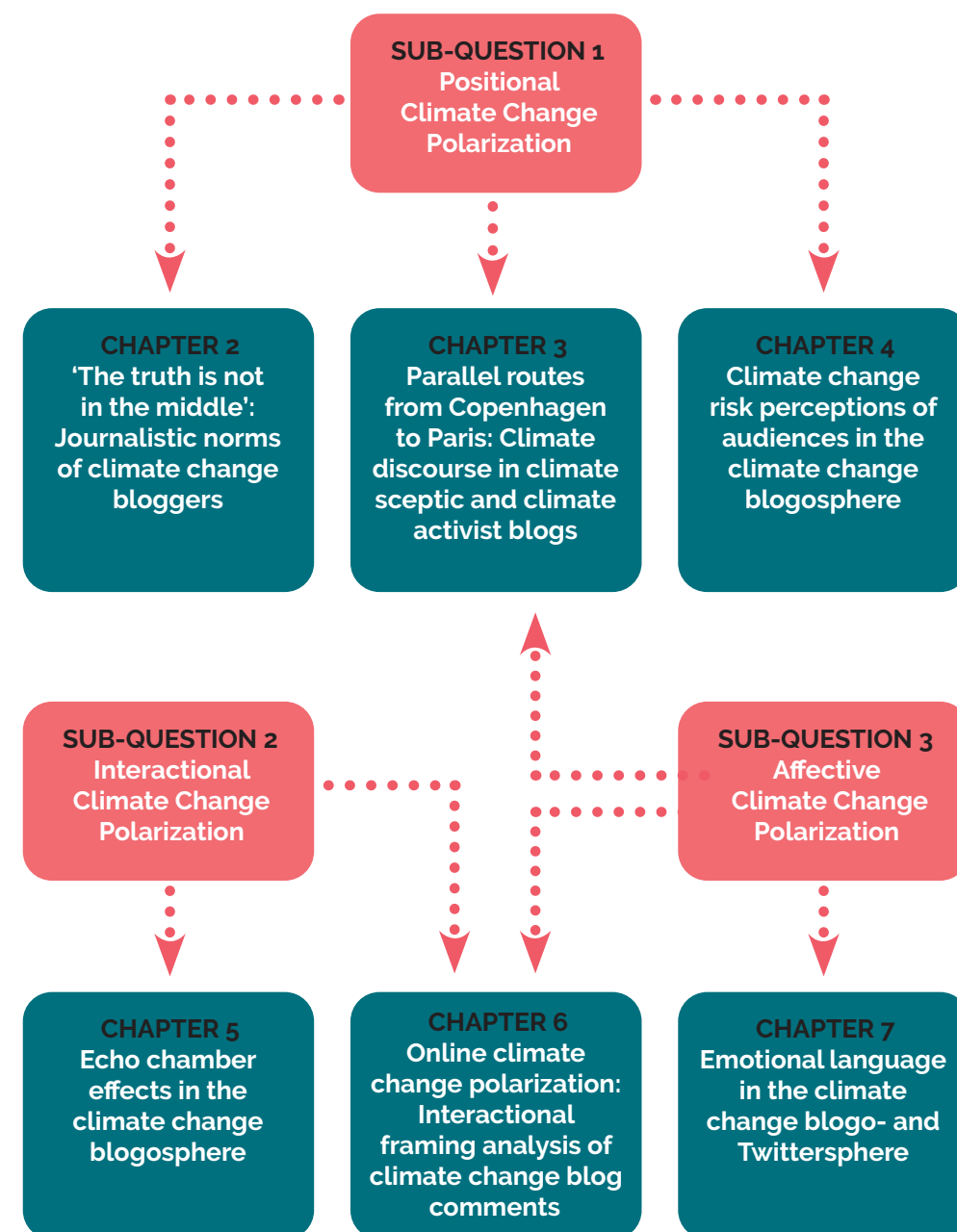
## **1.4 Methodological Approach**

A multi-dimensional approach to climate change polarization requires a mixed methods research design that allows one to investigate polarization from different perspectives. Johnson, Onwuegbuzie, & Turner (2007, p.122) defined mixed methods research as 'the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration.' Such an approach is still relatively scarce in online media research. In fact, computational methods are predominantly employed to investigate polarization in online contexts (Yarchi et al., 2020).

**TABLE 1 OVERVIEW OF THEORIES AND RESEARCH METHODS**

CHAPTER	THEORETICAL LENS	CASE	DATA COLLECTION	DATA ANALYSIS
2. 'The truth is not in the middle': Journalistic norms of climate change bloggers	Journalistic norms	Climate change bloggers	Purposive sampling; semi- structured interviews	Qualitative content analysis; deductive and inductive coding in ATLAS.ti
3. Parallel routes from Copenhagen to Paris: Climate discourse in climate sceptic and climate activist blogs	Environmental discourse	Blog posts of five climate sceptical blogs and five climate activist blogs between COP15 and COP21	Purposive sampling of climate change blogs; manual selection of blog posts based on inclusion criteria	Qualitative content analysis; discourse analysis; deductive and inductive coding in ATLAS.ti
4. Climate change risk perceptions of audiences in the climate change blogosphere	Climate change risk perception model (CCRPM+)	Audience members in the climate change blogosphere	Survey that was published on climate change blogs	Hierarchical multiple regression in SPSS and relative importance manually calculated
5. Echo chamber effects in the climate change blogosphere	Blog consumption patterns and echo chamber affect	Audience members in the climate change blogosphere	Survey that was published on climate change blogs	T-tests in SPSS
6. Online climate change polarization: Interactional framing analysis of climate change blog comments	Interactional framing	Five comment threads of the mainstream blog <i>RealClimate</i> and five comment threads of the sceptical blog <i>Watts Up With That</i>	Last five comment threads at the time of research manually retrieved from both blogs	Qualitative content analysis; interactional framing analysis; deductive, inductive, and abductive coding in ATLAS.ti
7. Emotional language in the climate change blogo- and Twittersphere	Emotional language	Climate change tweets and blog posts	Climate change tweet dataset of Littman & Wrubel (2019); climate change blogs identified through expert knowledge and snowball sampling; blog posts retrieved via APIs in Python	Automated content analysis with the Empath package in Python; t-tests and ANOVA in R

**FIGURE 2 RELATIONSHIPS BETWEEN SUB-QUESTIONS AND CHAPTERS**



**TABLE 2 OVERVIEW OF CHAPTERS' PUBLICATION STATUS**

CHAPTER	PUBLICATION STATUS
2 'The truth is not in the middle': Journalistic norms of climate change bloggers	Published in <i>Global Environmental Change</i>
3 Parallel routes from Copenhagen to Paris: Climate discourse in climate sceptic and activist blogs	Under review at international peer-reviewed journal
4 Climate change risk perceptions of audiences in the climate change blogosphere	Published in the special issue <i>The Social Psychology of Climate Change: New Challenges for a Healthier and More Sustainable World of Sustainability</i>
5 Echo chamber effects in the climate change blogosphere	Published in <i>Environmental Communication</i>
6 Online climate change polarization: Interactional framing analysis of climate change blog comments	Published in <i>Science Communication</i>
7 Emotional language in the climate change blogo- and Twittersphere	Submitted to international peer-reviewed journal

I employed a mixed methods approach, as the main research question of the current thesis both required confirmatory (verifying knowledge) and exploratory (generating knowledge) research (Ivankova & Wingo, 2018). The nature of the sub-questions guided which research methods were most appropriate to employ. Chapters 2, 3, and 6 are situated in the interpretative paradigm. Interpretative methods 'start from the position that our knowledge of reality (...) is a social construction by human actors' (Walsham, 2006, p.320). Specifically, we conducted semi-structured interviews, a discourse analysis, and interactional framing analysis. Yet, Chapters 4, 5, and 7 are situated in the positivist paradigm where the 'essence of science is objective verification, and that their methods are objective' (Onwuegbuzie & Leech, 2005, p.377). Specifically, we conducted a survey and automated content analysis. All of the quantitative research projects were preregistered on AsPredicted, in support of having an open science workflow (Nosek, Ebersole, DeHaven, & Mellor, 2018). Overall, this mixed methods approach was expected to provide a comprehensive answer to the main research question. Please see Table 1 for an overview of the employed research methods.

## 1.5 Outline of the Thesis

In the remainder of the current thesis, six empirical studies and finally a general discussion will be presented. All six studies provide an answer to one or multiple sub-questions, please see Figure 2. More specifically, Chapters 1, 2, and 3 investigate the role of the blogosphere in positional climate change polarization. Chapters 4 and 5 investigate how interactional climate change polarization is enacted in the blogosphere. Chapters 3, 6, and 7 investigate the role of the blogosphere in affective climate change polarization. Finally, Chapter 8 provides a general discussion in which the main research question is answered about what the role of the blogosphere is in positional, interactional, and affective climate change polarization. Please see Table 2 for an overview of each chapters' publication status.





## CHAPTER 2

# 'THE TRUTH IS NOT IN THE MIDDLE'

Journalistic norms of  
climate change bloggers

## ABSTRACT

Climate change has often been presented in a biased way in traditional media outlets, due to journalists' adherence to the norm of balanced reporting. More generally, journalistic norms shape the selection and composition of news and thereby influence how climate change is covered in traditional media. Climate change coverage is also prominent in new media outlets, such as blogs. The current research aims to identify which journalistic norms are supported in the climate blogosphere, on the basis of 27 interviews with climate change bloggers. The results show that climate change bloggers support the traditional journalistic norms of personalization, dramatization, novelty, authority and order, but not balance. Beyond the traditional journalistic norms, climate change bloggers identify contextualization, clarity, decency, and particularly truth as important journalistic norms. Truth is understood as a multi-dimensional norm comprising objectivity, transparency, and honesty. No differences are identified between norms supported by climate sceptical and climate mainstream bloggers, but each group operationalizes the norms differently. These results challenge and redefine traditional models of journalistic norms, and contribute to theorizing how journalistic norms shape climate change coverage in new media outlets. As such, this research on climate change bloggers and their journalistic norms is crucial for a fuller understanding of current climate change communications.

This chapter is published as: Van Eck, C.W., Mulder, B.C., & Dewulf, A. (2019). 'The truth is not in the middle': Journalistic norms of climate change bloggers. *Global Environmental Change*, 59, 1-10.

## 2.1 Introduction

According to the Intergovernmental Panel on Climate Change (IPCC), 'Limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society' (IPCC, 2018). Indeed, the scientific consensus about anthropogenic climate change has become stronger over the last decades. Most studies find at least a 97% consensus amongst scientists (Anderegg et al., 2010; Cook et al., 2013). Yet, in some Western nations scepticism about the reality and severity of climate change is common (Whitmarsh & Capstick, 2018). For example, the United States (US) is fiercely politically polarized around climate change, with on one side those identifying the negative consequences of industrial capitalism and on the other side those defending the economic system from such changes (McCright & Dunlap, 2011b). One possible explanation for this discrepancy between scientific consensus and divided public opinion is how media have presented climate change over the years.

Over the past decade, various studies have shown how professional journalistic norms shaped biased climate change coverage in traditional media outlets in the US (J. Boykoff & Boykoff, 2004; M. T. Boykoff & Boykoff, 2007). Most research focused, however, on traditional media outlets, while the media landscape is changing dramatically with the growth of new internet-based media formats (Painter et al., 2018; Schäfer, 2012). Technically, everyone with internet access and freedom of speech can publish content without being restricted to professional journalistic norms. Indeed, content about climate change is now produced by a greater variety of people in terms of education, motivation, and ideology (Moser, 2016). The climate change blogosphere is a prime example of transformed journalism.

Climate change blogs started popping up in the mid-90s, but the blogosphere truly came alive in 2009, when the 'climategate' controversy unfolded over hacked emails of the University of East Anglia Climatic Research Unit. The climate discussion became heated when climate sceptics seized the opportunity to present the leaked emails as evidence that data was manipulated and climate change a hoax, while climate scientists argued that private conversation was taken out of context (Bowe, Oshita, Terracina-Hartman, & Chao, 2014). During this episode, many sceptics worldwide positioned their blog as the representative sceptical voice in climate policy (Edwards, Bekkers, De Kool, & Straten, 2011). Scientists who accept the mainstream scientific position actively blogged to correct misinformation and address the allegations made by sceptics. The years after climategate, the discussion over climate change continued. 'Climate sceptics' and 'climate activists' both created divergent discursive realities in their blog posts (Van Eck & Feindt, 2020). Persistent polarization over climate change is manifest in the climate change blogosphere.

Climate change blogs are well known in the international climate science community. The bloggers directly and indirectly influence public discourse and political decision-making.

It is difficult to quantify the impact, but the influence of blogs should not be underestimated. Popular climate change blogs can have over 700,000 visitors a month and while this is less than some traditional media outlets, their readership is highly engaged and also consists of professional journalists and political elites that feed on bloggers work as source of information (H. Farrell & Drezner, 2007; Lewandowsky, Oberauer, et al., 2013). Especially climate sceptics have been credited as using blogs to their advantage (Nerlich, 2010; F. Pearce, 2010). In the US, they triggered several congressional investigations and uncovered a plagiarism case (Lewandowsky, Oberauer, et al., 2013). The sceptical blog *Watts Up With That?* won The Bloggies Award for best science blog in 2011 (The weblog awards, 2011). However, not only sceptical blogs are appraised. The mainstream science blog *RealClimate* was on the list of *Scientific American's Science & Technology Web Awards* in 2005 (Scientific American, 2005). Nature dedicated an editorial to the blog ('Welcome climate bloggers', 2004) and recognized *RealClimate* as the third most popular science blog ('Top five science blogs', 2006).

The influential climate change blogosphere only spurred scientists' interest over the last years. Analyses often focus on bloggers' risk perceptions about anthropogenic climate change (climate sceptical vs. mainstream) or frames and discourses (e.g. scientific or political) (Elgesem et al., 2015; Harvey et al., 2018; Sharman, 2014; Van Eck & Feindt, 2020). Earlier research scrutinizing journalistic norms revealed impediments in climate science communication via traditional media (M. T. Boykoff & Boykoff, 2007). While certain journalistic norms are firmly entrenched in traditional reporting, virtually no researchers have investigated norms in the climate change blogosphere. The current research aims to investigate impediments in climate science communication via the blogosphere, by identifying the journalistic norms that profoundly shape the selection and composition of blog content. Such research is crucial, because it not only provides insight into whether traditional journalistic norms are also honoured online or whether they are up for re-articulation (Dahlgren, 2016; Vos & Finneman, 2017), it also gives an understanding of what rules and guidelines inform the selection and composition of polarized climate change blogs. Hence, this research aims to answer the question: 'What journalistic norms do climate change bloggers support?'

## 2.2 Theoretical Framework

### Climate blogs

The blogosphere is constantly changing and as a result a clear and consistent definition of blogs in public discourse and scientific literature is missing (Garden, 2013; Perlmutter, 2008). New forms of blogging have emerged, such as microblogging and live blogging (Kirilenko & Stepchenkova, 2014; Thorsen, 2013). This research focusses on traditional blogging, but even characterizing traditional blogs is a challenge.

Distinguishing blogs from online professional journalism by simply verifying whether the term 'blog' is applied is not sufficient, as the word has become so popular that everyone is using the word alternately (Perlmutter, 2008). Blogs can be defined based on the technical features or on social and communicative features (Garden, 2013). Definitions based on technical features focus for example on whether the website uses blog software such as *Wordpress*, hyperlinks, enables comments, and views blog posts in reverse chronological sequence (Fischer, 2018; Garden, 2013; Lowrey, 2006; Matheson, 2004). However, these definitions are flawed, since traditional journalism websites can also enable these technical features, for example some online newspapers hyperlink while diary blogs do not (Garden, 2013; Herring, 2009; Lowrey, 2006). When blogs are defined on the basis of social and communicative functions, bloggers' opinionated tone or personal agenda are often highlighted as typical features (Fischer, 2018; Lowrey, 2006).

This research proposes a loose definition that recognizes the complexity of characterizing blogs and combines the technical features with the social and communicative functions. We define climate change blogs as websites that primarily and frequently produce content about climate change with dated entries in a reverse chronological order and possibly a comment section. Climate change bloggers are defined as people who regularly edit or write blog posts on climate change blogs. Many characterisation frames are being used in scientific literature to define the opposing opinions in the climate debate (Howarth & Sharman, 2015). In this research, climate sceptical bloggers are defined as the bloggers who are either doubtful about the existence, causes, or consequences of climate change (Rahmstorf, 2004) and climate mainstream bloggers are defined as the bloggers who endorse the scientific consensus on anthropogenic climate change (ACC). By applying either the term 'climate deniers', 'sceptics' or 'contrarians', there is a risk that it oversimplifies and increases polarization within the climate debate. Nevertheless, we chose the term 'sceptic' for the sake of the argument, but with the critical note that skepticism forms an integral part of the scientific method and that the phrase is therefore misapplied in the context of this research (O'Neill & Boykoff, 2010).

### Journalistic norms

By the late 19th and early 20th century, journalists came to a general agreement about what constituted news judgment and newsworthiness (Lazer et al., 2018; Vos & Finneman, 2017). Journalistic norms are underlying rules or guidelines for making rapid and consistent news content decisions (Bennett, 1996). However, not only journalistic norms influence the selection and composition of news, and in this case blogs. Media content is influenced by several factors at the micro, meso, and macro level, i.e. 'individual-level professionals and their routines, the organizations that house them, the institutions into which they cohere, and the social systems within which they operate and help maintain' (Reese and Shoemaker, 2016, p.390). Nonetheless, journalistic norms provide an explanation for patterns across reporting, as particular journalistic norms are followed by most journalists, which leads to standardization in news content (Bennett, 1996).

Boykoff is the researcher who primarily should be credited for his work on how traditional journalistic norms shaped biased climate change coverage (J. Boykoff & Boykoff, 2004; M. T. Boykoff, 2007a; M. T. Boykoff & Boykoff, 2007; M. T. Boykoff & Mansfield, 2008). Boykoff and Boykoff (2007) discuss how traditional journalists' adherence to the norms 'personalization', 'novelty', and 'dramatization', 'authority-order', and 'balance' led to coverage about dueling climate scientists and considerable scientific uncertainty during the end of the 1990s and early 2000s in the US.

Journalistic norms shape the selection and composition of content. The 'personalization' norm refers to journalists' focus on stories that emphasize the human-interest aspect of individuals' trials and tribulations in favor of structural or institutional analyses. The 'dramatization' norm favors controversy and an immediate sense of excitement over continuity in society and past or future conflicts. The 'novelty' norm clarifies journalists' focus on news that is fresh, original, and new in favor of repetition and long-term analyses. If journalists follow the 'authority-order' norm, they consult authority figures who reassure order. But when authorities are in disagreement the 'balance' norm prevails, when journalists pay roughly equal attention to both sides.

More recent research shows that traditional journalists have radically redefined the component of balanced climate change reporting (Hiles & Hinnant, 2014). Coverage in the US, United Kingdom, Germany, Switzerland, and India has shifted towards interpretative journalism, in which journalists actively contextualize and evaluate climate sceptic voices in line with the mainstream scientific perspective (M. T. Boykoff, 2007a; Brüggemann & Engesser, 2014, 2017). In this research, we dub this type of reporting as the contextualization norm. Thus, the literature focusing on traditional climate change reporting puts forward the following norms: personalization, dramatization, novelty, authority-order, balance, and contextualization.

However, these journalistic norms are identified for professional journalists working for print media and television, while increasingly more content is produced by others. Professional journalists claim their authority by emphasizing the collective character of the professional journalistic enterprise and their support for journalistic norms (Örnebring, 2013). Indeed, external control over bloggers usually comes from a loose, fluidly structured collective that seem not bound to a particular set of normative priorities (Singer, 2007). Nonetheless, bloggers who view their work as a form of journalism tend to have journalistic motivations and support professional journalistic norms (Gil de Zúñiga et al., 2011).

Then the question is what journalistic norms shape bloggers' news selection and composition of content. Singer (2007) explains that truth and transparency are two central normative aspects to journalists' and bloggers' ethical codes, although they define and express it differently. Most journalistic conceptualizations of truth are based on enlightenment philosophers' definition of truth: 'what is verifiable, replicable and universal' (Patterson, Wilkins, & Painter, 2018, p.25). However, this conceptualization is challenged by postmod-

**TABLE 3 OVERVIEW OF JOURNALISTIC NORMS IDENTIFIED IN SCIENTIFIC LITERATURE**

JOURNALISTIC NORMS	DEFINITION
Personalization	Coverage should emphasize the human-interest aspect of individuals' trials and tribulations
Dramatization	Coverage should focus on controversy and give an immediate sense of excitement
Novelty	Coverage should be fresh, original, and new
Authority-Order	Coverage should focus on authority figures who reassure order
Balance	Coverage should provide roughly equal attention to both sides of the story
Contextualization	Coverage should contextualize and evaluate climate sceptic voices in line with the mainstream scientific perspective
Truth	Coverage should be the result of discourse that is collectively created
Transparency	Coverage should explain the blogger's mission, reference sources, publicly correct mistakes, disclose conflicts of interest, and note the use of potentially biased sources

ern notions, which bloggers are committed to (Singer, 2007). They rather perceive truth as the result of discourse that is collectively created instead of a prerequisite (Singer, 2005). Bloggers highly value transparency, as a pathway to achieve truth (Singer, 2007). Bloggers can be transparent in their blog posts if they explain the blog's mission, reference sources, publicly correct mistakes, disclose conflicts of interests, and note the use of potentially biased sources (Blood, 2002; CyberJournalist.net, 2013). It remains unclear, though, whether climate change bloggers also support the norms truth and transparency.

This research aims to identify whether and how climate change bloggers support the journalistic norms of personalization, dramatization, novelty, authority-order, balance, contextualization, truth, transparency, and possibly other norms that are not put forward in scientific literature yet. Table 3 provides an overview of the journalistic norms identified in scientific literature with a complementing definition that we use as starting point for the analysis.

## 2.3 Methodology

Climate change bloggers' journalistic norms were identified on the basis of semi-structured interviews. While interviews are subject to obtaining socially desirable responses that may differ from actual behaviour of the interviewees, they do identify the bloggers' arguments and rationalizations for selecting and composing climate change blog posts. The research followed a grounded theory approach with the journalistic norms of the theoretical framework (see Table 3) as synthesizing concepts.

### Sample

A group of 47 interviewees was selected using purposive and snowball sampling. Bloggers from company- and NGO blogs were excluded. Climate change blogs and bloggers were identified via Google, blog rolls, and recommendations of other interviewees. They were all approached via email or, in case no email address was provided on the blog, a comment was posted to get in touch via email. In total, 31 climate change bloggers responded to the email invitation of whom 27 accepted the request to be interviewed and actually participated (see overview in Supplemental Material I).

The aim was to create a sample that was diverse (taken into account the inclusion/exclusion criteria), in order to capture the great variety of climate change bloggers that the internet knows. The final sample of interviewees consisted of bloggers that edit or write blog posts for varying types of climate change blogs, including blogs in which science, politics, personal experiences, and other issues are subject of discussion. The authors categorize the bloggers as follows: six climate sceptical bloggers and 21 climate mainstream bloggers. They were from different countries, namely The Netherlands (6), US (5), UK (5), Australia (2), France (2), Canada (1), India (1), Ireland (1), Italy (1), Norway (1), Poland (1) and Sweden (1). It was attempted to include climate change bloggers from other continents, but this proved to be a challenge as no climate change blogs that met the definition were identified in these continents (i.e. Africa, South-America).

### Data collection

Except of one interview that was conducted via telephone, all interviews were conducted by the first author via Skype or Google Hangouts, which are online conversation tools. It was expected that bloggers are used to operating from their computers and therefore felt safe to express their thoughts and feelings by doing the interview via these tools (Janghorban, Latifnejad Roudsari, & Taghipour, 2014). The conversations were video and/or audio recorded with the permission of the interviewees. All of the interviews were conducted between the 21st of September and 7th of November, 2018. On average, the interviews lasted 61 minutes, ranging from 34 to 130 minutes. The interviews were semi-structured, which allowed the interviewer and interviewee to deviate from the topic list and explore issues they felt were important in a conversational manner (Longhurst, 2009). First the bloggers were asked to introduce themselves and their blog, followed by questions about

their training, expertise, blogging style, and role in society. Subsequently, bloggers were interviewed about their journalistic norms. Probing questions were related to criteria for news selection, shaping of content, and climate change reporting challenges. After that, other norms that the bloggers did not formulate by themselves were discussed as well. These norms included the eight journalistic norms that were identified in the literature (see Table 3) with complementing follow-up questions.

### Data analysis

All of the interviews via the online conversation tools were transcribed and coded in ATLAS.ti (version 7.5.18). The interview via telephone was not transcribed as the audio was inaudible, hence, notes that were made directly after the interview were coded instead. Separate codes were deductively created for the eight norms that were identified in the literature (see Table 3). In addition, new codes were created for norms that were inductively identified during the coding process. After coding, all the text of individual codes was analysed to identify how many interviewees provide support for specific statements (Longhurst, 2009).

The interviewees were offered the opportunity to validate the statements that are used in this article, to ensure that the interviewer interpreted the results correctly. Besides a few interviewees who slightly changed wording without changing the quote's intended meaning, only one interviewee made an addition to the quote to provide more context and one interviewee expressed the wish to remain anonymous.

## 2.4 Results

Some interviewees explain that they are not consciously supporting particular journalistic norms when they select and compose content. Blogging is a pragmatic endeavour. Nonetheless, the interviews helped them to reflect on their practices and explicate their own set of journalistic norms. Adam Corner who writes blog posts for *The Guardian & NewScientist* comments: 'You don't realize that lots of norms are there, you just follow them. But I think there are some clear patterns that I've been applying through the different blogs that I've written.' The interviewees discuss that their journalistic norms are determined by their journalistic training, scientific norms, personal norms of being a decent human being, or legislation.

The journalistic norms that are identified in the literature (see Table 3) are first presented, followed by the journalistic norms clarity and decency that were inductively identified. Table 4 clarifies the labels that we use to indicate how many interviewees provide support for respective statements.



**TABLE 4 CLARIFICATION OF LABELS**

LABEL	AMOUNT OF INTERVIEWEES
All	27 interviewees
Most	20-26 interviewees
Some	6-19 interviewees
A few	1-5 interviewees
None	0 interviewees

### Personalization

Some interviewees support the traditional interpretation of personalization by linking the science to readers' personal lives, in order to reduce the psychological distance. Ranjan Panda of the blog *climatecrusaders* comments: 'I always try to focus on how climate change is impacting the majority of people, the poor, and the marginalized'. Interestingly, the interviewees also give other meanings to the personalization norm, by sharing stories about themselves and writing about what personally interests them.

Half of the interviewees tries to personalize their blog posts by sharing stories about themselves, in order to bring the human aspect into the story. Hans Labohm, author and editor of the blog *Climategate.nl*, comments: 'I have recently urged several authors to tell a personal story, so that it is not only about science, problems and issues. They can write about what they have experienced and how it affects their personal lives and how they have become climate sceptics.' A few interviewees share in their blog posts personal stories about the challenges of living a sustainable life. Jelmer Mommers of *The Correspondent* explains: 'The debate should not be too technocratic. People need to be able to relate to the challenges that come with living a sustainable life. It is human to experience challenges and we should be able to discuss this.' A few interviewees discuss how they want to popularize science by showing the human being behind the research. However, the other half of the interviewees are not sharing personal stories, as they mostly focus on the science. Nonetheless, a few interviewees express the wish that they could write more personally.

Another interpretation of the personalization norm relates to the selection of content. Some interviewees write about what personally interests them. A few interviewees argue that it is their intuition that is decisive in what they write about. Arnaud Delebarre of *Le blog de Arnaud Delebarre* discusses: 'It's intuition. At one moment, I'm thinking about a blog post for quite some time and at the end, I'm preparing one day a post on another subject. So, it's completely unpredictable.' The interviewees explain that the selection

process about what to write is pragmatic. Their mood and time available are highly influential factors in this process.

### Dramatization

Most interviewees discuss how they try to capture the audience's attention by supporting the dramatization norm. They try to give the audience an immediate sense of excitement, for example by having a great headline. Similar to the traditional understanding of the norm, some interviewees look for conflict to excite the audience, but they also use other strategies. That is they use humour or thrilling messages to engage the audience or try to take them on an adventure.

Some interviewees look for conflict, for example in science. Judith Curry comments: 'I'm not interested in stuff we already know. It's really the knowledge frontier or places where people disagree.' Adam Corner explains: 'I think the conflict that I bring in is a classic norm. It's like contrasting two things. I am often being critical of something that's happened or upcoming.' A few interviewees argue that they are not looking for the conflict, but that they try to be sharp. Ken Rice of the blog *...and Then There's Physics* explains: 'I think I now know how to write posts that can provoke a reaction and get lots of comments and views. In particular, if you highlight a disagreement with some other people. However, I don't think this is all that constructive, so have mostly tried to avoid it.' However, a few interviewees mention they prefer to create dialogue rather than debate.

Next to that, a few interviewees try to use humour to engage the audience. They feel that humour entertains the audience and makes the blog posts less boring to read, and simultaneously, less boring to write. Peter Sinclair says: 'Occasionally, I hear messages from people like, 'Boy, thank you. That really made me laugh.' Or, 'This was an illuminating thread. Thank you.' I'm constantly gratified when I see that, especially after a series of particularly snarky or tough posts.' Another interviewee who wishes to remain anonymous discusses: 'The most fun blog posts are the ones in which a humoristic approach is used to criticize someone.'

A few interviewees send out thrilling messages. Geoff Beacon of the *Brussels Blog* says: 'My approach is ... I'm afraid to say it, 'Look, you stupid bastards, what you're doing! Look at this stuff happening! What are you gonna do about it?!' I know that's not necessarily very effective, but I'm just hoping a few people will notice.' However, a few interviewees also strongly oppose fear-inducing messages. One interviewee who wishes to remain anonymous comments: 'I am outrageous, emotional, when I notice that children are frightened about the future.'

A few interviewees try to take the audience on an adventure in their writing. Willis Eschenbach who regularly writes for *Watts Up With That* says: 'In my scientific writing, I like to bring people along on a scientific trip of adventure. To give them some inkling of the joy of voyage of scientific discovery. Going where scientists haven't gone.' Likewise, Jakub Mal-

ecki who is a glaciologist and runs the blog *Glacjoblogia* reports about his adventures at the glaciers: 'I go to these glaciers year-by-year and take photographs of them in intervals from exactly the same spot to show people how they are changing over time. That helps to show people we are losing the ice and this is bad.'

### Novelty

Most interviewees support novelty as a norm, but interpret it differently. They support the traditional understanding of novelty, in which coverage is fresh, original, and new, or they support coverage that is up-to-the-minute. Nonetheless, there is also critique that focuses on the traditional interpretation.

Half of the interviewees discuss how every blog posts needs to contain new information. Johan Lorck of the blog *global-climat* comments: 'I noticed that when you write something new, something which you don't expect is often what people are most interested in.' A few interviewees use a new angle or frame to make it novel. Rasmus Benestad of the blog *RealClimate* discusses: 'You could tell a story about an old item. It could also be about something that happened a long time ago, being revisited ... or in light of new knowledge. But to repeat things that everybody says, I find that really boring'. Some interviewees aim to link the science to news and current affairs. John Gibbons of the blog *ThinkOrSwim.ie* explains: 'You take your opportunity, and you have to, to use the window of extreme weather to explain why climate change is such a risk.'

A few interviewees are also critical of providing content that focuses on incidents and instead favour coverage with long-term analyses. Jelmer Mommers argues: 'If there's an extreme hurricane, then someone asks whether that is related to the warming. I believe that what I do is actually fundamentally different. The starting point is one of concern and a journalistic curiosity about how climate change is developing and our response to it.' Michael Tobis of *Planet 3.0* even argues that explanations of how climate change works need to be repeated over and over, until people understand it. Gavin Schmidt of the blog *RealClimate* comments: 'Most of the coverage of new articles is the background of the story; not the actual discovery. The actual discovery is often not actually that much of a discovery. It totally fits in with everything else. I guess this is where it's different from journalism. We're not looking for the front page.' The suggestions of these interviewees that reporting should focus on long-term analyses and repeat messages might provide a basis for new norms.

A few interviewees discuss how blogging provides them with the opportunity or demands them to be up-to-the-minute. Willis Eschenbach explains: 'If I see something that's an issue today out there in the climate world and I want to research and do an article for a science journal, it won't appear for six months if I'm lucky. But I can respond to it in three days on *Watts Up With That* while it's still bubbling.' Gavin Schmidt adds: 'At the beginning, we tried to be up to the minute. Something would happen and we had to be the first feed, and then people would say, 'Oh! What did *RealClimate* say about this?' And so, there was a pressure to be very reactive, in particular when there was this big thing called climategate.'

### Authority-order

The interviewees regard 'authority' and 'order' as two different concepts, since they do not agree that authorities necessarily should reassure order. They perceive 'authority' as a norm in which coverage should focus on authorities and 'order' as a norm in which coverage should reassure social order in favour of social chaos.

All of the interviewees give authority to particular scientists and scientific institutions and a few to particular media organizations and civil society organizations that are in line with their ideas about ACC. However, which scientists and scientific institutions are regarded as authoritative differs per interviewee. All of the interviewees who accept the mainstream scientific perspective of climate change, generally regard the IPCC and similar scientific institutions as authorities in the field. Jelmer Mommers explains: 'At a certain point, you know which scientists work for institutions that are not paid by the fossil fuel industry. On the basis of these criteria, you decide whether you find a source reliable. But, the reputation of certain institutions also plays a role.' A few interviewees explain that they focus on authorities that urge people to act upon climate change. John Gibbons discusses: 'What I'm looking for is a science report that's saying 'We need to act.' Climate sceptical bloggers discuss that they primarily regard scientists and their institutions as authorities, if they conduct in their opinion solid research. Some interviewees regard themselves as authorities. Michael Tobis responds to the question whether he would use NGOs or politicians as sources the following : 'My ideal is that they would use me as a source, not the other way around'

The bloggers are divided about whether the norm 'order' is a good norm to support. The climate sceptical bloggers are against apocalyptic framing, because they believe bloggers should not cause social chaos as ACC is not supported by science. Other bloggers agree that apocalyptic framing should not be used, but for another opposite reason. Peter Sinclair of the blog *Climate Denial Crock of the Week* explains: 'When people tell me that the world is going to end, that we're going to see near term human extinction, I tell them, 'We're not getting off that easy.' We, and our children, are going to be here, and we are going to have to deal with and solve the problems we have created. To the extent that we do not, there will be suffering.'

Whereas a few interviewees refrain from hope or threat messaging and argue they prefer to stick to the science, a few others argue that they stick to the science, but that the scientific facts are threatening in itself. John Gibbons discusses: 'I don't have a reputation for being a person who fills people with hope. I see my job as being a guy who speaks the truth. It's not a very popular thing to do.' Since, some bloggers find the truth fear-inducing and learned from social science research that this type of messaging is ineffective, they try to provide hope in their writing. Jakub Malecki says: 'When I'm writing about the impact of climate warming on glaciers, I'm not really trying to convince them this is our fault. I don't want to make them feel guilty.'

Some scientist bloggers struggle with whether it is their responsibility to warn people for the dangers of ACC. Ken Rice explains: 'If you try to be optimistic and hopeful, will people look back and say that you didn't speak out enough? On the other hand, if you're too apocalyptic and alarmist and highlight how bad things could be and things aren't that bad, people look back and say, 'Ah, yes, you exaggerated everything and everything's fine.' So I think there's a really difficult balance to how this is approached.' Others believe that it is actually traditional journalists' responsibility, who have failed in their opinion in taking on this job. Michael Tobis discusses: 'The scientists are too negative, the scientists are too positive.' First of all, it's not our job to do the communication. You left this in our lap because you guys didn't do it. So don't give us a hard time. We're expected to somehow solve all these other problems in our spare time. That's crazy.' Jelmer Mommers shares this critique: 'Many science journalists are very careful to be put in a camp. The worst thing you can say to a science journalist is that you are alarmist, let alone that you would warn for something because you are worried about something. That is actually not done. I think that is part of the problem, so I do it differently.'

### Balance

None of the interviewees supports the norm balance. Most interviewees are critical of the fact that traditional journalists are trying to provide a balanced overview of opinions, with the result that facts are distorted. Peter Sinclair says: 'If one side of the issue is that the sky is blue and the other side of the issue is the sky is purple with pink polka dots, that those are not two sides that deserve equal weight.' Some interviewees argue that traditional journalists' adherence to this norm has given an unreasonably large stage to sceptics. Most interviewees agree that they do not want to make the same mistakes as traditional journalists and therefore do not support the norm balance. Gavin Schmidt comments: 'There's no balance between sense and nonsense. The balance between right and wrong is not somewhere in the middle.'

### Contextualization

Some interviewees blog to explain the science of climate change and provide background. They want to ensure that the public debate about climate change is based on scientific facts. Some interviewees follow the contextualization norm, as they actively try to contextualize and evaluate climate sceptical voices in line with the mainstream climate scientific perspective. They explain that they are often frustrated how climate science is presented in the media and by some scientists. Hence, they want to address misinformation about ACC in their blog posts. Bart Verheggen of the blogs *Klimaatverandering* & *My view on climate change* comments: 'Rebutting sceptical stories functions as a rearguard fight for recycling stories. We have to write rebuts for the umpteenth time. Those sceptics are truly the biggest recyclers in the world, as they keep recycling these old myths.'

Not surprisingly, climate sceptical bloggers support another interpretation of the context norm. They actively try to contextualize and evaluate mainstream voices in line with science that is sceptical of ACC.

However, some interviewees do not follow the contextualization norm. They argue that they do not want to pay too much attention to climate sceptical voices, as they could spend their time more efficiently. Over the years, they have lost willpower to continuously address misinformation. David Thorpe of the blog *The Low Carbon Kid* explains: 'I really prefer to ignore them because it is a waste of energy. We know we are right, we know climate change is happening. These people are trying to leech away our energy. And I think if we give them the oxygen and publicity it just reinforces them.'

### Truth

All of the interviewees agree that being truthful is an important journalistic norm, but what truth effectively means and how it is attained differs per interviewee. Most interviewees allude to the enlightenment philosophers' definition of truth, in which objectivity is considered to be attainable. The interviewees are well aware that there is a lot of misinformation about climate change out there, which makes it difficult for audiences to assess what objective information is. Hence, most interviewees believe that objectivity only is not enough, one also needs to be transparent and honest. All in all, most interviewees define truth as: 'what is objective, transparent, and honest', which is a multidimensional concept that is elaborated on in the following sub-sections.

### Objectivity

Some interviewees support the norm objectivity, which means that coverage should be scientifically measurable. David Thorpe argues: 'One can be very passionate about something and be completely wrong. One has to have some objective measure.' Some interviewees explain that before they publish a blog post they do careful research and let their peers review it. A few interviewees argue that traditional journalists do not properly fact-check information. Miriam O'Brien of the blog *HotWhopper* argues: 'I think we hold ourselves to a higher standard than journalism in the sense of trying to present the truth and the facts.'

Some other interviewees believe they are objective and subjective simultaneously, by arguing that their ideas about ACC are supported by science, but their opinion about how to address ACC is subjective. A few interviewees also explain that the selection of content is subjective. Mike Shanahan of the blog *UNDER THE BANYAN* explains: 'I'm objective with respect to the veracity of what I'm saying and I know that I'm biased in the topics I choose to write about. What interests me determines what I write about, so there's already a natural bias.'

A few interviewees do not support objectivity as a norm, because they believe that this norm is unattainable. Jelmer Mommers argues: 'Objectivity is a way of dampening the real meaning of what we are talking about. It is a way of avoiding that you want to say 'hello, may I have your attention. Something very bad is happening'. We should actually do that, because it is very bad.'



## Transparency

All of the interviewees agree that transparency is important. There are different ways how they aim to achieve transparency, by explaining their mission, using their own name, disclosing conflicts of interest, publicly correcting mistakes, referencing sources, noting the use of potentially biased sources, and making their data available.

Most interviewees are transparent about their mission on the blog. They have an 'About' page on which they explain why they blog. Gavin Schmidt says: 'Everything is viewed through my subjective lens. I'm certainly not pretending to be a view from nowhere. We make no pretence that we're not advocating for something.' Only Miriam O'Brien blogs under a pseudonym: 'At the time I started blogging, I didn't want the focus to be on me. Also, I was still working and I didn't want my clients to be tarred with, 'Oh, Miriam, she's that crazy blogger lady.' A few interviewees are critical of the fact that bloggers can use pseudonyms, because it does not create trust and the person cannot be held accountable. However, a few interviewees also understand why bloggers would use pseudonyms, especially women, as comments can be quite rude and sexist.

Most interviewees are transparent about any potential conflicts of interest, although, half of the interviewees have never experienced a conflict of interest and argue that they feel free to write about anything. John Gibbons says: 'I've always felt it's been a kind of a safe place that I can go to write. No, I wouldn't have said that I've felt a need to censor something on that, unless it was a legal problem with it.' Some interviewees have experienced conflicts of interest, but they dealt with it differently. They reported it on their blog, withdrew from the other activity, felt restricted to write about the issue, or did nothing. Some interviewees refer to the fact that they are also transparent about whether they are receiving funding or not.

Most interviewees aim to be transparent in how they deal with mistakes in their writing. They correct it in the text and highlight it or write a rectification in the comment section. A few interviewees comment that it is alright to make mistakes, but that it is important that you own up to your mistakes. Willis Eschenbach argues: 'One of the reasons that I'm widely followed and widely believed is that when I'm wrong, I stand up and announce it. I say, 'You were 100% right'. I don't say, 'I guess I must have been a little off the path'. In part, it's because I have a somewhat different opinion about the value of being shown to be wrong. I find it very valuable. Most people find it demeaning or insulting.' Some interviewees discuss their cautiousness in making errors, because of the responses. Rasmus Benestad comments: 'I'm very aware that whenever I write a thing, before I press the publish button, I'm a bit afraid because I know I'm taking a big chance. There's a big height to fall down, because we have made a brand name and there's a very high set of expectations about what we write. If I make a silly mistake, I will hear it.'

Everyone aims to be transparent about their sources, by referencing and hyperlinking their blog posts. Some interviewees only make use of scientific sources and do not use poten-

tially biased sources. In contrast, Judith Curry argues: 'I don't care whether somebody's biased or not. It's really about their argument. That's why this whole funding thing is a little bit of a red herring.'

A few interviewees discuss that it is very important that the method and data should be available. Climate sceptical blogger Paul Driessen, who describes himself as an energy analyst, argues: 'You can't have a debate and prove or disprove anything if one side is successful in hiding its data, its computer algorithms, its computer codes for climate models, its general methodologies – and then refuses to actually discuss or debate the climate science, or its claim that renewable energy truly is renewable, earth-friendly or sustainable. This is a big part of the battle, as well. I get into a lot of that in my articles. I try to challenge the other side to step forward and actually have an honest debate.'

## Honesty

Some interviewees articulate that honesty is an important journalistic norm and see it as their responsibility to provide the public with honest information. They perceive honesty as the intention to tell the truth and not to deceive. Adam Corner argues: 'You should never write anything that is misleading, or disingenuous, or that hides or obscures evidence or information that you're aware of.' John Gibbons adds: 'I think there's a chronic shortage of honest reporting on climate change in Ireland and elsewhere. I'm trying to fill a gap. I'm trying to make sure that if people are interested in unvarnished information and opinion, then I can provide that.'

Michael Tobis describes that the journalistic norm dramatization and honesty can be conflicting. He believes that being honest about climate change is to many not entertaining. Hence, for him the honesty norm is superior to the dramatization norm: 'I used to think that I could be entertaining and honest at the same time, but I realize that I cannot be entertaining to most people out there. I want to be honest, that's my goal.'

## Clarity

Writing clearly may seem obvious and natural for traditional journalists, but writing in an understandable manner is not necessarily straightforward for the interviewees. Climate science is perceived as quite complex, as one generally needs academic reasoning capacity to understand the science. This complexity makes it challenging to translate the science in such a way that it is understandable for the reader. Hence, the interviewees articulate that clarity is another important norm. The interviewees discuss different strategies to achieve clarity, ranging from the writing style to the design of the blog post.

Some interviewees mention how they try to adapt their writing to the knowledge level of the audience. A few discuss how blog posts need to be self-contained, which means that they cannot assume any prior knowledge of the readers. Some explain that they try to avoid using jargon and technical terms, although a few also admit that they find this a challenge. Half of the interviewees mention that they do not want the blog post to be lengthy,

instead it needs to be specific and concise. However, a few others argue that lengthy blog posts are not a problem. John Gibbons comments: 'The beauty of the blog is that there's no particular content limit. I guess it's a type of long-form journalism, and people seem to be perfectly happy to stay with you for a long article.' A few discuss that they pay careful attention to the structure of the blog post, for example by making short paragraphs and sentences. Adam Corner explains: 'I try and keep it quite energetic; quite bouncy, so that it feels like you're moving along.' Next to that, a few interviewees mention that their writing ideally needs to provide a summary, charts and diagrams.

### Decency

Half of the interviewees articulate that decency is an important norm, as they also expect that from their readers in the comment sections. They explain decency in terms of having respect for others. Some interviewees describe that they do not enjoy some of the discussions they have on the blog. The discussions can be very hostile and personal. Willes Eschenbach explains: 'You have to have some basic norms about decency. For me it boils down to a simple rule which is attack the ideas and not the person. That's in part because I've been attacked so bitterly for being a generalist, for not having a scientific education.' Other interviewees confirm they also follow Eschenbach's rule that they don't want to personally insult. A few interviewees describe how they are trying to avoid discussions with climate sceptics or trolls for these reasons.

## 2.5 Discussion

While scientists have reached consensus about the fact that humans cause climate change, public opinion is still divided (Whitmarsh & Capstick, 2018). The transformation of the media landscape has created an opportunity for many to speak their minds about climate change. The climate change blogosphere presented itself as a venue where a variety of people advocate their cause (Elgesem et al., 2015; Van Eck & Feindt, 2020). In our research, climate change bloggers were provided with the opportunity to reflect on what journalistic norms inform the selection and composition of their blog posts. The results of 27 interviews with climate change bloggers identified the journalistic norms that these bloggers support, complementing earlier research on how journalistic norms shape traditional climate change coverage (M. T. Boykoff & Boykoff, 2007) and linking them to broader developments in the media landscape (Moser, 2016).

First, the analysis showed that the journalistic norms of traditional journalists identified by Boykoff & Boykoff (2007) are not identical to the journalistic norms of climate change bloggers. The norms personalization, dramatization, and novelty are supported by some interviewees, but not by everyone. Some interviewees are critical of the traditional interpretation of the norms dramatization and novelty, because these type of norms have misrepresented climate change and failed to provide a comprehensive story in terms of providing context. The interviewees redefine the norms personalization, dramatization

and novelty, by providing multiple interpretations. Besides the traditional understanding of personalization, climate change bloggers also understand this norm as rules to share stories about themselves and write about what personally interest them. The interviewees also interpret dramatization as a way to use humour or thrilling messages or try to take the audience on an adventure, next to the traditional focus on conflict. The interviewees also perceive novel reporting as coverage that is up-to-the-minute, besides fresh, original, and new content. Another important finding is that climate change bloggers do not perceive authority-order as one norm, but rather as two different ones. Many climate change bloggers regard themselves as the authority and are divided about the idea whether social order should be reassured in their writing. None of the climate change bloggers supports the balance norm. These findings suggest that the norms of Boykoff & Boykoff (2007) are up for re-articulation with respect to the climate change blogosphere (Vos & Finneman, 2017).

Second, bloggers who accept the mainstream scientific perspective on climate change actively contextualize and evaluate climate sceptic voices in line with their perspective. Although, it needs to be noted that some interviewees do not want to pay attention to climate sceptic voices anymore. Climate sceptic bloggers interpret the contextualization norm differently. They contextualize and evaluate mainstream voices in line with science that supports their perspective. These findings complement more recent research focusing on traditional media that shows that balanced coverage shifted towards interpretative journalism (M. T. Boykoff, 2007c; Brüggemann & Engesser, 2014, 2017). One can speculate about whether traditional journalists followed bloggers' example.

Third, truth is a salient journalistic norm to all climate change bloggers. They redefine truth as a multi-dimensional concept, consisting of objectivity, transparency, and honesty. This finding confirms earlier research that put forward the idea that these individual concepts are closely related to, or part of, the norm truth (Deaver, 1990; Hafez, 2002; Singer, 2007), but is novel in combining the different concepts. Objectivity means for the interviewees coverage should be scientifically measurable. Transparency is interpreted as explaining their mission, using their own name, disclosing conflicts of interest, publicly correcting mistakes, referencing sources, noting the use of potentially biased sources, and making their data available. Lastly, the interviewees define honesty as the intention to tell the truth and not to deceive. This redefinition of truth borrows and combines elements of enlightenment philosophers' definition of truth and postmodern notions (Patterson et al., 2018; Singer, 2005). In comparison, traditional journalists also redefine objectivity by shifting their view on balance, but most journalists are not comfortable revealing their personal opinions (Hiles & Hinnant, 2014).

Additionally, the current study puts forward clarity and decency as new journalistic norms. Importantly, both norms should be understood in the context of climate change reporting, as generally the science is perceived as complex to communicate and the online debate as hostile. Bloggers aim to be clear in their writing, which reflects a sensitivity to effective

science communication (Moser & Dilling, 2011). The decency norm relates to what Collins & Nerlich (2015) define as 'civility' in their analysis of user comment threads about climate change. A question for future research would be what norms bloggers have when they moderate their blog's comment sections.

Interestingly, overall the climate sceptical and mainstream climate change bloggers support the same journalistic norms. However, climate sceptical bloggers operationalize certain norms in a different way, as their truth about climate change is different from bloggers who accept the mainstream scientific perspective. These bloggers perceive other persons and institutions as authorities, argue social order should be reassured because climate change is not dangerous, and provide context to mainstream arguments instead of sceptical arguments. These findings confirm earlier research that the climate change blogosphere is polarized on the micro-level of discursive constructions (Van Eck & Feindt, 2020).

Overall, the findings confirm earlier research that focusses on journalistic practices in the blogosphere and challenges the framework of traditional journalistic norms of journalists. Our research shows that as users now also have the opportunity to communicate about climate change, coverage is transforming and simultaneously the journalistic norms that shape this coverage. Table 5 provides an overview of the journalistic norms of bloggers that are identified in this research with complementing definitions.

Finally, the research identified climate change bloggers' norms by conducting interviews, which is subject to social desirability and memory biases. In other words, the present research does not shed light if and how norms translate into blog content. Hence, a critical future research direction would be what journalistic norms can be identified in climate change blog posts on the basis of a content analysis. The researchers make no claim that these results are generalizable to all climate change bloggers, partly because it is difficult to theoretically define who are part of this community. However, a wide range of climate change bloggers was interviewed, which allowed the researchers to identify patterns in their answering. The sample was international but the analysis was not cross-culturally focussed, which could be problematic since the bloggers operate in countries with different media systems. Having said that, such cross-cultural effects would likely have surfaced in the analysis. Moreover, exchanges between climate change bloggers rather happen on the level of one's scientific position than across countries (Elgesem et al., 2015), which is interesting given that all bloggers aim to be truthful in their writing. Future research could therefore focus on climate change bloggers' scientific norms. Lastly, another interesting future research direction is investigating other factors at the micro, meso, and macro level that influence how climate change blog posts are shaped, in comparison to traditional journalistic output (Reese & Shoemaker, 2016).

**TABLE 5 OVERVIEW OF JOURNALISTIC NORMS IDENTIFIED IN THE CURRENT RESEARCH**

JOURNALISTIC NORMS	DEFINITION
Personalization	<ul style="list-style-type: none"> <li>Coverage should emphasize the human-interest aspect of individuals' trials and tribulations</li> <li>Coverage should focus on stories about bloggers themselves</li> <li>Coverage should be selected on the basis of bloggers' personal interests</li> </ul>
Dramatization	<ul style="list-style-type: none"> <li>Coverage should give an immediate sense of excitement, by using humour or thrilling messages, trying to take the audience on an adventure, or looking for disagreements, conflicts or controversy</li> </ul>
Novelty	<ul style="list-style-type: none"> <li>Coverage should be fresh, original, and new</li> <li>Coverage should be up-to-the-minute</li> </ul>
Authority	<ul style="list-style-type: none"> <li>Coverage should focus on authorities</li> </ul>
Order	<ul style="list-style-type: none"> <li>Coverage should reassure social order</li> </ul>
Contextualization	<ul style="list-style-type: none"> <li>Coverage should contextualize and evaluate climate sceptic voices in line with the mainstream scientific perspective</li> <li>Coverage should contextualize and evaluate mainstream voices in line with science that is sceptical of ACC</li> </ul>
Truth	<ul style="list-style-type: none"> <li>Coverage should be objective, transparent, and honest:</li> <li>Coverage should be scientifically measurable</li> <li>Coverage should explain the mission, not be pseudonymous, disclose conflicts of interest, publicly correct mistakes, reference sources, note the use of potentially biased sources, and make the used data available</li> <li>Coverage should not deceive</li> </ul>
Clarity	<ul style="list-style-type: none"> <li>Coverage should be understandable for the reader</li> </ul>
Decency	<ul style="list-style-type: none"> <li>Coverage should be respectful to others</li> </ul>

## 2.6 Conclusion

The current research supplemented earlier research on the climate change blogosphere:

- For the first time, research focused on whether journalistic norms also shape climate change coverage in blogs. Also for the first time, interviews were conducted with climate change bloggers. On the basis of 27 interviews, we can conclude that climate change bloggers also support particular journalistic norms.
- The results showed that climate change bloggers support the following journalistic norms: personalization, dramatization, novelty, authority, order, contextualization, truth, clarity, and decency. The interviewees give new meanings to the different norms in comparison to traditional understandings. Hence, the current study challenges traditional models of journalistic norms that shape climate change coverage and confirm and elaborate theories focusing on journalistic norms of bloggers in general.
- The researchers found that there are no differences in journalistic norms across the divide between climate sceptics and the climate mainstream, except of the fact that they operationalize some norms differently.

The current research contributed to the scientific literature about traditional journalistic norms, broader developments in the media landscape, and climate change communications. The theoretical framework that combined elements of traditional journalism with blogging enabled the researchers to deductively identify journalistic norms of climate change bloggers. The inductive coding process of the semi-structured interviews also provided room to identify new journalistic norms specific to the online debates about climate change. The research is important for our understanding of how climate change is presented in blogs.

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## CHAPTER 3

# PARALLEL ROUTES FROM COPENHAGEN TO PARIS

Climate discourse in  
climate sceptic and  
climate activist blogs

## ABSTRACT

The Copenhagen climate summit in 2009 was a watershed moment in the international climate change discourse, reinforcing controversy and polarization between climate sceptics and climate activists. Simultaneously, the blogosphere, known as a place for polarized mobilization, became a proliferating forum for both camps. Building on Dryzek's and Carvalho's conceptualization of environmental discourse, this paper analyses how ideological polarization is grounded in the climate sceptic and climate activist blogs between COP15 and COP21. We investigated ten climate sceptic and climate activist blogs accessible in the UK. Qualitative-quantitative analysis of 357 blog posts revealed contrasting ontological and epistemological worlds in the climate change controversy. Both sides describe the issue in diverging terms, recognize different basic entities, disagree on natural relationships, assign differing motives to the key agents, and make different use of normative guidance. The research shows how climate activist bloggers produce a discursive reality that engages their readers with climate change, while climate sceptical bloggers present climate change and policy as detached from their readers' lifeworld. Implications for policy, practice, and future research are provided.

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## 3.1 Introduction

In the run-up to the 15th Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen in 2009, the public climate controversy flared up when hacked emails by climate scientists provided climate sceptics with the opportunity to question the integrity of climate science. The hacker uploaded the emails onto the climate science blog *RealClimate* (Schmidt, 2010). After that, the climate sceptical blog *WattsUpWithThat* first broke the story and soon its readers dubbed the event 'Climategate', a term that caught on in mainstream press (Nerlich, 2010; Norton, 2010). 'Climategate' has had a long-lasting effect on public opinion on climate change and trust in scientists (A. Leiserowitz et al., 2013).

Ever since 'Climategate', the polarization of the climate discourse has been rooted in augmented cognitive and normative ambiguity. The uncertain situation provided an opening for pundits to advance their interpretations of the facts and appropriate action. Uncertainty increased when UNFCCC negotiators failed to meet their own timetable to reach a binding agreement in Copenhagen and instead settled on a roadmap towards an accord at the COP16 in Cancun in 2012, later postponed to the COP21 in Paris in 2015. Finally, on 12 December 2015, the Parties to the UNFCCC reached an accord on measures to prevent dangerous climate change (UNFCCC, 2015).

The COPs can be considered as *critical discourse moments*, as they affected public understandings of climate change by leveraging challenges to established discursive representations (Carvalho & Burgess, 2005). As such, COPs have attracted much scholarly attention. Bäckstrand & Lövbrand (2016) found that three overarching discourses – labelled green governmentality, ecological modernization, and civic environmentalism – have shaped how (global) climate governance was imagined and enacted during COPs 17, 19, and 20. The increased media salience around climate change makes coverage of the events suitable material for identifying prevailing representations of climate change in traditional media. Previous studies have for example analysed how Swedish newspapers framed COP15 and COP21 (Christensen & Wormbs, 2017); how German news articles used scepticism frames in their coverage of COP17 (Kaiser & Rhomberg, 2016); how NGOs succeeded in having their visuals published in five countries' news coverage of COP19 and COP20 (Wozniak, Wessler, & Lück, 2017); and which problem-solving frames prevailed in three countries' media coverage of COP21 (Pan, Opgenhaffen, & Van Gorp, 2019). Only some recent studies have focused on online media content around the COPs, in particular their differences from traditional media coverage of COP21 (Hopke & Hestres, 2018; Painter et al., 2018) and citizens' participation in climate change discourse online around COP21 (Artt, Hoppe, Schmitt, De Silva-Schmidt, & Brüggemann, 2018). Yet, a detailed reconstruction of climate discourses between COP15 and COP21 in blogs is lacking. Hence, the current research aims to reconstruct blog coverage of the COPs between Copenhagen (2009) and Paris (2015) as focal events and critical discourse moments for the articulation of climate controversy.



Climate change blog content provides an interesting vantage point for analysis, as the climate change blogosphere is polarized between bloggers that either support or reject the mainstream scientific position on climate change (Elgesem et al., 2015). Blogs form an integral part of climate sceptics' communication strategy and therefore amplify the dissemination of climate sceptical views (Lewandowsky et al., 2019). Climate sceptical blog content has therefore attracted scholarly attention. Research has shown that climate sceptical blogs questioned the science during the 'Climategate' debate, using a paradoxical mixture of religious metaphors and demand for 'better' science (Nerlich, 2010). Climate sceptical bloggers engage with science by criticizing the conduct of climate scientists or by directly challenging the scientific mainstream (Sharman, 2014), e.g. disregarding scientific evidence of Arctic sea-ice loss and polar bear vulnerability (Harvey et al., 2018). Another type of climate scepticism in blogs focuses on the discussion of climate change politics (especially U.S. politics), besides discussions about climate science (Elgesem et al., 2015).

In contrast, less scholarly attention is given to blogs that support the mainstream scientific position. Research showed that 'climate accepters' are more concerned with climate politics than science, discussing different topics such as 'energy' or 'development issues' (Elgesem et al., 2015). Besides, representations of the future in English-language blogs on climate change were more often related to sustainability and positive, value-laden characterizations than gloom-and-doom perspectives (Fløttum et al., 2014). Lastly, the main content of 'green' blogs is concerned with climate change's environmental impact with the depletion of natural resources as the most prominent issue (Luck & Ginanti, 2013).

Few studies have compared climate sceptical blogs systematically with climate communication in pro-environmental blogs. A study of the Russian blogosphere identified four discursive categories (conspiracies of climate change, climate change impact, political games of climate change, online (anti-) environmentalism) along which 'climate activist' and 'climate denier' bloggers framed the same topics in different ways (Poberezhskaya, 2018). Previous research (Carvalho, 2000; Dryzek, 2013; Feindt & Oels, 2005; Hajer, 1995; Leipold, Feindt, Winkel, & Keller, 2019) has shown how environmental policy has been structurally constrained by discursive constructions of what is considered as reality (ontology) and knowledge (epistemology). Yet, a comparative discourse analysis in the English-language blogosphere is virtually absent. Such research is crucial though, since the reconstruction of the discursive realities of these competing online camps explains how support for or resistance against certain climate policies is rooted in competing discursive constructions of reality.

Therefore, we aim to analyse ten climate change blogs that were popular in the UK between COP15 and COP21. Due to the political nature of the COPs, we are interested in blogs that articulate competing political reasoning around these events. Hence, we focus our analysis on five climate sceptical blogs and five climate activist blogs. We define 'climate sceptic blogs' as online content providers that openly reject the mainstream scientific position on climate change. 'Climate activist blogs' actively campaign for climate action as their main content.

The focus on the UK is motivated by the tension that British policy discourse shifted from applause for its leading role in innovative climate change policy to a widespread questioning of climate policies (Gillard, 2016). The UK was the first to set legally binding emission reduction targets by adopting the *Climate Change Act 2008* and signed the Paris Agreement in 2016 (UNFCCC, 2015). However, after 2010, climate politics became more partisan, as the Conservative party became divided over the issue, effectively ending the consensus politics (Carter, 2014). While some parts of the British public actively promoted climate action, others sympathized with climate sceptic positions, which was reflected in the climate sceptical UK Independence Party which enjoyed growing support (Carter, 2014). Thus, the UK government's role in climate policy and the public's polarized views reflect the country's history of climate controversy.

Our goal is to understand how ideological polarization in the climate change blogosphere is grounded in the discursive constructions of reality of climate sceptics and climate activists. By adopting and refining the general discourse analytical framework of Dryzek (2013) and Carvalho's (2000) conceptualization of environmental discourse, this paper aims to reconstruct the competing ontological and epistemological constructions of issues around the COPs between 2009 and 2015. By focussing on this specific segment of the climate change controversy, we expect to understand in particular the interface between competing worlds of knowledge (climate change acceptance vs. scepticism) and competing political projects (support for or resistance against multilateral climate agreements) as communicated in online blogs.

## 3.2 Analytical Framework

A discursive approach to climate politics starts with the assumption that the social and political meaning of climate change, its causes and impacts is negotiated through the medium of discursive interaction. Discourses can be defined as a shared way of apprehending the world (Dryzek, 2013). Building on Hajer (1995), we understand climate change discourse as the 'ensemble of ideas, concepts, and categories' that determine the social meaning of claims about the occurrence, causes and potential impacts of climate change and possible mitigation and adaptation strategies. Climate-themed blogs are among the 'identifiable set of practices' through which climate discourses are 'produced and reproduced'.

Various approaches to discourse analysis 'differ with regard to their ontological and epistemological premises as well as with regard to their methodology' (Feindt & Oels, 2005, p.163). They have different purposes, different concepts of language and ask different questions (Doulton & Brown, 2009; Leipold et al., 2019). In this paper, we focus on the epistemological and ontological premises of climate sceptic and climate activist discourses by drawing upon a Foucauldian form of discourse analysis and Critical Discourse Analysis (Fairclough, 2013).

Dryzek (2013) has established four analytical categories to explain competing environmental discourses: the basic entities whose existence is recognized or constructed, assumptions about natural relationships, agents and their motives, and key metaphors and rhetorical devices. Dryzek's approach allows to analyse both environmental and anti-environmental discourses and aims to avoid the 'narrowness of strict linguistic analysis and the broad generalizations that characterize ideological analysis' (Doulton & Brown, 2009, p.192).

Normative judgments are a salient aspect in climate change discourses. They receive special attention in Carvalho's (2000) approach, a textual analysis that includes the following analytical categories: (1) surface descriptors and structural organization; (2) objects; (3) actors; (4) language and rhetoric; (5) discursive strategies and processes; and (6) ideological standpoints. This is complemented by a comparative-synchronic and historical-diachronic analysis of context.

Combining elements of Dryzek's (2013) and Carvalho's (2000) approaches, Doulton & Brown (2009) developed an analytical framework for the comparative analysis of multiple environmental discourses which proved useful in identifying discourses in newspapers. To our knowledge, the framework has not yet been applied to the blogosphere or another online venue.

In our research, each selected blog was analysed along the following categories, which were slightly adjusted to tailor it to blog posts instead of newspaper articles:

1. *Basic Entities Recognized or Constructed* represent the ontology of the discourse; this includes how climate change-related phenomena are understood. We have categorized the basic entities that were recognized or constructed as belonging to either a social, natural, technological, or transcendent ontology.
2. *Assumptions about Natural Relationships* include the causes and consequences of changes in the climate and the scale of impacts of climate change.
3. Representations of *Agents and their Motives* determine who the key actors are and characterise their intentions, thereby framing them as heroes, villains, victims, or ignorant actors.
4. *Key Metaphors and other Rhetorical Devices* are deployed to persuade readers by putting a situation in a particular light. We have categorized the devices that were recognized or constructed as devices related to science, the conferences, judgments about climate change, and commitments of actors.
5. *Normative Judgments* propose explicitly what should be done, and by whom, and the extent to which issues should be given priority.

Besides, we also coded the usual surface descriptors, i.e. the website, author, date, section, word count, title of the blog post, and whether it is cross-posted.

### 3.3 Methodology

In 2015, the blogs were selected in three steps using purposive sampling in order to create a sample that meets the research goals (Etikan, Abubakar, & Alkassim, 2016). First, we entered the following search terms in Google: 'climate change blog UK', 'climate change NGO UK', 'climate change blog NGO UK', 'climate skeptic blog UK', 'climate skeptic blog', and 'climate skeptic'. Google was deployed as it was the most popular search engine in the UK at the time of research. Second, the most frequently listed websites were consequently selected according to the following inclusion criteria: they (1) have a blog section, (2) are accessible in the UK, and (3) have a sceptic or activist agenda respectively. The climate sceptic blogs selected were: *Global Climate Scam*, *WattsUpWithThat*, *climate-skeptic*, *Dr Roy Spencer*, and *Bishop Hill*. As climate activist blogs, *WWF UK*, *Greenpeace UK*, *Friends of the Earth UK*, *Climate Action Network*, and *Oxfam UK* were included in the analysis. Third and lastly, the climate sceptical blogs did not only include blogs owned by British bloggers. Therefore, the climate sceptical blog selection was presented to an expert on climate scepticism in the UK who corroborated that these blogs were established climate sceptic blogs with a popular following in the UK. See Supplemental Material II for an overview of the profiles of the selected blogs.

Blog posts within each of the ten blogs were selected according to the following criteria:

1. The blog post was published one week before, during, or after an annual COP between 2009 and 2015. It can be assumed that these month-long periods were critical discourse moments with increased media salience around climate change and climate politics (Carvalho & Burgess, 2005).
2. The blog post featured in its title or lead either
  - at least one of the following generic terms: 'climate change', 'global warming' or 'greenhouse effect'; or
  - a term that referred to the conference: 'COP', 'climate summit', 'UN climate conference', 'Copenhagen', 'Cancun', 'Durban', 'Doha', 'Warsaw', 'Lima', or 'Paris'; or
  - a term that reflected the controversy: 'sceptic', 'skeptic', 'conspiracy', 'hoax', 'propaganda', 'climate science'.

The analysis was limited to written text and excluded audio-visual media. Blog posts that only consisted of audio-visual media were therefore eliminated from the sample. After removal of four duplicates, the selection process resulted in a corpus of 357 blog posts (253 climate sceptic and 104 climate activist, see Table 6). The inclusion criteria delivered an appropriate number of blog posts for analysis to allow an assessment of discursive differences in the climate blogosphere between Copenhagen and Paris.

The blog posts were coded, using the software ATLAS.ti. Within the six main analytical categories (the deductive element of the research design), an inductive coding strategy was adopted. Unit of analysis was the entire blog post for the main analytical category



**TABLE 6 NUMBER OF BLOG POSTS PER BLOG**

CLIMATE SCEPTICAL BLOGS	N
Global Climate Scam	32
WattsUpWithThat	191
climate-skeptic	5
Dr Roy Spencer	5
Bishop Hill	20
Subtotal	253
CLIMATE ACTIVIST BLOGS	N
WWF UK	20
Greenpeace UK	25
Friends of the Earth UK	36
Climate Action Network	17
Oxfam UK	6
Subtotal	104
<b>TOTAL</b>	<b>357</b>

*basic entities recognized or constructed*, and sentences for the other categories. All blog posts were first coded and recoded by the first author in order to develop and refine codes within each main analytical category. Subsequently, all blog posts were independently coded again by the main coder, while a second coder analysed a random subsample of 90 blog posts. Both coders had three intermediate joint rounds to improve the reliability of the coding system, each resulting in further adjustments to the codebook to include more specific agreements on the coding strategy. After the fourth round, the coders had reached full consensus on the codebook and how codes should be applied to carry out a reliable content analysis. Remaining inconsistencies were mostly due to the fact that coders failed to apply codes, given the wide range of 154 codes, the large number of blog posts, and the fact that statements could be ambiguous, which made it difficult to consistently apply the coding category 'rhetorical devices'. See Supplemental Material III for the final codebook.

After coding, a descriptive statistical analysis identified the frequencies of the codes, which represent the discourse elements. The findings were synthesized by summarizing the most

prominent discourse elements for both the sceptic and activist camp for each year. We ran additional analyses to test whether the discourses of individual blogs were largely consistent with the overarching discourse of climate sceptical and activist blogs. The findings were externally validated through semi-structured feedback interviews with two climate sceptic and two climate activist bloggers.

## 3.4 Results

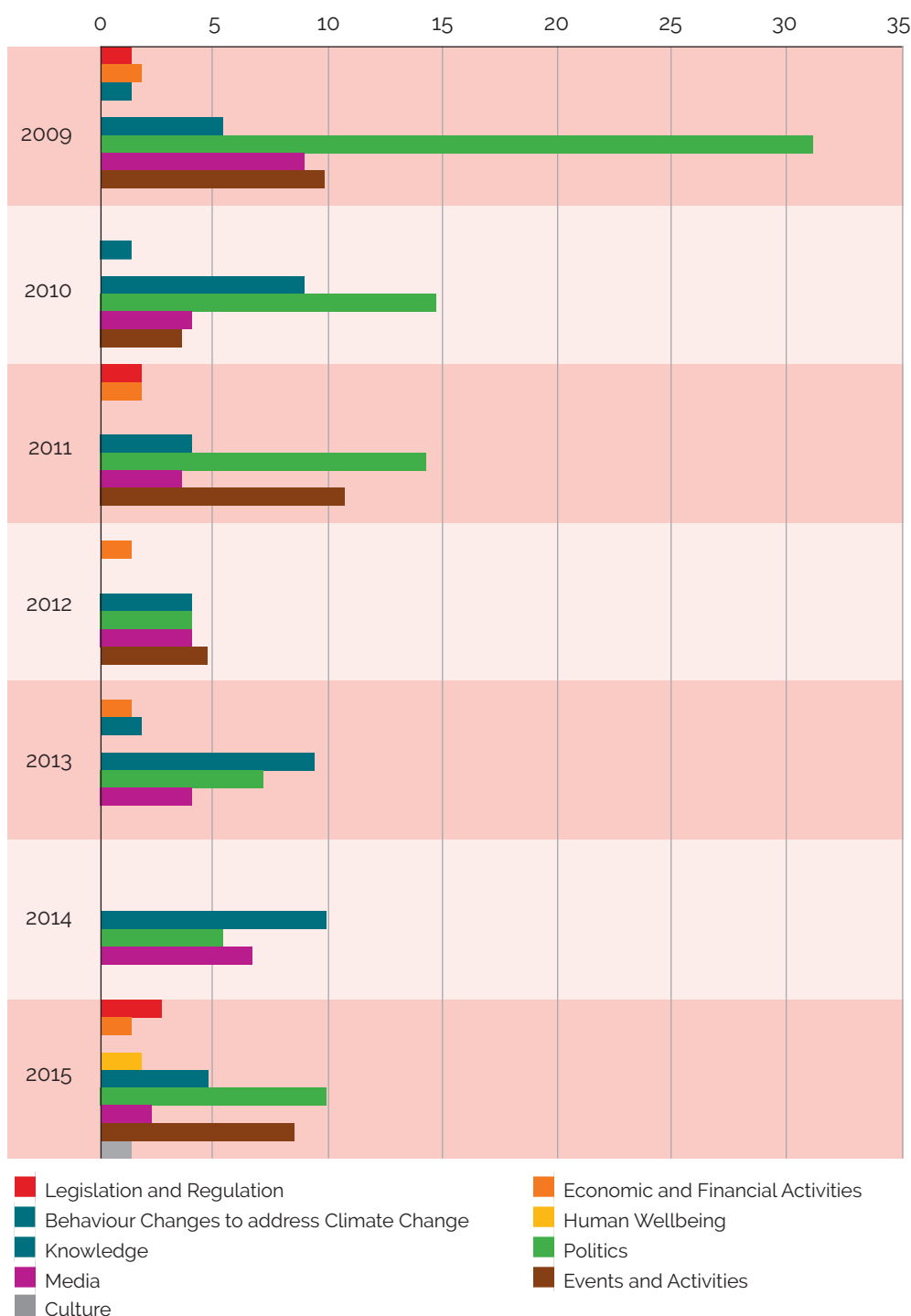
### Climate sceptical blog discourse

*Ontological entities:* At the center of the climate sceptical discourse around the COPs 15-21 were mostly social entities, which were much more frequent than natural, technological, or transcendent categories. As Figure 3 shows, within this discursive social world, the categories 'politics', 'knowledge', 'events & activities' and 'media' were especially prevalent, mirroring the favorite topics of the sceptics around these events: the climate negotiations themselves, conspiracy, difficulties with the evidence for global warming, and inappropriate campaigns of climate activists around the events.

In 2009, besides the actual climate negotiations in Copenhagen, 'Climategate' received much attention. Climate sceptics made allegations that the theory of anthropogenic climate change (ACC) was a conspiracy. Furthermore, 'media' and 'events & activities' were more prevalent in 2009 than in other years because the sceptics critically discussed media coverage of the COP and commented on the COP and related events. Much of the discourse was also devoted to contesting the science on ACC (category 'knowledge'). Consequently, the social ontology of climate change in the climate sceptic discourse is far removed from the lifeworld of most people and populated with an imagery of politics characterized by resentment and suspicion. In contrast, behavioural changes to address climate change, culture, and human wellbeing are only a small part of this discursive world. In 2010 and 2011, 'politics' was again most prominent in the social ontology, driven by coverage of the negotiations in Durban and Cancun and ongoing discussions about 'Climategate'. The prevalence of the knowledge category in 2013 and 2014 reflects, amongst other accounts of contested science like the 'global warming pause', the intense responses to the various parts of the IPCC's Fifth Assessment Report (AR5). In 2015, 'politics' and 'events & activities' dominated the social ontology again, reflecting treatment of the negotiations to find a successor treaty to the Kyoto Protocol in Paris and events & activities around this COP.

*Assumptions about natural relationships* articulated in the climate sceptic blogs largely concerned the causes and consequences of 'global warming', a term that was widely preferred in these blogs over 'climate change'. 'Global warming' only refers to the planet's rising surface temperature, while 'climate change' also includes the side-effects of warming, which are obviously backgrounded by the sceptics' terminology. Over the entire period of observation, the sceptic bloggers continued to debate the causes of global warming,

**FIGURE 3 CLIMATE SCEPTIC – SOCIAL ONTOLOGIES**



mostly questioning ACC. Each year, climate sceptics argued that human activities do not significantly affect the climate, and attributed any global warming mostly to natural variability. E.g., Roy Spencer (2009) wrote: *'In any event, I believe that the scientific community's confidence that climate change is now mostly human-caused is seriously misplaced.'* Moreover, climate sceptic blogs argued that CO<sup>2</sup> was not the main driver of a changing climate, as the climate system was more complex and factors such as solar radiation, fluctuations in stratospheric water vapour, and ocean heat uptake were also influential.

From 2009 till 2012, sceptics more frequently discussed whether the surface air temperature was increasing. In 2013, the sceptical bloggers started to write about a 'global warming pause' around the release of a part of AR5 of the IPCC, and concluded that the world surface air temperature was no longer increasing. For example, David Whitehouse (2013) wrote on *WattsUpWithThat*: *'It has been said by some politicians and journalists that 'sceptics' have used the 'pause' to undermine climate science. Actually there are a great many scientists and others working hard to understand the 'pause'. The 'Pause' IS climate science.'* Throughout the years, sceptics also often discussed the assertion that extreme weather events did not necessarily reflect climate change. The sceptics often referred to the 'Gore Effect', an allusion to unseasonably cold weather during events organized by climate activists, especially those visited by Al Gore. Sceptics also asserted their doubts about sea level rise, glacier melting rates, and ice cap sizes, each discussed on varying geographical scales. Overall, the climate sceptic discourse around the COPs 15-21 represents a world where weather and climate are still the realm of nature, largely unaffected by humankind, which should accept them as a given.

The actors that were most frequently portrayed as heroes by climate sceptics were scientists rejecting ACC theory, e.g. in 2013, when the coverage of the IPCC report emphasised discussions between mainstream scientists and 'sceptical scientists'. Mainstream scientists who 'got it wrong' were each year portrayed unfavourably or as ignorant. In 2009 and 2015, around the Copenhagen and Paris summits, politicians, media, and climate sceptics were more frequently presented as heroes compared to the other years. Correspondingly, politicians, mainstream scientists, climate activists, and in 2009 also the media that supported the theory of ACC and/or climate action were regularly portrayed as villains, e.g. as 'enviro-zombs', 'alarmists', or 'climate crusaders'. Remarkably, from 2011 onward, the general public, developed countries, and occasionally developing countries were presented as victims, when climate sceptics highlighted the alleged unfairly high contributions to the Green Climate Fund. For example, Will Alexander (2011) wrote on *WattsUpWithThat*:

**“I believe that this whole global warming/climate change issue is no more than a monumental scam perpetrated by the affluent nations to protect their economic supremacy, regardless of the effects on the many millions of poor and disadvantaged populations of Africa and elsewhere”**

Overall, the sceptics conjure a battle between the 'good' people who defend industrialized countries against a coalition of 'bad' guys who want to impose costly climate policies.

The most frequently deployed rhetorical devices in the climate sceptic blogs were science-related, most of the times alleging that there is no evidence for ACC, that mainstream science is not sound, and that the theory of ACC is a conspiracy. For example, Hans Labohm (2010) wrote on *WattsUpWithThat*: *'For decades, the climate debate has been obfuscated by cherry-picking, spin-doctoring and scaremongering by te UN's IPCC and other climate alarmists, including the environmental movement and mainstream media.'* The sceptic bloggers dismissed the scientific evidence for ACC by claiming that the science was not sound, especially around the climate negotiations in Copenhagen and Paris and during the release of AR5. In 2011, when the Green Climate fund was adopted at COP17, the sceptic bloggers framed the agreement negatively, suggesting that it was economically not beneficial to act upon climate change. Lastly, the climate sceptics also consistently framed climate change as an issue not to worry about, as it was not dangerous.

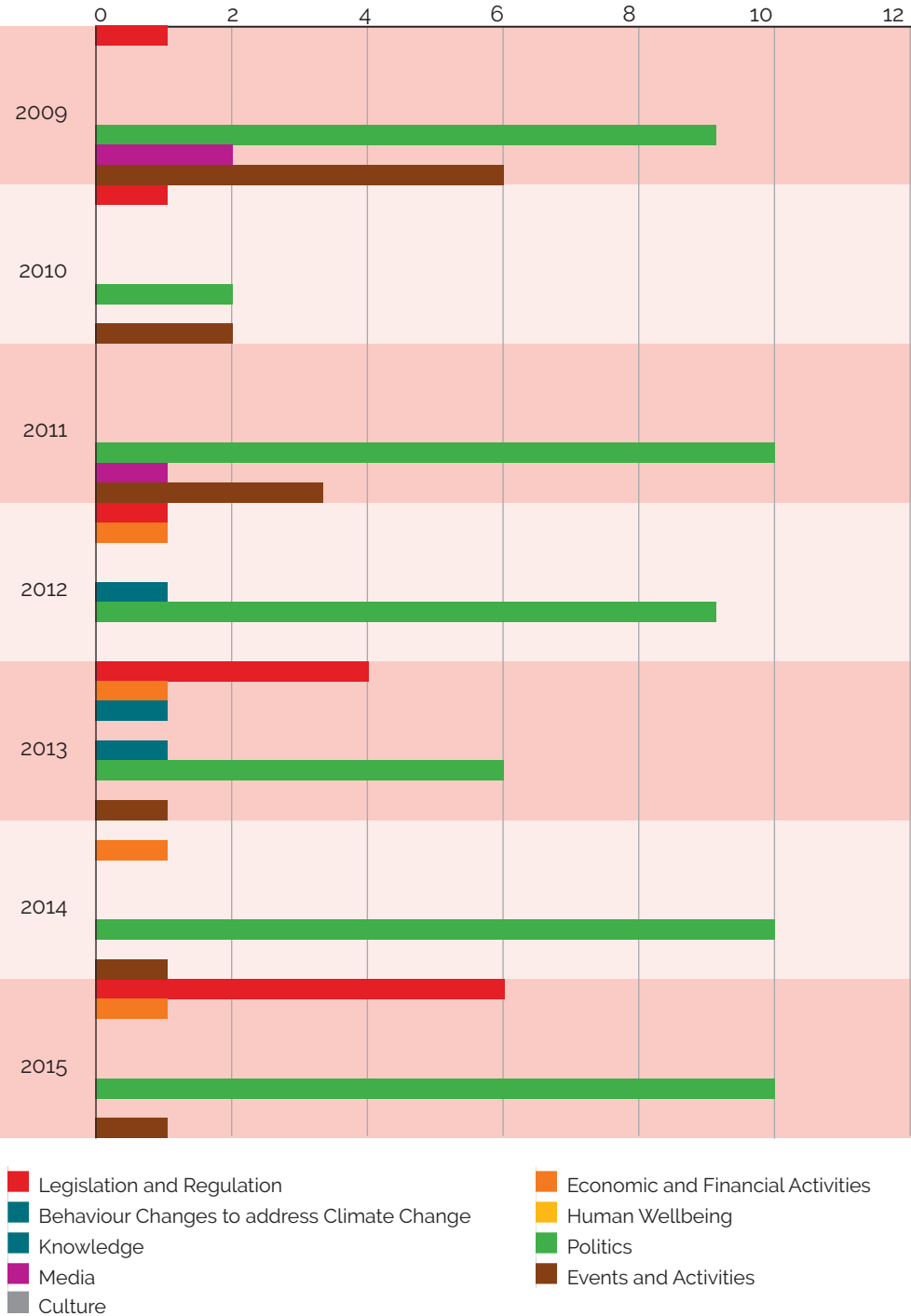
Explicit *normative judgments* were surprisingly rare in the climate sceptic blogs throughout the years. The very few explicit normative judgments that we found mostly focused on the opinion that the science needs to be revisited, with fluctuating frequency over the years. For example, Roy Spencer (2009) wrote on his blog: *'The computer codes for the climate models now being used by the IPCC should be made available to other researchers for independent testing and experimentation.'* Overall, the climate sceptic discourse contains relatively little explicit normative guidance, apart from distrust in climate science and politics.

### Climate activist blog discourse

In the ontology of the climate activist bloggers' discourse around the COPs 15-21 social entities were the most frequent category as well. Figure 4 shows the frequency of the different sub-categories of social ontology. As in the climate sceptic discourse, 'politics' was the most frequent sub-category in every year. 'Events & activities' and 'legislation & regulation' also appear frequently, while the sub-categories 'knowledge' and 'media' are much less salient than in the climate sceptic blogs. This pattern reflects that climate activist bloggers mostly wrote about the ongoing politics during the COP negotiations and on the campaigns and demonstrations surrounding the formal negotiations.

Especially in 2009 and 2015, virtually all activist blog posts focused on the negotiations in Copenhagen and Paris, but also the intermediate negotiations in Durban, Warsaw, and Lima received much attention. The activist blogs discussed the political manoeuvres by politicians and nation states, the events and activities organized by civil society organisations, and the need for a 'fair, ambitious, and legally binding' successor treaty to the Kyoto Protocol. Overall, the activist discourse constitutes a world of engagement through campaigns and events for binding international commitments and climate action, where climate science is mostly taken for granted and hence backgrounded.

FIGURE 4 CLIMATE ACTIVIST – SOCIAL ONTOLOGIES



*Assumptions about natural relationships* in the climate activist blogs mostly pertain to the causes and consequences of ACC, with a focus on the latter. The climate activist bloggers prefer the term 'climate change', which refers to a broader range of changing weather patterns, over 'global warming'. Over the years, the activists highlighted variegated negative and dangerous consequences of ACC, often by attributing extreme weather events to climate change, e.g. typhoon Haiyan that hit the Philippines in 2013, to underline the importance of acting upon climate change. For example, David Nussbaum (2013) wrote on *WWF UK*: 'If we don't [act], we face a future world where we either have to adapt – or succumb – to further heat waves, flooding, intense storms and sea level rise.' In 2015, the climate activist bloggers extensively featured the local consequences of climate change that people around the globe are already experiencing. The causes of the phenomenon were presented only in the context of carbon dioxide or greenhouse gas emissions and the need for their reduction.

*Actors*: The climate activist bloggers' discourse often constituted a self-congratulatory representation by frequently portraying themselves as heroes. In 2013, the most frequent type of heroes were mainstream scientists, mostly in connection with the publication of AR5. In 2015, the general public and businesses were often presented as heroes, with examples of actors who already take responsibility and act upon climate change. Businesses are sometimes presented as both potential heroes and villains if they did not take action. An example of ambiguous character attribution is Ruth Mhlanga's (2015) comment on *Oxfam UK*: 'Fossil fuel companies will be most impacted by climate pricing, yet some of them have formed climate groups, which have showed support for carbon pricing and called for ambitious climate deals. Unfortunately, all too frequently we have been burnt by these same companies within the fossil fuel sector, so this spate of announcements showing support for climate action can only be regarded with scepticism, if not outright incredulity.'

Especially in 2009 and 2015, during the climate negotiations in Copenhagen and Paris, politicians and nation states were either portrayed as heroes or as villains, depending on their stances towards a climate treaty. Throughout the years, the general public and developing countries were frequently portrayed as victims of climate inaction. In line with traditional environmental mobilization strategies, in this discourse activists and scientists advocate for climate action and defend developing countries and the broader public against corrupt politicians and industrialized nations.

The most frequently deployed *rhetorical devices* in the climate activist blogs were clearly aimed at generating a sense of urgency and presenting the need of an agreement as a moral cause. Especially in 2009 and 2015, during the climate negotiations in Copenhagen and Paris, rhetorical devices often referred directly to the ongoing climate negotiations, for example by advocating an 'FAB agreement' – fair, ambitious, and binding. They urged for commitments by presenting climate change as dangerous, protests and demonstrations as evidence of public concern, empty promises as irresponsible, and effective negotiation management as crucial. For example, an alliteration-saturated comment by Joss (2009)

on *Greenpeace UK* contrasts the commitment of grassroots activists with the inaction and neglect displayed by political incumbents:

**“As we all try to come to terms with the historic failure of nerve and vision that paralysed the Copenhagen climate summit, the response of Greenpeace members around the world has been fast and focused: expressing their condemnation of world leaders unwilling or unable to lead in a time of crisis, and demanding the release of the four Greenpeace activists who face spending Christmas in jail after making a peaceful protest at the Danish Queen's dinner for Heads of State”**

In 2015, new rhetorical devices were deployed to convince the readership that action on climate change is morally right and economically beneficial, but also to stay optimistic. In contrast to the climate sceptic discourse, climate activist bloggers deployed few rhetorical devices related to science apart from representing the climate science as settled.

The explicit *normative judgments* in the climate activist blogs were mostly related to the support of serious regulations and commitments. Over the entire period, the activists pushed for binding targets and effective action to reduce GHG emissions. They also called for long-term commitments on finance and for political commitment and leadership, especially in 2011, when the Green Climate Fund was established. For example, Tim Gore (2011) wrote on *Oxfam UK*: 'Critically, they [political leaders] must take decisions which ensure the Green Climate Fund will be fully operational by 2013, and they must start to mobilise the long-term finance rich countries have promised to fill it.' And especially in 2015, climate-activist blogs explicitly demanded that 'we need to work and campaign together' and that 'we need to do that now and fast'. Overall, climate activist bloggers gave much more explicit normative guidance than climate sceptic bloggers, presenting serious action to reduce climate change emissions and mutual commitments with a development component as a moral imperative.

## 3.5 Discussion

### Contributions to the literature

The postponement of an agreement about a successor treaty to the Kyoto Protocol at the COP15 in Copenhagen opened a period of extended struggle over the future climate policy regime. This period coincided with the rise of the climate change blogosphere as an important venue for political discussion that is particularly prone to processes of audience segmentation and polarization (Elgesem et al., 2015). Our goal was understanding how ideological polarization in the climate change blogosphere is grounded in the discursive construction of reality of climate sceptic and climate activist bloggers around COP15 and

COP21, complementing earlier research on climate discourses and frames in the blogosphere (e.g. Elgesem et al., 2015; Sharman, 2014) and around COPs (Hopke & Hestres, 2018; Painter et al., 2018). Overall, we found significant differences between climate sceptic and activist blogs along all dimensions of environmental and anti-environmental discourse identified in the analytical frameworks of Dryzek (2013) and Carvalho (2000).

First, our analysis of 357 blog posts shows that climate sceptic and climate activist discourses share common themes in their coverage around COP15 and COP21, in particular the successor treaty of the Kyoto Protocol, the Green Climate Fund, and IPCC's Fifth Assessment Report were of interest. While they share common themes, the results show how both sides created divergent discursive realities around these themes. This finding is consistent with research on the Russian blogosphere that showed how climate sceptical and activist bloggers framed the same topic in different ways based on their worldviews (Poberezhskaya, 2018). Differences remain though: 'Climategate' received more attention from sceptics between 2009 and 2011 and typhoon Haiyan in 2013 from activists. The blog discourses of both camps present a world that is mostly constituted of a social ontology, backgrounding natural, technological, and transcendent entities.

As explained above, the *social worlds represented in both discourses* differed widely: climate sceptic bloggers presented an often conspirational, remote world of dirty politics, dubious science, partial media, and unwanted treaties that potentially interferes with people's lives, thereby often reproducing the playbook of a well-established climate denial discourse (Dunlap & McCright, 2010). In contrast, climate activist blogs linked climate policy to a world of political engagement, campaigns and events and thereby align with discourses in global climate governance and other online media that give substantial attention to grass-root activism and protests (Bäckstrand & Lövbrand, 2016; Painter et al., 2018). Thus, in comparison to climate activists, climate sceptics create a discursive reality about climate change that is far removed from the lifeworld of readers. Given that effective climate change communications require strategies that resonate with the social worlds of audiences (Corner & Clarke, 2017), this finding is critical for understanding how climate sceptics' discursive representations are effective in creating public disengagement with climate change.

In fact, also most of the bloggers' discursive representations of *assumptions about natural relationships* reflect this strategy. Climate activist bloggers emphasised how the impacts of climate change are already affecting people around the globe. Their shift to focusing on the local impacts shows how these bloggers have learned to communicate more effectively, meaning that bloggers invoked place identity in their communication, a strategy that generally enhances desired behaviour changes (Moser, 2014). As opposed, climate sceptical bloggers disputed the occurrence and anthropogenic causes of 'global warming' and paid little attention to or even denied eventual consequences of climate change. Extreme weather events are an excellent example of a topic around which both sides built divergent discursive representations to create (dis)engagement. Climate activist bloggers

used extreme weather events to underscore the importance of the COPs. In contrast, climate sceptical bloggers repeatedly stressed that extreme weather events did not reflect climate change, e.g. by introducing the 'Gore Effect', cleverly creating a semantic association between this assumption and the COPs and thereby insinuating a futility of climate policy. This finding is critical as it adds to knowledge about the creation of public engagement or disengagement in relation to extreme weather events (Corner & Clarke, 2017; Marshall, 2014).

Bloggers of both camps promulgated often contrary *actor characterizations*. In the climate sceptic blogs, the heroes were sceptical scientists, media, politicians, and other climate sceptics who fight a climate science establishment and colluding politicians who want to impose costly policies and environmentalist lifestyles on populations in industrialized and developing countries. Meanwhile, the climate activist blogs presented as heroes scientists and activists that battle against neglectful politicians and industrialized countries to rescue developing countries and the general public from the adverse effects of climate change.

While both sides characterize actors' motives differently, it is nevertheless interesting to observe that both sides portray scientists as heroes. This finding is in contrast with the assumption that sceptics tend to be right-wing populists with an anti-science attitude (Lockwood, 2018). Instead, this research shows that climate sceptical bloggers do not necessarily present an anti-science discourse, but rather promote a 'different' type of science. An interesting research direction would therefore be investigating what concepts of science are behind these discursive representations. Another novel finding is that both sides of the debate portray developing countries as the victim of the fight over climate change. This finding is especially interesting in light of Painter & Ashe's (2012) research showing that developing countries paid considerably less attention to climate sceptics in their print media. In other words, climate sceptical bloggers might aim to gain traction by portraying developing countries as the victims. Lastly, both discourses constitute a self-congratulatory representation, which was identified through the 'heroes', 'villains', 'victims' element of our framework. This finding is not surprising in itself, but shows that this theoretical refinement of the framework is useful for identifying patterns of mobilization in discourse, and thereby adds to Dryzek's (2013) framework.

In addition, the discourses of both camps were flavoured with divergent *rhetorical devices* that aimed at either promoting or discouraging action on climate change. Climate sceptic bloggers mostly used science-related rhetorical devices to persuade readers that there was no evidence for ACC, that mainstream science was not sound, and that ACC science was a conspiracy, which is largely consistent with the discursive category 'conspiracies of climate change' that Poberezhskaya (2018) identified in the Russian blogosphere. In contrast, climate activist bloggers pushed for a 'FAB agreement', signalling their connection to a network of environmental groups that has rallied around this term since COP15 (McGregor, 2011). Activist bloggers' discourse is therefore largely congruent with the discourses



of global climate governance that Bäckstrand & Lövbrand (2016) identified (labelled green governmentality, ecological modernization, and civic environmentalism), in particular regarding how climate governance was imagined and enacted during COPs 17, 19, and 20.

Lastly, while the previous discursive categories often imply normative premises, climate sceptical bloggers widely refrained from *explicit normative judgments*. In contrast, the climate activist discourse was saturated with *explicit* normative guidance on the necessity of binding commitments and specific courses of action. This finding might be partly explained by the fact that the climate activist content was mostly produced by bloggers who were frequently paid staffers of the respective NGOs. As indicated by the use of the 'FAB agreement' trope, environmental NGOs are part of a much larger network of coordinated action around the COPs that produces content with unifying, media-savvy narratives (McGregor, 2011; Wozniak et al., 2017). Such morally-laden calls for action are an established part of mobilization strategies for environmental causes (Stern & Dietz, 1994). In contrast, the climate sceptic discourse questions any reason for concern about climate change and thereby any moral obligations to its potential victims that might lead people to support pro-active climate policies. Abstaining from explicit moral appeals is coherent with a worldview that sees no reason for action in the first place.

Overall, by for the first time conducting a Dryzek and Carvalho-inspired systematic discourse analysis on blogs, we show how ideological polarization is grounded in the discursive realities of climate sceptical and climate activist bloggers. Both camps describe the issue in diverging terms, recognize different basic entities, disagree on natural relationships, assign differing motives to the key agents, and make different use of explicit normative guidance. Climate activist bloggers produce a discursive reality that engages their readers with climate change, while climate sceptical bloggers produce a world that achieves the opposite. As such, we identified linkages between climate change communication literature for building public engagement and bloggers' discursive constructions of reality. Hence, future research could generate more conversation between the research fields of communication and discourse.

### Limitations

The research has limitations that one needs to bear in mind when interpreting the results. First, Google's underlying search algorithms are not transparent. For validation, we therefore presented our sample to an expert on climate scepticism who confirmed that the selected climate change blogs were popular in the UK between 2009 and 2015. Second, the ten selected blogs provided different numbers of relevant blog entries, leading to stronger representation of some blogs than others. However, since the discursive characteristics were largely similar within each of the two competing discourses, we are confident that our main findings are not affected by the weight of individual blogs. Third, four of the climate sceptic blogs were US-based while all climate activist blogs operated from the UK.

Consequently, it appeared that selected climate sceptic bloggers often discussed issues going on in other countries, such as the United States. This raises the question whether predominantly UK-based climate sceptic blogs would discuss different issues. Therefore, more research is needed to draw any conclusions about cross-national effects on climate change blog coverage. Finally, the selected blog posts were published one week before, during, or after one of the COPs, which might have skewed the findings towards topics related to international climate politics. Therefore, it is important to note that this part of the findings might have been less pronounced during other times.

### Practical implications and future research

The implications for practice are consistent with a growing body of knowledge about effective climate communication strategies (Corner & Clarke, 2017). The findings cast doubt on the possibility to address climate change as a matter of meaningful dialogue and problem-solving unless the underlying ontological and epistemological divides are addressed. Such a reflexive approach becomes more difficult in a polarized public sphere (Feindt & Weiland, 2018). Overcoming the polarization in turn faces significant structural barriers if diverging worldviews are produced and reproduced through discursive structures with potentially little overlap.

Regarding future research, we recommend to inquire whether the findings presented here are also valid for other parts of the climate blogosphere, e.g. blogs in other languages. Further research should also address mobilization and demobilization effects among audiences, in particular the effects of discourse dissonant with audience's previous perceptions, as well as the extent to which similar forms of discursive polarization also affect other areas of environmental politics. We also recommend applying the discourse analytical framework used here to investigate whether the discourses that we found in the blogosphere are also prominent in traditional media, on other online platforms, and in institutionalized political deliberations.

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## CHAPTER 4

# CLIMATE CHANGE RISK PERCEPTIONS OF AUDIENCES IN THE CLIMATE CHANGE BLOGOSPHERE

## ABSTRACT

The Climate Change Risk Perception Model (CCRPM, Van der Linden, 2015) has been used to characterize public risk perceptions; however, little is known about the model's explanatory power in other (online) contexts. In this study, we extend the model and investigate the risk perceptions of a unique audience: the polarized climate change blogosphere. In total, our model explained 84% of the variance in risk perceptions by integrating socio-demographic characteristics, cognitive factors, experiential processes, socio-cultural influences and an additional dimension: trust in scientists and blogs. Although trust and the scientific consensus are useful additions to the model, affect remains the most important predictor of climate change risk perceptions. Surprisingly, the relative importance of social norms and value orientations is minimal. Implications for risk and science communication are discussed.

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## 4.1 Introduction

Over the years, climate change blogs have become a popular outlet in which climate science, politics, policy, and other topics are discussed (Lewandowsky et al., 2019). Especially since the 'climategate' episode, which significantly influenced public trust and opinion (A. Leiserowitz et al., 2013), blogs played a prominent role in the global climate discussion, influencing scientific, political, and media discourse (Edwards et al., 2011; H. Farrell & Drezner, 2007; Lewandowsky, Oberauer, et al., 2013; Nerlich, 2010). There is a community of 'climate sceptical bloggers' that rejects the scientific consensus on climate change (Elgesem et al., 2015). Some of these bloggers are part of a greater network of scientists, conservative think tanks, and private corporations that intentionally spread misinformation on climate change to delay action (Dunlap & Jacques, 2013; J. Farrell, 2016; Oreskes & Conway, 2011). This network uses blogs as one of their main communication outlets (Lewandowsky et al., 2019). Next to that, there are various communities of bloggers that support the scientific consensus on climate change ('climate mainstream bloggers') (Elgesem et al., 2015), for example climate scientists that blog to correct misinformation on climate change (Van Eck, Mulder, & Dewulf, 2019). Previous studies showed that persistent polarization around climate change manifests itself in online communities and topics (Elgesem et al., 2015), hyperlinking (Elgesem, 2019; Kaiser & Puschmann, 2017), bloggers' operationalization of journalistic norms (Van Eck et al., 2019), discursive constructions of reality (Brüggeman et al., 2020; Van Eck & Feindt, 2020), and interaction strategies in comment threads (Van Eck, Mulder, & Dewulf, 2020) of the climate change blogosphere. Importantly, to date, little research has focused on audiences in the climate change blogosphere.

Climate change blog visitors form a unique media audience in comparison to other audiences, since climate skepticism is widespread in the climate change blogosphere. Lewandowsky, Oberauer, et al., (2013, p. 213) note that visitors of climate change blogs are 'a self-selected audience that is by definition highly engaged in the increasingly polarized climate debate'. A user thread analysis of the Air Vent blog, in which readers commented about their various background and how they became interested in climate science, reveals that climate change blogs were important in forming climate skepticism (Matthews, 2015). In a recent experiment, Lewandowsky et al. (2013) find that climate blogs that either do or do not support the scientific consensus can partially shape public opinion on the issue. Although research on climate skepticism and the rejection of climate science makes clear that blogs can exert significant effects on public opinion, to the best of our knowledge, no other studies have systematically assessed audiences' climate change risk perceptions and the socio-psychological factors that explain these perceptions. Such research is crucial though, as Lewandowsky, Oberauer, et al., (2013, p.629) note: '*This group of people has a demonstrable impact on society and understanding their motivations and reasoning is therefore of importance*'.



Hence, the current research will examine the climate change risk perceptions of audiences in the English-language climate mainstream blogosphere. Breakwell (2010, p.858) defines a risk representation as *'the product of a process in which a hazard is recognized, its characteristics identified, and the probability of its negative impacts occurring are estimated'*. Climate change poses a 'unique' risk (Breakwell, 2010), as the causes are invisible and the impacts are temporal and often geographically distant (Moser, 2010). Because the notion of 'risk' is socially constructed (Kasperson et al., 1988; Van der Linden, 2017), blogs can act as a powerful conduit, shaping public risk perception through both posts and subsequent discussion (Lewandowsky et al., 2019).

To investigate risk perceptions in the climate mainstream blogosphere, the current research will adopt and advance the Climate Change Risk Perception Model (CCRPM) of Van der Linden (2015). The goals of the current research are twofold. First, we will test the CCRPM in a novel context by investigating the socio-psychological factors that predict the climate change risk perceptions of blog audiences. Second, we aim to improve the explanatory power of the model by adding trust and knowledge about the scientific consensus as new predictor variables.

## 4.2 Theoretical Framework

To date, the CCRPM of Van der Linden (Van der Linden, 2015b, 2017) has been one of the most successful climate change risk perception models, predicting 68% of the variance in climate change risk perceptions. Although the CCRPM was initially validated on a representative national sample of the UK population (Van der Linden, 2015b), Xie, Brewer, Hayes, McDonald, & Newell (2019) replicated the CCRPM amongst a representative sample of the Australian general public, which accounted again for 68% in variance.

For the first time, a variation of the CCRPM will be applied to a media audience instead of the general public. Therefore, we expect to find slightly different results, as skepticism is more prevalent in the climate change blogosphere than amongst the general public (Elgesem et al., 2015; Lewandowsky et al., 2019; Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011; Sharman, 2014). Moreover, this audience is highly engaged with climate change in comparison to the general public (Lewandowsky, Oberauer, et al., 2013). As such, the current research will provide novel insights into whether the CCRPM produces largely consistent results across different target populations.

Van der Linden (2015) conducted a literature review to get an overview of the psychological factors that drive and shape climate change risk perceptions. Past research shows that factors that predict climate change risk perceptions can mostly be categorized into socio-demographic, cognitive, experiential, and socio-cultural dimensions (Helgeson, Van der Linden, & Chabay, 2012). Accordingly, the CCRPM model combines and integrates cognitive factors, experiential processing mechanisms, and socio-cultural influences,

while controlling for key socio-demographic characteristics. In the following section, these four dimensions of the original CCRPM will be outlined. Importantly, Van der Linden (2015, p. 122) wrote: *'While the aim of the current study was to examine key social-psychological determinants, the list is certainly not exhaustive, as other important factors have also been noted to influence risk perception, including trust in scientists'*. Accordingly, the CCRPM+ will be proposed as a new model that incorporates knowledge about the scientific consensus and trust in scientists and blogs to specifically examine risk perceptions in the blogosphere.

### Dimensions of the Climate Change Risk Perception Model

In the original CCRPM, key *socio-demographic characteristics* include gender, age, education, income, religiosity, and political party affiliation. In the final model of Van der Linden (2015), only gender and political party affiliation appeared to be significant predictors of variances in climate change risk perceptions, accounting for 2.2% of the explained variance. Consistent with these results, being female and holding liberal political views are generally both associated with higher climate change risk perceptions (Brody, Zahran, Vedlitz, & Grover, 2008; Sundblad, Biel, & Gärling, 2007).

The *cognitive* dimension comprises knowledge about the causes, impacts, and responses to address climate change. In the final model of Van der Linden (2015), all these factors contributed to 9.3% of the explained variance in climate change risk perceptions. In line with these results, studies generally show that if 'accurate' knowledge about climate change is assessed, this factor is a positive and significant predictor of climate change risk perceptions (e.g. see Hornsey, Harris, Bain, & Fielding, 2016a; Milfont, 2012).

The *experiential processing* dimension consists of affect and personal experiences with extreme weather events. The factor affect here draws on a variety of affective-laden adjectives (unpleasant, unfavorable, and negative) to establish 'holistic' affect. In the final model of Van der Linden (2015), both factors were strong predictors of variances in risk perceptions, accounting for 22.1% of the explained variance (also see Xie et al., 2019). Other research on experiential processing generally revealed similar results, in which negative affective evaluations of climate change (e.g. see Smith & Leiserowitz, 2012; Sundblad et al., 2007) and experiences with extreme weather events (Akerlof, Maibach, Fitzgerald, Ceden, & Neuman, 2013; McDonald, Chai, & Newell, 2015) are influential predictors of high climate change risk perceptions.

Lastly, the dimension that comprises *socio-cultural influences* includes social norms and value orientations. Van der Linden (2015, p. 116) distinguished between descriptive social norms and prescriptive social norms, whereas the first refers to 'the extent to which referent others are taking action to help reduce the risk of climate change' and the latter to 'the extent to which an individual feels socially pressured to view climate change as a risk that requires action'. Moreover, following prior research, Van der Linden (2015, p. 116) also distinguished between: '1) egoistic values (i.e., maximizing individual outcomes), 2) socio-altruistic values (i.e., caring about others), and 3) biospheric values (i.e., caring for non-human nature

and the biosphere itself' (Schwartz, 1992; Stern, Dietz, & Kalof, 1993). In the final model of Van der Linden (2015), descriptive and prescriptive social norms and biospheric values were significant predictors and contributed to the majority of 34.4% of the explained variance in climate change risk perceptions. These results are consistent with other research on the influence of social norms (e.g. see Renn, 2011; Swim et al., 2009) and value orientations (e.g. see De Groot, Steg, & Poortinga, 2013; Steg, De Groot, Dreijerink, Abrahamse, & Siero, 2011) on climate change risk perceptions.

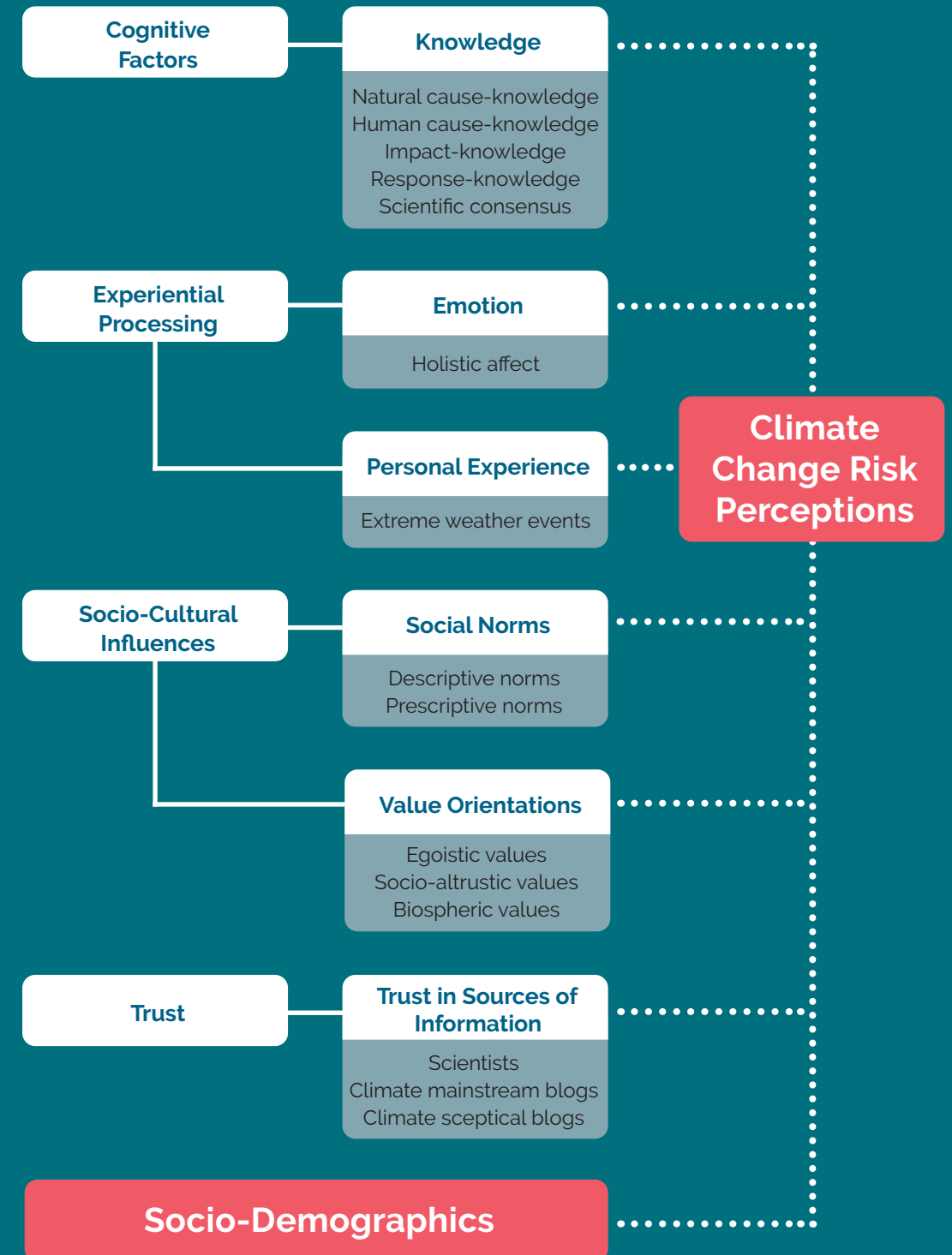
#### CCRPM+

Given the high relevance of trust in scientists and the scientific consensus for the blogosphere (Lewandowsky et al., 2019), in the current research we aim to increase the explanatory power further by adding trust in sources of information about climate change and knowledge about the scientific consensus. We dub this new theoretical model the CCRPM+ (see Figure 5).

The role of *trust* in risk assessments has been recognized by many studies that discuss extreme distrust of the public in individuals, industries, and institutions responsible for risk management (Slovic, 1993). In the context of climate change, scientists are generally the most trusted source of information about climate change (Buys, Aird, van Megen, Miller, & Sommerfeld, 2014; A. Leiserowitz et al., 2013; Whitmarsh, 2009). Importantly, trust in scientists is associated with greater concerns about the issue, while distrust in scientists is associated with little concern (A. Leiserowitz et al., 2013; Malka, Krosnick, & Langer, 2009), but there are exceptions (e.g. see Kellstedt, Zahran, & Vedlitz, 2008). Trust is often conditional on political ideology such that Liberals are more likely than Conservatives to trust scientists as a source of information about climate change (Hamilton, Hartter, & Saito, 2015). Moreover, trust in media as a source of information about climate change is also an important predictor of risk perceptions, where different groups of audiences trust different media (Bråten, Strømsø, & Salmerón, 2011; Whitmarsh, 2009). Previous research has shown that trust in scientists mediated the effect of news media on public perceptions (Hmielowski, Feldman, Myers, Leiserowitz, & Maibach, 2014). Van der Linden (2015) himself noted that trust in scientists was potentially an interesting addition to the original model. Accordingly, the current research will investigate respondents' trust in (a) scientists; (b) climate sceptical blogs; and (c) climate mainstream blogs as a source of information about climate change. Because trust does not fit any of the existing dimensions of the CCRPM, it will be added as a new dimension.

Additionally, research has generally found that the cognitive dimension of the original model contributes least to risk perception (~9% in Van der Linden (2015) and ~4% in Xie et al., (2019) for the original dimension). Most studies show a 97% agreement amongst climate scientists that climate change is human-caused (Anderegg et al., 2010; Cook et al., 2013; Doran & Zimmerman, 2009). Previous research has shown that respondents' *knowledge about this scientific consensus* is an important 'gateway' to concern about climate change (Ding, Maibach, Zhao, Roser-Renouf, & Leiserowitz, 2011; Lewandowsky, Gignac, & Vaughan, 2013; Van der Linden, 2015b; Van der Linden, Leiserowitz, & Maibach, 2019). Therefore, the current research

FIGURE 5 CCRPM+



will also test respondents' knowledge about the scientific consensus on climate change, by adding it to the cognitive dimension in an attempt not to underestimate the influence of different kinds of knowledge on public risk perception.

## 4.3 Materials and Methods

### Research design

The current research is a cross-sectional study ( $N = 674$ ), in which data was obtained through a survey questionnaire that was disseminated amongst audience members in the English-language climate mainstream blogosphere.

### Materials and procedure

The project proposal was reviewed and approved of by the Social Sciences Ethics Committee of Wageningen University & Research (WUR) and preregistered on AsPredicted (#28868).<sup>2</sup> The survey was pilot tested at the Communication, Philosophy, and Technology section of WUR. The input was used to refine the language and restructure the order of items of the survey. Subsequently, 66 bloggers of English-language climate change blogs were invited to publish the survey on their blog. All of the 29 approached climate sceptical bloggers either did not reply or informed us that they did not want to participate.<sup>3</sup> Ultimately, the survey was posted on 12 climate mainstream blogs, e.g. *RealClimate*, *...And Then There's Physics*, and *HotWhopper*. These climate mainstream blogs consist of climate science and climate activist blogs (see Supplement IV for a more elaborate description of the blogs).

The survey was launched on the first blog on 8 October 2019, and shortly after this date the 11 other blogs each published the survey. Participation was on a voluntary basis and anonymous. Respondents also had the opportunity to leave their contact details to get a chance of winning a gift card or get a sneak peak of the results. To prevent that the sample would not include any climate sceptical blog audience members, in the event that none of the climate sceptical blogs would post the survey, we preregistered that we would employ a quota sampling strategy. Quota sampling was used to determine whether data collection would continue after one month; the goal was to collect at least 100 responses of audience members that answered 'yes' to the question whether they 'visit blogs that reject evidence for human-caused climate change' (Y/N) and at least 100 responses of audience members that answered 'yes' to whether they 'visit blogs that support evidence for human-caused climate change'. On 8 November 2019, data collection ended. A total of 832 audience members participated in the survey.

### Measures

This paper used the same measures as Van der Linden (2015), while making several ad-

<sup>2</sup> AsPredicted #28868 <https://aspredicted.org/xe7xj.pdf>

<sup>3</sup> Climate sceptical bloggers that did not want to participate provided different reasons for that. For example, because they did not trust the researchers or did not endorse the survey.

justments. Questions were tailored to an international audience instead of the UK general public. In addition, the knowledge scale was updated by obtaining input of an IPCC scientist, e.g. by making a distinction between knowledge about the natural and human causes of climate change. Moreover, new measures were added that tested respondents trust in scientists and climate change blogs and their knowledge about the scientific consensus. Please see Supplement V for an elaborate description of all measures.

### Risk perception

Following Van der Linden (2015), a holistic risk perception index was created. A total of 8 items evaluated respondents' risk perceptions across affective, cognitive, and temporal-spatial dimensions on a 7-point Likert scale. For example, respondents were asked 'How serious of a threat do you think that climate change is to the natural environment?' A highly reliable score was obtained ( $M = 5.73$ ,  $SD = 1.40$ ,  $\alpha = 0.95$ ).

### Knowledge about climate change

Four scales with in total 50 randomly ordered items were created about natural causes, human causes, impact and responses to test respondents' knowledge about climate change. For example, the natural cause-knowledge scale asked respondents to what extent each item (i.e., volcanic eruptions) contributes to natural influences on climate change (i.e. major, minor, or no contribution). In total, 37 of the statements were 'correct', which means that there is a strong scientific consensus in the literature on these statements. Importantly, prior to each scale, respondents answered a question about their beliefs in climate change. Depending on this answer, skip logic was applied in order to avoid that respondents would get tired of reviewing statements that were, according to them, based on false assumptions about climate change.<sup>4</sup> The statements were reviewed by two climate scientists (Van der Linden, 2015b) and updated by another climate scientist for accuracy. Responses were dichotomized as either right (1) or wrong (0) and for each respondent a mean score per scale was calculated. Reliable scores were obtained for the impact scale ( $M = 0.86$ ,  $SD = 0.16$ ,  $\alpha = 0.77$ ), and response scale ( $M = 0.85$ ,  $SD = 0.16$ ,  $\alpha = 0.68$ ). The natural cause scale ( $M = 0.85$ ,  $SD = 0.19$ ,  $\alpha = 0.40$ ) and human cause scale ( $M = 0.86$ ,  $SD = 0.12$ ,  $\alpha = 0.45$ ) were less reliable. The natural cause scale was not validated previously and therefore omitted from the analysis. However, since the human cause scale has been validated in earlier research (Van der Linden, 2015b; Xie et al., 2019), it was retained in the current research for comparative purposes.

In addition, following Van der Linden (2015), a single-item measure asked respondents to indicate, to the best of their knowledge, 'what percentage of climate scientists have concluded that human-caused climate change is happening (0%-100%)'. Again, responses were dichotomized as either correct (1) or wrong (0). Based on IPCC's *very likely* probability indication, a scientific consensus of 90% or higher was considered as correct (IPCC, 2014) ( $M = 93.68$ ,  $SD = 13.69$ ).

<sup>4</sup> These 20 responses with missing data were removed from the dataset.

**Holistic affect**

Three 7-point bi-polar adjective items were used to evaluate holistic affect, e.g. 'I believe that climate change is something very positive' (strongly disagree – strongly agree). A reliable score was obtained ( $M = 6.55$ ,  $S = 0.82$ ,  $\alpha = 0.94$ ).

**Personal experience with extreme weather events**

Respondents were asked in a single-item measure how often they have personally experienced any type of extreme weather event in their local area (e.g. floods, severe heat waves, droughts, freak storms, etc.) while residing in their country of residence (never, once, twice, more than three). Responses were dichotomized into 0 = no experience ( $N = 127$ ) and 1 = experience ( $N = 547$ ).

**Broad value orientations**

De Groot & Steg's (2007) standardized value scales were used to measure respondents' broad value orientations. The egoistic, socio-altruistic, and biospheric value scales comprised four randomly ordered items each. Respondents rated the importance of 12 values as guiding principles in their lives on a 9-point Likert scale, ranging from -1 opposed to my values, 0 not important, to 7 extremely important. A reliable score was obtained for altruistic ( $M = 7.19$ ,  $SD = 1.36$ ,  $\alpha = 0.82$ ) and biospheric ( $M = 7.22$ ,  $SD = 1.50$ ,  $\alpha = 0.90$ ) values. The egoistic scale was less reliable ( $M = 3.58$ ,  $SD = 1.06$ ,  $\alpha = 0.57$ ); however, it was still included in the analysis as this scale has been included in previous research (Van der Linden, 2015b; Xie et al., 2019).

**Social norms**

- **Descriptive norm**  
On a 7-point Likert-scale, respondents answered three items about how likely they think it is that important referent others are taking personal action to help tackle climate change. A reliable score was obtained ( $M = 4.01$ ,  $SD = 1.46$ ,  $\alpha = 0.87$ ).
- **Prescriptive norm**  
Similarly, on a 7-point Likert scale, respondents answered four items about the extent to which they feel socially pressured to personally help reduce the risk of climate change. A reliable score was obtained ( $M = 5.05$ ,  $SD = 1.24$ ,  $\alpha = 0.79$ ).

**Socio-demographic factors**

Respondents' gender (1 = female), age, country of residence, income, education, and political views was surveyed. We measured respondents' political views with a 7-point slider, as follows: 'Here is a 7-point scale on which the political views that people might hold are arranged from extremely liberal (left) to extremely conservative (right). Where would you place yourself on this scale?'. Political views was recoded into binary responses (Left-wing:  $0 > 3.5 = 1$ , Right-wing:  $3.5 \geq 7 = 0$ ).

**Trust in sources of information about climate change**

he single-item measure of Hmielowski et al. (2014) was used to assess trust in scientists.

Respondents were asked 'how much they trust scientists as a source of information about climate change', on a 7-point Likert scale ( $M = 6.38$ ,  $SD = 1.16$ ). Two other items on a 7-point Likert scale asked respondents 'how much they trust blogs that support evidence for human-caused climate change as a source of information' and 'how much they trust blogs that reject evidence for climate human-caused climate change' (climate mainstream:  $M = 5.70$ ,  $SD = 1.31$ , climate skeptic:  $M = 6.30$ ,  $SD = 1.19$ ,  $r = 0.57$ ).

**Statistical analysis**

The responses with missing data (mostly drop-outs, 19%) for the predictor variables in the multiple regression were removed from the dataset<sup>5</sup>, resulting in a final dataset of  $N = 674$  responses. For all scales (excluding the single item measures), the mean score and Cronbach alpha was calculated. Trust in climate sceptical blogs and a prescriptive norm item were reverse-scored, so that higher scores indicated higher levels of risk perceptions.

First, descriptive statistics are reported, in order to understand the dataset. Second, a bi-variate, two-tailed Pearson correlation test of the CCRPM+ variables was conducted to examine whether these variables were correlated in the expected direction. Subsequently, on the basis of a theory-based approach (Van der Linden, 2015b, 2017), a hierarchical multiple regression analysis was conducted to assess to what extent cognitive, experiential, socio-cultural, and the new trust dimension can explain and predict climate change risk perceptions of blogosphere audience members. Lastly, following Van der Linden (2015) and Xie et al. (2019), Pratt's (1987) measure was used to calculate the relative importance among the predictor variables. The calculation measure comprises the sum of each variable's standardized regression coefficient ( $\beta_j$ ) multiplied by its zero-order correlation with the dependent variable ( $r_j$ ), the sum of which equals the standardized explained variance of a regression model ( $R^2$ ).

$$\sum(\beta_j \cdot r_j) = R^2$$

The relative importance scores were manually calculated and all the other analyses were conducted with IBM SPSS Statistics (version 25).

**4.4 Results**

**Overview of socio-demographic characteristics**

Table 7 provides an overview of the socio-demographic characteristics of the research sample. The majority of respondents are male (89.6%). More than half of the respondents are 55 or older (65.3%). Respondents came from 40 different countries, but the United States was the most frequently reported country of residence (44.7%). More than half of the respondents obtained a master's or doctoral degree (59.1%). Lastly, most respondents hold left-leaning political views (85.8%).

<sup>5</sup> We preregistered that we have 'no formal a priori exclusion criteria'. Thus, this decision was made after the data was collected.

**TABLE 7 OVERVIEW OF SOCIO-DEMOGRAPHIC CHARACTERISTICS SAMPLE**

SOCIO-DEMOGRAPHIC CHARACTERISTICS	VALID PERCENT
1. Gender	
Female	10.4%
Male	89.6%
2. Age	
24 or younger	2.2%
25-34	5.9%
35-44	8.8%
45-54	17.8%
55-65	32.8%
66 or older	32.5%
3. Country of Residence	
United States	44.7%
United Kingdom	12.3%
Australia	9.2%
Canada	7.4%
The Netherlands	4.5%
Other	21.9%
4. Highest Level of Education	
No qualification	1.3%
High school degree or equivalent	5.6%
Vocational degree or equivalent	5.5%
Bachelor's degree or equivalent	27.6%
Master's degree or equivalent	32.2%
Doctoral degree	26.9%
Prefer not to answer	0.9%
5. Political Views	
Left-wing	85.8%
Right-wing	14.2%

### Descriptive statistics of variables CCRPM+

Table 8 provides an overview of the intercorrelations, means, and standard deviations of the CCRPM+ variables. All of the predictor variables are significantly and positively correlated with risk perceptions, ranging from ( $r = 0.32$  to  $r = 0.86$ ) – except egoistic values ( $r = 0.05$ ,  $p > 0.05$ ) and human causes-knowledge ( $r = 0.01$ ,  $p > 0.05$ ) which are both not significant. Affect ( $r = 0.86$ ) is the strongest correlate of risk perceptions.

### Multiple regression CCRPM+

Model 1 is the baseline model comprising significant socio-demographic predictor variables. Gender ( $\beta = 0.08$ ,  $p < 0.05$ ) and political views ( $\beta = 0.47$ ,  $p < 0.01$ ) are both positive significant predictors and income ( $\beta = -0.11$ ,  $p < 0.01$ ) is a negative significant predictor. These predictors explain a total of 25% of the variance in risk perceptions (see Table 9 and Supplement VI). Thus, being female, having a low income, and holding liberal political views is associated with high climate change risk perceptions.

Model 2 investigated the explanatory power of the cognitive dimension, while controlling for socio-demographic characteristics. Knowledge about the impacts of climate change ( $\beta = 0.44$ ,  $p < 0.01$ ), responses to address climate change ( $\beta = 0.14$ ,  $p < 0.01$ ), and the scientific consensus ( $\beta = 0.20$ ,  $p < 0.01$ ) were all positive and significant predictors. Knowledge about the human causes of climate change was a negative significant predictor ( $\beta = -0.19$ ,  $p < 0.01$ ). Overall, model 2 explained an additional 35% of the variance in risk perceptions. Thus, having knowledge about the impacts of climate change, responses to address climate change, and perceived scientific consensus are all associated with high risk perceptions, while, surprisingly, having knowledge about the human causes of climate change is associated with lower risk perceptions.

Model 3 tested to what degree experiential processes explain variations in climate change risk perceptions, while controlling for cognitive and socio-demographic factors. Negative affect ( $\beta = 0.61$ ,  $p < 0.01$ ) and personal experiences with extreme weather events ( $\beta = 0.13$ ,  $p < 0.01$ ) were both significant predictors. Together, these factors explain an additional 21% of the variance in risk perceptions of audience members. In other words, negative evaluative feelings towards climate change and personal experiences with extreme weather events are both positively associated with risk perceptions.

Model 4 explored the explanatory power of socio-cultural influences on risk perception, while controlling for experiential, cognitive, and socio-demographic characteristics. Biospheric values ( $\beta = 0.10$ ,  $p < 0.01$ ) and descriptive social norms ( $\beta = 0.06$ ,  $p < 0.01$ ) were the only significant predictors, explaining 1% additional variance in risk perceptions.

Lastly, model 5 investigated the explanatory power of the new dimension of trust, while controlling for the other dimensions. Trust in scientists ( $\beta = 0.08$ ,  $p < 0.01$ ) and mainstream blogs ( $\beta = 0.14$ ,  $p < 0.01$ ) and distrust in climate sceptical blogs ( $\beta = 0.09$ ,  $p < 0.01$ ) were significant predictors of climate change risk perceptions, explaining a further 2% of the



**TABLE 8 DESCRIPTIVE STATISTICS AND INTERCORRELATIONS**

	1	2	3	4	5	6
1. Biospheric values	(0.90)					
2. Egoistic values	.09*	(0.57)				
3. Altruistic values	.71**	.09*	(0.82)			
4. Human cause	-.121**	-.10**	-.06	(0.45)		
5. Impact	.26**	.03	.25**	.28**	(0.77)	
6. Response	.18**	.01	.19**	.37**	.72**	(0.68)
7. Scientific consensus	.24**	.05	.23**	.17**	.68**	.57**
8. Descriptive norm	.19**	.16**	.22**	.04	.26**	.26**
9. Prescriptive norm	.32**	.14**	.31**	.04	.35**	.32**
10. Affect	.46**	.04	.42**	.04	.66**	.50**
11. Personal experience	.22**	.01	.16**	-.07	.29**	.23**
12. Trust scientists	.31**	.07	.27**	.14**	.62**	.53**
13. Trust climate mainstream blogs	.36**	.08*	.31**	.08*	.60**	.50**
14. Distrust climate sceptical blogs	.36**	.04	.31**	.08*	.61**	.51**
15. Risk perceptions	.50**	.05	.45**	.01	.69**	.56**
Mean	7.22	3.58	7.19	0.86	0.86	0.85
SD	1.50	1.06	1.36	0.12	0.18	0.16

7	8	9	10	11	12	13	14	15
(1.0)								
.18**	(0.87)							
.31**	.66**	(0.79)						
.56**	.24**	.39**	(0.94)					
.24**	.21**	.25**	.33**	(1.0)				
.57**	.25**	.34**	.63**	.31**	(1.0)			
.49**	.26**	.36**	.65**	.27**	.65**	(1.0)		
.64**	.23**	.33**	.69**	.31**	.63**	.57**	(1.0)	
.62**	.32**	.43**	.86**	.43**	.69**	.71**	.72**	(0.95)
93.68	4.01	5.05	6.55	0.81	6.38	5.70	6.30	5.73
13.69	1.46	1.24	0.82	0.39	1.16	1.31	1.19	1.40

Note: scale reliabilities (Cronbach's alpha) are presented along the diagonal. \* $p < 0.05$ , \*\* $p < 0.01$ .



TABLE 9 CCRPM+ RESULTS

INDEPENDENT VARIABLES	SOCIO- DEMOGRAPHICS MODEL 1 ( $\beta$ )	COGNITIVE FACTORS MODEL 2 ( $\beta$ )	EXPERIENTIAL PROCESSES MODEL 3 ( $\beta$ )	SOCIO- CULTURAL INFLUENCES MODEL 4 ( $\beta$ )	TRUST MODEL 5 ( $\beta$ )
Gender	0.08*	0.11**	0.07**	0.06**	0.06**
Income	-0.11**	-0.08**	-0.04*	-0.04*	-0.04**
Political views	0.47**	0.16**	0.06**	0.04	0.02
Human causes		-0.19**	-0.08**	-0.06**	-0.06**
Impact		0.44**	0.11**	0.11**	0.07*
Responses		0.14**	0.10**	0.09**	0.06**
Scientific consensus		0.20**	0.10**	0.10**	0.06**
Affect			0.61**	0.56**	0.45**
Personal experience			0.13**	0.11**	0.10**
Biospheric values				0.10**	0.07**
Egoistic values				0.01	-0.01
Altruistic values				0.01	0.02
Descriptive norm				0.06**	0.05*
Prescriptive norm				0.01	-0.01
Trust in scientists					0.08**
Trust in climate mainstream blogs					0.14**
Distrust in climate sceptical blogs					0.09**
N	674	674	674	674	674
adj. $R^2$	0.25	0.60	0.81	0.82	0.84
$\Delta$ adj.		0.35	0.21	0.01	0.02
$F_{change}$	76.41	146.05	367.06	9.86	30.01

Note: Dependent variable is risk perceptions (index). Entries are standardized beta coefficients. \* $p < 0.05$ , \*\* $p < 0.01$ .

TABLE 10 RELATIVE IMPORTANCE OF CCRPM+ PREDICTOR VARIABLES

INDEPENDENT VARIABLES	PARTITIONING OF EXPLAINED VARIANCE
1. Socio-Demographics	
Gender	0.66%
Income	0.56%
Total Variance Explained	1.22%
2. Cognitive Factors	
Human causes – knowledge	-0.06%
Impacts – knowledge	4.83%
Responses – knowledge	3.36%
Scientific consensus – knowledge	3.72%
Total Variance Explained	11.85%
3. Experiential Processes	
Affect	38.70%
Personal experience	4.30%
Total Variance Explained	43.00%
4. Socio-Cultural Influences	
Biospheric values	3.50%
Descriptive norm	1.60%
Total Variance Explained	5.10%
5. Trust	
Trust in scientists	5.52%
Trust in climate mainstream blogs	9.94%
Distrust in climate sceptical blogs	6.48%
Total Variance Explained	21.94%
Overall Variance Explained	83.11%

variance. Thus, trust in scientists and climate mainstream blogs and distrust in climate sceptical blogs as a source of information are associated with higher risk perceptions.

In summary, (a) being female; (b) having lower income; (c) more liberal political views; (d) more knowledge about the impacts; (e) the responses; and (f) the scientific consensus on climate change; (g) stronger negative affective evaluations of climate change; (h) more personal experiences with extreme weather events; (i) stronger biospheric values; (j) higher perceptions of being surrounded by people who believe it is important that you take personal action to tackle climate change; (j) more trust in scientists; and (k) climate main-

stream blogs as a source of information; and lastly (l) less trust in climate sceptical blogs as a source of information were all independently associated with increased risk perceptions of climate change. The final model explains 84% of the variances in climate change risk perceptions of audience members in the climate mainstream blogosphere.

### The relative importance of CCRPM+ predictor variables

Table 10 shows the relative importance for each of the single variables as well as the five dimensions of CCRPM+. The results show that in the final regression model *experiential processes* (43%) and *trust* (21.94%) account for the majority of explained variance (64.94%). Moreover, *cognitive factors* (11.85%) and *socio-cultural influences* (5.10%) contribute significantly less and *socio-demographics*' contribution is nearly insignificant (1.31%). *Affect* (38.70%) is the single strongest predictor variable of climate change risk perceptions. Another interesting observation is that *knowledge about the human causes of climate change* (-0.06%) does not significantly contribute to the relative explained variance, whereas *knowledge about the impacts, responses and scientific consensus* together account for 11.79% of the explained variance.

## 4.5 Discussion

The goals of this paper were twofold: (a) investigating the socio-psychological factors that predict the climate change risk perceptions of mainstream blog audiences by replicating the CCRPM; and (b) improving the explanatory power of the model by adding trust and knowledge about the scientific consensus as new predictor variables.

### Evaluation of CCRPM+

Whereas the CCRPM predicted 68% of the variance in climate change risk perceptions for the UK (Van der Linden, 2015b) and the Australian public (Xie et al., 2019), the CCRPM+ explained 84% of the variance for international audiences in the climate mainstream blogosphere. The relative contribution of predictors to climate change risk perceptions in the CCRPM are largely congruent with our findings for the CCRPM+, however, there were some remarkable differences with the British and Australian general public. First of all, gender and income were the only significant socio-demographic predictors in the final model. Thus, when audience members are female and have a lower income, they especially tend to view climate change as a greater risk. Van der Linden (2015) found that political views were a significant and consistent predictor of risk perception, which is congruent with our findings though in our model ideology lost its significance after controlling for socio-cultural influences. Overall, the relative contribution of socio-demographic factors to risk perceptions was nearly zero, which is consistent with other research (e.g. 3% in Xie et al., 2019) and the general expectation that the influence of socio-demographic variables is diminished when introducing theory-based psychological dimensions (Van der Linden, 2017). Second, knowledge about impacts, responses and the scientific consensus were all significant and positive predictor variables. Therefore, adding the latter as new predictor vari-

able is a useful advancement of the CCRPM. Thus, when audience members have knowledge about the impacts, responses, and the scientific consensus on climate change, they tend to view climate change as a higher risk. Surprisingly, knowledge about the human causes of climate change is significantly and negatively related to risk perceptions. Yet, we caution against interpreting this finding for two main reasons; (a) human causation did not reveal a significant zero-order correlation with risk perception likely due to (b) the very low reliability of the scale in this study. Overall, it appears that the relative importance of cognitive factors to explain risk perceptions was more substantial for mainstream blogosphere audience members than for the British and Australian general public.

Third, experiential processes were the strongest contributor to the total variance in risk perceptions. Affect was the greatest predictor of climate change risk perceptions overall and personal experiences with extreme weather events was also a significant and positive predictor. These findings are largely congruent with the findings of Van der Linden (2015) and Xie et al. (2019). While the importance of affect in shaping risk perceptions was diminished in earlier research (Sjöberg, 2006), more recent research largely endorses the idea that emotions and affect play a crucial role in forming climate change risk perceptions (Curnock et al., 2019; Gustafson et al., 2020; Jovarauskaite & Böhm, 2020; Anthony Leiserowitz, 2006; Salama & Aboukoura, 2018; Slovic, 2010; Smith & Leiserowitz, 2012; Van der Linden, 2014, 2015b; Xie et al., 2019). Therefore, since once again the importance of emotions and affect in understanding risk perceptions of climate change is underscored, the need for future research focusing on how emotions can – and should – be addressed in climate change communications is paramount.

Fourth, the relative importance of socio-cultural influences on risk perceptions as a whole is minimal compared to the contribution of other dimensions. This finding goes somewhat against current academic scholarship, which stresses the importance of recognizing the role of social norms and human values in how climate change risk perceptions are formed (e.g. see Corner, Markowitz, & Pidgeon, 2014; De Groot et al., 2013; Swim et al., 2009), but may speak to the unique composition of factors that predict the risk perceptions of blog audiences. Although the relative importance was minimal, biospheric values and descriptive norms were both significantly and positively related to climate change risk perceptions. Thus, audience members that hold biospheric values and perceive that others are taking action to help reduce the risk of climate change tend to view climate change as greater risk. In contrast to Van der Linden (2015) and Xie et al. (2019), prescriptive norms was not a significant predictor of risk perceptions. Thus, although perceived consensus seems to be important in shaping perceptions of blog visitors (Lewandowsky et al., 2019), the extent to which audience members feel directly socially pressured to view climate change as a risk that requires action does not affect their risk perceptions. This finding suggests that audiences in the climate mainstream blogosphere are perhaps more inclined to view themselves as independent thinkers and therefore defer to other heuristics, such as trust in science.

In fact, the new dimension of trust is a useful addition to the model, as it accounted for a quarter of the total explained variance in risk perceptions. Trust in scientists was a positive and significant predictor of risk perceptions. Importantly and perhaps unsurprisingly, the predictive power of trust in climate mainstream blogs and distrust in climate sceptical blogs was even greater. Thus, this finding adds to the notion that the degree to which individuals trust certain media as a source of information about climate change is critical for understanding how climate change risk perceptions are formed (Malka et al., 2009).

Overall, these results largely replicated earlier studies using the CCRPM. However, it is important to note that some of our findings deviated from previous research, like the minimal relative importance of socio-cultural influences. We suggest that these counterintuitive results show that the assigned weight of predictor variables influencing climate change risk perceptions may be dependent on each unique target population. In this case, since climate change blog audiences are highly engaged and climate skepticism is more prevalent in the blogosphere (Lewandowsky, Oberauer, et al., 2013), one can speculate about whether mainstream audience members view themselves as more independent thinkers with a greater interest in climate science than members of the general public. We recommend to replicate the CCRPM+ in the context of climate sceptical blogs and in other (non-English) contexts and cultures.

### Implications for practice and future research

The current research has important implications for risk communication via blogs. Van der Linden (2015) recommends to craft risk messages that appeal to affective and experiential processing mechanisms and socio-cultural influences, besides providing people with increased knowledge about the causes, impacts, and responses about climate change. We largely endorse this recommendation, but we have a few suggestions for crafting risk messages which are intended for climate change blog audiences.

First of all, we suggest to continue educating audiences about the causes, impacts, and responses of climate change, including the scientific consensus given that, besides the present study, a large literature highlights the benefits of doing so (Lewandowsky, Gignac, et al., 2013; Ranney & Clark, 2016; Van der Linden et al., 2019). Second, we suggest that although the perception of social consensus on blogs is important (Lewandowsky et al., 2019), crafting messages in which audience members feel directly socially pressured to view climate change as a risk may not be effective or even elicit psychological reactance.

For example, previous research showed that some climate change bloggers are already sensitive to selecting and composing blog content that aims to evoke certain emotions, in addition to a focus on objective and scientific content (Van Eck et al., 2019). However, scientist bloggers might feel restrained to craft content that appeals to audience members' emotions and prefer to stick to content that feeds knowledge to the audiences. However, according to Engdahl and Lidskog (2014, p.714), this strategy is not effective for building trust. Instead, they discuss that trust is created when individuals feel *'emotionally involved'*

*take part, have a say, and in some sense are able to recognize themselves in the recipient of their trust'*. Therefore, we encourage bloggers to write blogs that appeal to audiences' emotions, given that both audiences' affect and trust in climate change blogs is an influential predictor of their climate change risk perceptions.

The current research also has important implications for risk communication in general. Our research provides evidence for the fact that each target audience has its own unique characteristics. Therefore, we suggest that risk communicators aim to understand the socio-psychological factors that shape their audience's risk perceptions so that a risk message can be crafted that is tailored to the characteristics of this specific audience. Moreover, we recommend to test communications to evaluate their effectiveness (Corner & Clarke, 2017).

Of course, this research has limitations that need to be considered. First and foremost, the survey was not published on any climate sceptic blogs. Second, the sample was self-selected. Thus, we recognize that the sample is not representative of the entire climate change blog audience population, but instead representative of the climate mainstream blogosphere. However, the sample did include audience members with low risk perceptions. Therefore, the composition of the sample allowed us to evaluate what socio-psychological factors explain the variance in climate change risk perceptions of blog audiences. Third, the data is self-reported, which makes the research prone to social desirability- and memory biases. However, if respondents coordinated their responses to insert noise into the data (Lewandowsky, Oberauer, et al., 2013), such results would likely have surfaced in the analysis. Fourth, the reliability scores of the natural and human cause – knowledge scales were low. Therefore, we recommend to restructure the items that were used in the present research and develop scales that are reliable in different contexts. Lastly, the data is cross-sectional, which means that the associations reported here cannot be used to infer causality.

## 4.6 Conclusions

We advanced the CCRPM to investigate the climate change risk perceptions of audiences in the climate mainstream blogosphere. Our model explained 84% of the variance in risk perceptions. The most important predictor variable is affect. Overall, this research shed light on the views of the highly-engaged audiences of polarized climate change blogs.

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## CHAPTER 5

# ECHO CHAMBER EFFECTS IN THE CLIMATE CHANGE BLOGOSPHERE

## ABSTRACT

**This research provides evidence for echo chamber effects by investigating blog consumption patterns of audiences in the climate change blogosphere. The aim of this research was to assess whether audiences with low climate change risk perceptions primarily consume climate sceptical blogs and audiences with high climate change risk perceptions primarily consume climate mainstream blogs. Audience members participated in a self-administered survey that measured a) their climate change risk perceptions, b) whether they visit climate mainstream and/or sceptical blogs, c) how many days a month, and d) how much time they typically spend on a blog during a visit. Consistent with expectations, findings reveal that audience members (N = 760) with high risk perceptions primarily consume climate mainstream blogs and audience members with low risk perceptions primarily consume climate sceptical blogs. Implications for research and practice are discussed.**

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## 5.1 Introduction

**T**here is still no clear consensus on whether the internet contributes to audience fragmentation and polarization or not, as studies often reveal mixed evidence (Dahlgren, 2018). On the one hand, internet may increase exposure to content that is not in line with audiences' pre-existing views (Dubois & Blank, 2018), which in turn contributes to deliberation and therefore can have a depolarizing effect. On the other hand, 'echo chambers' may organize the media environment in such a way that audiences are mostly exposed to content that is in line with their pre-existing views (Colleoni, Rozza, & Arvidsson, 2014; Jamieson & Cappella, 2008; Sunstein, 2017), which in turn reinforces existing beliefs and therefore can foster processes of polarization.

The climate change debate is polarized, with on one side the 'climate mainstream' that support the mainstream scientific consensus on climate change, and on the other side 'climate sceptics' that reject this position. The role of bloggers and commenters in processes of polarization in the climate change blogosphere has been extensively investigated. Echo chamber effects and polarization around climate change strongly manifest in blog posts (Brüggeman et al., 2020; Elgesem et al., 2015; Kaiser, 2017; Poberezhskaya, 2018), hyper-linking (Elgesem, 2019; Kaiser & Puschmann, 2017), and interactions in comment threads (Edwards, 2013; Van Eck, Mulder, & Dewulf, 2020). Moreover, blogs form an integral part of sceptics' communication strategy (Lewandowsky et al., 2019). However, the role of audiences in processes of polarization in the climate change blogosphere has been paid less attention to. Thus, although much is known about polarization in terms of 'production', virtually no studies have yet investigated polarization in the climate change blogosphere in terms of 'consumption'.

More generally, little research has focused on audiences' online media 'consumption' on climate change. Research has primarily focused on 'production' by investigating online interactions about climate change and the existence of echo chambers (see e.g., Walter, Brüggemann, & Engesser, 2018; Williams, McMurray, Kurz, & Hugo Lambert, 2015). This lack of research on audiences' actual online media consumption is remarkable, given the academic concern about whether audiences' customized online media diets contribute to processes of audience fragmentation and polarization (Jamieson & Cappella, 2008; Sunstein, 2017). Therefore, acquiring a better understanding of audiences' climate change blog consumption is crucial, as potential echo chamber effects reinforce sceptical views on climate change, which potentially hinder public support for climate action.

Therefore, the current research aims to provide insight into echo chamber effects in the climate change blogosphere, by investigating whether blog audiences solely consume climate change blogs that are in line with their climate change risk perceptions (i.e. echo chambers) or whether they consume content on both sides of the spectrum. More specifically, this research investigates whether audiences with low climate change risk percep-

tions primarily consume climate sceptical blogs and audiences with high climate change risk perceptions primarily consume climate mainstream blogs.

## 5.2 Method

The current research is designed as a cross-sectional study, employing a survey for data collection (see Supplemental Material VII), which was disseminated via English-language climate mainstream blogs for their audiences to fill out. This study was part of a larger research project that investigates the climate change risk perceptions of audiences in the climate change blogosphere. Only blog consumption data in relation to climate change risk perceptions are reported here.

### Materials and procedure

The project proposal was reviewed and approved by the Social Sciences Ethics Committee of Wageningen University & Research (WUR) and preregistered on AsPredicted (#28868).<sup>6</sup> The survey was pilot tested to refine the language and order of items of the survey. In total, 66 English-language blogs were identified (e.g. via blog rolls and Google) and approached via email or via a post in the comment sections and 12 climate mainstream blogs ultimately published the survey on their website, e.g. *RealClimate*, ...And Then There's Physics, and HotWhopper (see Supplemental Material VIII). Out of the 66 blogs, 29 climate sceptical bloggers were invited, but none of them wanted to participate or responded to the invitation. 832 audience members participated in the survey between the 8th of October and 8th of November, 2019. Please see the socio-demographic characteristics of the sample in Table 11. The sample mostly consisted of males, who were 55 or older, highly educated, and left-wing. With 43.5%, the United States was the most frequently reported country of residence.

### Measures

#### Climate change risk perceptions

Climate change risk perceptions were measured with the eight-item scale of van der Linden (2015). Only minor adjustments were made to tailor the items to an international audience. All items were rated on a 7-point Likert scale. An example of an item is: 'How concerned are you about climate change?' A reliable scale was obtained ( $M = 5.59$ ,  $SD = 1.55$ ,  $\alpha = 0.96$ ).

#### Climate change blog consumption

Measuring audiences' climate change blog consumption was operationalized by investigating a) whether audiences visit blogs (Y/N), b) how many days a month (range 0-31 days), and c) how much time they typically spend on a blog during a visit (range: 0-12 h).

<sup>6</sup> AsPredicted #28868 [aspredicted.org/xe7xj.pdf](https://aspredicted.org/xe7xj.pdf)

TABLE 11 OVERVIEW OF SOCIO-DEMOGRAPHIC CHARACTERISTICS SAMPLE

SOCIO-DEMOGRAPHIC CHARACTERISTICS	VALID PERCENT
1. Gender	
Female	10.8%
Male	89.2%
2. Age	
24 or younger	2.8%
25-34	6.5%
35-44	8.7%
45-54	17.6%
55-65	32.2%
66 or older	32.2%
3. Country of Residence	
United States	43.3%
United Kingdom	13.1%
Australia	9.1%
Canada	7.0%
The Netherlands	4.2%
Other	23.3%
4. Highest Level of Education	
No qualification	1.5%
High school degree or equivalent	6.2%
Vocational degree or equivalent	5.7%
Bachelor's degree or equivalent	27.3%
Master's degree or equivalent	31.1%
Doctoral degree	26.6%
Prefer not to answer	1.6%
5. Political Views	
Left-wing	83.7%
Right-wing	16.3%



These three items were used to assess both audience members' climate sceptical blog consumption and their climate mainstream blog consumption, i.e. a total of six items. Importantly, skip logic was applied if respondents answered 'no' to the item asking whether they visit the aforementioned blogs.

Statistical analysis

Respondents with missing data ( $N = 72$ ) for the risk perceptions scale or blog consumption items were removed from the dataset<sup>7</sup>, which resulted in a final dataset of  $N = 760$ . Because Cronbach's alpha for the risk perceptions scale was sufficient, the mean item score was calculated for this scale. Subsequently, mean item scores were dichotomized. Based on the semantics of the response options, we reasoned that low risk perceptions ranged from the responses 'not at all' to 'somewhat' and high risk perceptions corresponded to the higher response options of the risk perception items. As a result, 0 indicated 'low climate change risk perceptions' (mean item score  $1 \leq 5$ ,  $N = 142$ ) and 1 indicated 'high climate change risk perceptions' (mean item score  $5 > 7$ ,  $N = 618$ ). The main results proved robust when the mean item scores were dichotomized on the basis of a median split (median = 6.14).

After the descriptive statistics, Phi's correlations were computed to investigate the bivariate relationship between the dichotomized risk perceptions and whether audience members visit mainstream/sceptical blogs. Pearson's correlations were computed to investigate the bivariate relationships between the dichotomized risk perceptions and number of 'visits a month' and 'duration of visits' in hours. Third, a Chi-square test of independence was conducted to assess whether audience members with high risk perceptions are more likely to visit climate mainstream blogs than audience members with low risk perceptions. The same analysis was conducted for visits to climate sceptical blogs. Fourth, independent-samples t-tests were conducted to compare how many days a month, as well as how many hours per visit, audience members with low and high risk perceptions visit climate mainstream blogs, if they have answered yes to the question whether they visit climate mainstream blogs. Both t-tests were also run for visits to climate sceptical blogs, for those respondents that indicated they visit climate sceptical blogs. All of the analyses were conducted with IBM Statistics (version 25).

5.3 Results

Descriptive statistics

Overall, 618 respondents (81%) reported 'high climate change risk perceptions' and 142 respondents hold 'low climate change risk perceptions' (19%). Due to the skip logic in the survey, sample sizes vary for 'visits a month' and 'duration of visits' (see Table 12).

<sup>7</sup> 'No formal a priori exclusion criteria' were preregistered. Thus, this decision was made after the data was collected. Further, we preregistered that the current research was exploratory. Instead of ANOVA, we report Chi-square and t-tests here given that we only have two groups.

TABLE 12 N, MEANS, AND STANDARD DEVIATIONS

	CLIMATE MAINSTREAM BLOG CONSUMPTION			CLIMATE SCEPTICAL BLOG CONSUMPTION		
	Visitation (Y/N)	Visits a month	Duration of visits	Visitation (Y/N)	Visits a month	Duration of visits
N	760	715	715	760	363	363
Mean	94% (Y)	17.66	1.11	48% (Y)	8.76	.87
SD	.23	10.40	1.39	.50	9.78	1.42

Correlations

There was a positive correlation between audience members' climate change risk perceptions and whether they visit climate mainstream blogs ( $r = 0.17$ ,  $p < .001$ ) and how many days a month they visit these blogs ( $r = 0.21$ ,  $p < .001$ ), but not for duration of visits in hours ( $r = 0.04$ ,  $p = .25$ ). Thus, as expected, higher climate change risk perceptions were associated with higher consumption of climate mainstream blogs.

In addition, there was a negative correlation between audience members' climate change risk perceptions and whether they visit climate sceptical blogs ( $r = -.34$ ,  $p < .001$ ), how many days a month they visit these blogs ( $r = -.51$ ,  $p < .001$ ), and for how many hours ( $r = -.019$ ,  $p < .001$ ). Thus, also as expected, lower climate change risk perceptions were associated with higher consumption of climate sceptical blogs.

Evaluating audience members' climate blog consumption

Visitation (Y/N)

A Chi-square test of independence was conducted to assess whether audience members with high risk perceptions are more likely to visit climate mainstream blogs than audience members with low risk perceptions. Indeed, 96% ( $N = 593/618$ ) of the audience members with high risk perceptions visit climate mainstream blogs, while 86% ( $N = 122/142$ ) of the audience members with low risk perceptions visit climate mainstream blogs, a significant difference with  $X^2(1, N = 760) = 20.89$ ,  $p < .01$ ,  $\phi_{Cramer} = .17$ .

For climate sceptical blogs, results showed that 83% ( $N = 118/142$ ) of the audience members with low risk perceptions visit those blogs, opposed to 40% ( $N = 245/618$ ) of the audience members with high risk perceptions. Again, this is a significant difference,  $X^2(1, N = 760) = 87.39$ ,  $p < .01$ ,  $\phi_{Cramer} = .34$ .

### Visits a month

With regards to how many days a month audience members visit climate mainstream blogs, the t-test showed a significant difference between audience members with low climate change risk perceptions ( $N = 122$ ,  $M_{low} = 13.72$ ) and high risk perceptions ( $N = 593$ ,  $M_{high} = 18.46$ );  $M_{diff} = -4.73$ , 95% CI [-6.74, -2.73],  $t(713) = -4.64$ ,  $p < .01$ , Cohen's  $d = 0.46$ . In other words, of the audience members that visit climate mainstream blogs, audience members with high climate change risk perceptions visit those blogs almost five more days a month than audience members with low climate change risk perceptions.

Similarly, of the audience members that visit climate sceptical blogs, audience members with low climate change risk perceptions ( $N = 118$ ,  $M_{low} = 15.16$ ) visit those blogs approximately 9 more days a month than audience members with high climate change risk perceptions ( $N = 245$ ,  $M_{high} = 5.68$ );  $M_{diff} = 9.48$ , 95% CI [7.36, 11.59],  $t(184) = 8.83$ ,  $p < .01$ , Cohen's  $d = 1.03$ . Levene's test indicated unequal variances ( $F = 36.38$ ,  $p < 0.001$ ), so degrees of freedom were adjusted from 361 to 184.

### Duration of visits

With regards to the duration of visits in hours to climate mainstream blogs, there was no significant difference in scores for audience members with low and high risk perceptions ( $N = 122$ ,  $M_{low} = 0.96$ ;  $N = 593$ ,  $M_{high} = 1.14$ ;  $M_{diff} = -.17$ , 95% CI [-.44, 0.10],  $t(713) = -1.24$ ,  $p = .22$ , Cohen's  $d = -0.13$ ).

With regards to the duration of visits in hours to climate sceptical blogs, there was a significant difference in scores between audience members with low climate change risk perceptions ( $N = 118$ ,  $M_{low} = 1.18$ ) and high risk perceptions ( $N = 245$ ,  $M_{high} = 0.72$ );  $M_{diff} = 0.47$ , 95% CI [0.15, 0.78],  $t(223) = 2.92$ ,  $p < .01$ .

Cohen's  $d = 0.33$ . Levene's test indicated unequal variances ( $F = 4.54$ ,  $p = 0.03$ ), so degrees of freedom were adjusted from 361 to 223. Of the audience members that visit climate sceptical blogs, audience members with low climate change risk perceptions visit climate sceptical blogs approximately 30 min longer than audience members with high risk perceptions.

## 5.4 Discussion & Conclusion

The aim of the current research was to provide insight into echo chamber effects in the climate change blogosphere, by investigating whether blog audiences solely consume climate change blogs that are in line with their climate change risk perceptions (i.e. echo chambers) or whether they consume content on both sides of the spectrum. Our results indeed suggest that audience members with low climate change risk perceptions primarily (but not solely) consume climate sceptical blogs and audiences with high climate change risk perceptions primarily (but not solely) consume climate mainstream blogs. We

quantified audiences' blog consumption in terms of a) whether they visit climate mainstream and/or sceptical blogs, b) how many days a month, and c) how much time they typically spend on a blog during a visit.

For climate sceptical blog consumption, all associations with risk perceptions were significant and in the expected direction. Moreover, all results were significant for audience members' climate mainstream blog consumption, except for the time spent on a blog during a visit. Thus, audience members with high risk perceptions primarily consume climate mainstream blogs in comparison to audience members with low risk perceptions. In contrast, audience members with low risk perceptions primarily consume climate sceptical blogs in comparison to audience members with high risk perceptions. In other words, besides the fact that polarization manifests in climate change blog content, audiences' climate change blog consumption also provides potential evidence for echo chamber effects. Echo chamber effects potentially occur as audience members primarily consume content that coincides with their pre-existing climate change risk perceptions. While a strict definition of echo chambers does not allow for any kind of counter-attitudinal exposure, we posit that it is in reality more often the case that audiences are *disproportionality* exposed to one view versus another, as is the case here.

However, one needs to bear in mind that the sample was self-selected. The sample mostly consisted of males, who were 55 or older, from the United States, highly educated, and left-wing. Matthews (2015) earlier showed that climate sceptical blog commenters reported high levels of education; yet, more research is needed to confirm whether this sample is representative for climate change blog audience members. Moreover, the research shows that respondents spend relatively large amounts of time on these blogs. Respondents with more time on their hands were potentially overrepresented in the sample. Nonetheless, if this was the case, the research is still important, as this group of respondents is particularly prone to becoming polarized and more extreme in their views.

These results add to our understanding of processes of polarization in the climate change blogosphere (Edwards, 2013; Elgesem et al., 2015; Kaiser, 2017; Poberezhskaya, 2018; Van Eck et al., 2019; Van Eck, Mulder, & Dewulf, 2020) and, more broadly, provides potential evidence for online echo chamber effects (Colleoni et al., 2014; Dahlgren, 2018; Sunstein, 2017). Our results are important, as climate sceptical echo chambers could potentially reinforce climate scepticism and threaten collective action on climate change amongst blog audience members. More generally, these results suggest that online media could potentially be a breeding ground for polarization and extremism (Sunstein, 2017). Moreover, processes of polarization are not only at play in the production of online content, but also in the consumption of this content. Thus, polarization needs to be understood as a multi-dimensional concept that manifests in different shapes and forms (DiMaggio et al., 1996).

Climate mainstream bloggers should therefore go beyond their blogs if they want to communicate with climate sceptical audiences (Walter et al., 2018). For example, they could

actively engage with alternative viewpoints in deliberative open forums, in which civil discussions and exchanges of ideas take place (Williams et al., 2015). Alternatively, climate bloggers could invest in attracting a more diverse audience, as the current research shows that respondents do not solely visit blogs that coincide with their own views. However, Bail et al. (2018) find that exposure to opposing views on social media could also foster political polarization. Hence, we deem investigating the effects of echo chambers on climate change polarization more extensively an important direction for future research.

Furthermore, Lewandowsky, Cook, Fay, & Gignac (2019) demonstrated in an experiment that blog audiences' perceptions are partially shaped by the degree that comments accept the opinion expressed in the blog post. In line with this research, Walter, Brüggemann, & Engesser (2018) showed how user comments on websites of news outlets serve as echo chambers. Hence, another critical research direction would be investigating to what extent climate change blog comments are consistent with the blogs' scientific position and its audiences' risk perceptions on climate change. In addition, Van Eck et al. (2020) showed how commenters on climate change blogs mostly used polarizing interaction strategies. The current research does not shed light on how audience members engage with climate change blogs. Thus, a future research direction would be investigating to what extent and how audience members engage with climate change blogs when they consume content. Lastly, this research does not reveal what other sources of information about climate change audience members consume. Future research should therefore inquire whether and to what extent the potential echo chamber effect that we have established here extends to other sources of information.

This study has, of course, limitations. First, the survey was not published on any climate sceptical blog. As a result the range was restricted; audience members with high climate change risk perceptions were overrepresented in this research. Nevertheless, we expect that including more audience members with low risk perceptions that solely visit climate sceptical blogs in the sample would strengthen, not weaken, the associations reported here. However, more research is needed to provide evidence for this hypothesis. Second, the research is subject to social desirability and memory biases, since the data is self-reported. Importantly though, in the event that respondents coordinated their responses to insert noise into the data (Lewandowsky, Oberauer, et al., 2013), such results would likely have surfaced in the analysis. Lastly, as the research is cross-sectional, no causality can be inferred between climate change risk perceptions and audiences' climate change blog consumption. The fact that audiences with low risk perceptions also visit climate mainstream blogs is noteworthy but does not necessarily contradict an echo chamber effect as in relative terms blog consumption remains fairly segregated. Having said this, whilst suggestive, we cannot provide causal evidence of echo chamber effects.

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COMMENT



## CHAPTER 6

# ONLINE CLIMATE CHANGE POLARIZATION

Interactional framing  
analysis of climate  
change blog comments

## ABSTRACT

**While increasingly more is known about how to reframe the relevance of climate change, much less is known about how people deal with situations in which they are confronted with frames that are incompatible with their own frames. The current research conducts an interactional framing analysis to investigate how users in climate change blog comments interactively construct the meaning of issues, identities & relationships, and their interactions. Results show that most framing differences start with issue framing, but thereafter shift to identity & relationship or process framing. Finally, users mostly deploy polarizing interaction strategies to deal with these framing differences.**

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## 6.1 Introduction

The scientific evidence for human influence on the climate system is growing (IPCC, 2014). Most studies find at least a 97% scientific consensus that humans are responsible for climate change (Anderegg et al., 2010; Cook et al., 2013). Nonetheless, scepticism about the reality and severity of climate change is still persistent in some Western societies (Whitmarsh & Capstick, 2018) resulting in a polarized climate change debate. McCright & Dunlap (2011b) discuss that there are those 'identifying the negative environmental consequences of industrial capitalism', and 'those defending the economic system from such changes' (p. 156), which shows that there is a strong ideological component underpinning the polarization. The persistent polarization around climate change has led to political inaction in industrialized countries such as the United States (Ladd & York, 2017).

Labels commonly appearing in conversations about climate change reflect and even sustain the polarized camps (Howarth & Sharman, 2015). Howarth and Sharman (2015) explain that 'those who express 'ambivalence', 'attitudinal uncertainty', 'dissonance', or 'cynicism' about mainstream climate science and/or the need for mitigation or adaptation climate policy are most commonly referred to as sceptics, deniers, or contrarians' (p. 241), whereas those that support the mainstream scientific position are often referred to as 'alarmist, warmist, believer, or catastrophist' (p.244).

Next to the labels, the deployed frames also reflect the antagonistic debate. For example, supporters of the mainstream scientific position deploy frames that stress the benefits of different climate change policies, while others deploy frames that stress the costs (Bernauer & McGrath, 2016). One explanation for whether people support one frame and reject another can be found in the identity-protective cognition thesis. This thesis suggests that people selectively credit and dismiss asserted dangers in a way that protects their in-group's cultural identity. More specifically, white males display scepticism towards risks when activities central to their cultural identity are under threat by this risk (white-male effect) (Kahan, Braman, Gastil, Slovic, & Mertz, 2007). Drawing on this thesis, McCright & Dunlap (2011a) show that conservative white males are more likely to deny climate change compared to the rest of the US population, because they consider conservative white male elites that challenge the reality of climate change to be their in-group. More generally, people support climate change frames that credit their cultural identity and dismiss frames that challenge this identity.

Therefore, communication scholars often suggest to reframe the relevance of climate change in ways that resonate with audiences' cultural identities (i.e. their worldviews and values), in order to depolarize the debate and create public engagement with climate change (Corner et al., 2014; Nisbet, 2009; Nisbet & Mooney, 2007). However, Bernauer and McGrath (2016) find that simply reframing climate policy is unlikely to increase public support. They explain that people are exposed to many competing frames and tend to

selectively accept frames that confirm their existing views. Thus, if people do not easily accept incompatible frames, the question is how people respond to situations in which they are confronted with incompatible frames. The climate change communication literature is scarce with respect to how people deal with situations in which differences in framing emerge. Such research is crucial, however, as it provides insight into whether and how people use polarizing interaction strategies when framing differences emerge.

In the current research, we specifically focus on user comments in the climate change blogosphere, as previous research pointed out that this online venue is polarized to the extent of communities, hyperlinks, topics, and discourses (Brüggeman et al., 2020; Elgesem, 2019; Elgesem et al., 2015). Climate change blogs are 'websites that primarily and frequently produce content about climate change with dated entries in a reverse chronological order and possibly a comment section' (Van Eck, Mulder, & Dewulf, 2019, p.2). Comments on climate change blogs provide a rich source of data (Matthews, 2015). User comments only represent the viewpoints of a small portion of media users and are not necessarily representative of public opinion. However, comment threads provide users with a public space for debate, which in turn can influence public opinion on climate change and further scientific discussion (Schäfer, 2012; Walter et al., 2018).

Generally, on the one hand research on climate change comment threads reveals demonstrations of incivility, echo-chamber effects, and the presence of climate sceptical views (Collins & Nerlich, 2015; De Kraker, Kuijs, Cörvers, & Offermans, 2014; Walter et al., 2018). On the other hand, it shows how comment threads offer the potential for a naturally occurring discursive space for dialogue, deliberation, and mobilization around climate change (Collins & Nerlich, 2015; Cooper, Green, Burningham, Evans, & Jackson, 2012; Graham & Wright, 2015; Uldam & Askanius, 2007). To the best of our knowledge, only Matthews (2015) investigated climate change blog comments, by analysing the backgrounds of users and how they became interested in climate science. Hence, the current research aims to contribute to understanding processes of climate change polarization in climate change blog comments. In this paper, we investigate whether and how users deploy strategies to deal with framing differences that either align the incompatible frames or rather further polarize the difference.

## 6.2 Theoretical Framework

In the current research, we will apply interactional framing theory. The following section explains this theory and the subsequent section will provide an overview of the theoretical focus of the current research.

### Interactional framing theory

The interactional perspective on framing focuses on the dynamic enactment of frames in ongoing interactions. Central to this thesis is that the primary focus is on how alignments,

disjunctions, or turning points emerge through the framing process. The theory contributes to our understanding of how meaning is co-constructed in interactions (Dewulf, 2006; W. B. Pearce & Cronen, 1980). This perspective is ontologically, theoretically, and methodologically different from the cognitive perspective on framing, in which the emphasis is on how the frames are stored and represented in memory (Dewulf, 2006). Thus, both theories differ to the extent that the cognitive perspective focuses on structures of expectations, while the interactional perspective focuses on the alignments negotiated in interaction (Aarts & Woerkum, 2006; Dewulf et al., 2009). Henceforth, we will refer to the latter perspective as 'framing' instead of 'frames', as this term captures the dynamic process more appropriately (Dewulf et al., 2009).

Besides conceptualizing these two different theoretical perspectives, we also need to consider 'what is it that gets framed?' in interactional framing theory. Dewulf et al. (2009) identify three general categories: issues, identities and relationships, and interaction processes. In the current research, we define 'framing category strategy' as the user's choice to deploy issue frames, identity and relationship frames, and/or process frames. Accordingly, in this research we will not only focus on how users interactively construct the meaning of issues in comment threads of climate change blogs, but also on how users interactively construct the meaning of self, other and relationships, as well as the ongoing interaction process between them.

Moreover, a 'framing difference' emerges when issue frames, identity and relationship frames, or process frames of two different actors are incompatible. The first interactional move by actor A is called the Act. The reaction to the initial act by actor B is called the Interact. After a minimum of these two interactional steps, a difference in framing can emerge (Dewulf & Bouwen, 2012). For example, if actor A argues that 'Climate change is caused by humans' and actor B reacts to that statement by arguing 'That's not true, the climate has changed before', a difference in issue framing emerges about the causes of climate change. In the current research, each singular comment is understood as an interactional step.

How actors deal with differences in framing arises in the subsequent interaction between the two actors (Lems, Aarts, & Van Woerkum, 2013). Hence, the Double interact is introduced, which defines the reaction of actor A on the reaction of actor B to the initial action of actor A (Weick, 1979). Thus, if the analysis focuses on how differences in framing emerge, step one and two need to be minimally completed. But if the analysis focuses on how actors actually deal with differences in framing, this minimal sequence of three interactional steps needs to be completed with a double interact. All the interactional steps that follow after the first double interact are named double interacts as well (Dewulf & Bouwen, 2012).

On the basis of this concept of double interact, Dewulf & Bouwen (2012) identified five interaction strategies for 'doing differences' that explain how actors deal with differences in issue framing in real life conversations. They identified frame incorporation, accommoda-



tion, disconnection, polarization, and reconnection as the respective interaction strategies (see Table 13 for definitions of the strategies). In the current research, we will adopt this framework and use ‘framing interaction strategy’ to refer to the user’s choice to deploy one of these strategies. We will analyse how users deal with framing differences in climate change blog comments. Additionally, we will investigate whether at the end of an interaction sequence, framing differences are often left unresolved or whether the actors aligned their framings.

Lastly, interactional framing theory has been applied to different fields, mostly complex issue settings in which differences in issue framing are bound to emerge (Aarts & Woerkum, 2006; Dewulf & Bouwen, 2012). Yet, research that builds on this theory is relatively scarce, especially in climate change communication literature, as most researchers follow the cognitive perspective on framing. The current research will apply interactional framing theory, as we are interested in how polarization is enacted in climate change blog comments.

### Overview of theoretical focus

Table 13 presents an overview of the terms and their definitions that we use in this research (Dewulf & Bouwen, 2012; Dewulf et al., 2009). In sum, we will focus our analysis on the following three aspects:

1. How many *double interacts* are present in user threads of climate change blogs?
2. What kind of *framing category strategies* do users deploy when framing differences emerge and continue?
3. What kind of *framing interaction strategies* do users deploy when they deal with differences in framing?

## 6.3 Methods

This research applied discourse analysis to investigate framing in interactions (Dewulf & Bouwen, 2012; Lems et al., 2013). Our approach draws from a social constructionist approach in the tradition of discursive psychology and conversation analysis, in which the focus is on how the turn-by-turn sequences of interaction plays out in various types of reciprocal action (Sacks, Schegloff, & Jefferson, 1974). Our approach, however, does not utilize traditional conversation analysis. We apply interactional framing theory and draw from the sequential turn-by-turn focus associated with traditional conversation analysis. In the current research, we want to analyze what framing category and interaction strategies users deploy and what they achieve by deploying these strategies (Potter & Wetherell, 1987; Wood & Kroger, 2000).

Our approach was a) deductive because we rely on existing framing category strategies and framing interaction strategies; b) inductive because in the analysis we are open to finding new framing interaction strategies that emerge directly from the data; and c) ab-

TABLE 13 OVERVIEW OF TERMS AND DEFINITIONS USED IN THIS RESEARCH

<b>Framing</b> Dynamic enactment of frames in ongoing interactions.	<b>Double interact</b> The reaction of user A on the reaction of user B to the initial action of user A.	<b>Framing difference</b> The enactment of two frames that are incompatible with one another in ongoing interactions.
<b>Framing category strategy</b> <div> The user's choice to deploy issue frames, identity &amp; relationship frames, and/or process frames. </div> <div> <b>1. Issue frames</b>  Issue frames refer to the meanings attached to agenda items, events or problems in the relevant domain or context. </div> <div> <b>2. Identity &amp; Relationship frames</b>  Identity &amp; relationship frames refer to the meanings about oneself and one's relationships with a counterpart(s). </div> <div> <b>3. Process frames</b>  Process frames refer to the interpretations that disputants assign to their interaction process. </div>		
<b>Framing interaction strategy</b> <div> The user's choice to deploy frame incorporation, accommodation, disconnection, polarization, and/or reconnection as interaction strategy. </div> <div> <b>1. Frame incorporation</b>  Incorporating a downgraded reformulation of a challenging element into your own issue framing. </div> <div> <b>2. Frame accommodation</b>  Accommodating your own issue framing to the challenging issue element. </div> <div> <b>3. Frame disconnection</b>  Disconnecting the challenging element from the ongoing conversation as irrelevant, unimportant or the like. </div> <div> <b>4. Frame polarization</b>  Polarizing the difference by reaffirming your own issue framing or an upgraded version of your own issue framing. </div> <div> <b>5. Frame reconnection</b>  Reconnecting frames by taking both elements seriously and taking away the incompatibility between them. </div>		

ductive because we are open to discovering new dimensions of interactional framing theory for which there is no appropriate explanation or rule yet (Reichert, 2007). This integral approach addresses concerns of discourse analysis that it overemphasizes the inductive character of qualitative research, without dismissing its value (Dewulf & Bouwen, 2012).

### Data collection

Comment threads of the popular, award-winning climate change blogs *Watts Up With That* and *RealClimate* were selected (The weblog awards, 2011; 'Top five science blogs,' 2006). *Watts Up With That* is generally characterized as a blog that does not support the mainstream scientific position on climate change. The tagline of this blog is 'The world's most viewed site on global warming and climate change' ('Watts Up With That,' 2019). *RealClimate* is generally characterized as a blog that endorses the mainstream scientific position on climate change. The tagline of this blog is 'Climate science from climate scientists' (*RealClimate*, 2019). The comment threads of both blogs are moderated.

Both blogs played a significant role when emails were stolen from the server of the University of East Anglia. A hacker uploaded the emails on *RealClimate* (Schmidt, 2010). A blogger from *Watts Up With That* first broke the story. Soon after that, the event was dubbed 'climategate' in the blog's comment threads, a term that caught on in mainstream news stories (Nerlich, 2010; Norton, 2010). Sceptics suggested that these emails written by climate scientists were proof that climate change was just a conspiracy. *RealClimate* received a great deal of comments with questions and actively blogged to counter all the misinterpretations (Schmidt, 2010). The event generated considerable press attention and had a significant effect on public beliefs in climate change and trust in scientists (A. Leiserowitz et al., 2013).

The last five published blog posts on each blog that received more than 25 and less than 250 comments were selected since April 30, 2019. Thus, a total of ten blog posts with corresponding comments was collected on the 6th of May between 10:00am and 11:00am GMT+2. This timeframe was selected, because it was at that stage of the research the latest point in time and would therefore deliver a fresh dataset. Around the blog publication dates, there were no *critical discourse moments* marked by relevant events (e.g. COPs or IPCC report releases) (Carvalho & Burgess, 2005), which is reflected in the content of the selected blogs. The selected blogs of *RealClimate* were about the a) Nenana Ice Classic, b) a successful model simulation, c) writing about worst case scenarios, and d) and e) two open threads on climate science issues. The selected blogs of *Watts Up With That* were about a) the Climate Action Now Act, b) a study about climate change friendly air conditioners, c) analysis of new NASA AIRS study, d) climate change costs for businesses, and e) China building coal plants. In addition, only blog posts with 25-250 comments were selected, in order to ensure that the thread included double interacts, but prevent that the dataset was dominated by one single extensive user thread. The five selected blog posts of *Watts Up With That* received a total of 436 comments and the five selected blog posts of *RealClimate* received a total of 531 comments, i.e. the entire sample included 10 blog posts and 967 comments.

### Data analysis

First, per blog post, a corpus was created that contained all the different interaction sequences. Interaction sequences were demarcated by selecting a sequence of comments in which previous users were explicitly addressed. For example, the comment was published as a reply comment, or the previous comment number or the name of the previous user was explicitly mentioned. Each singular blog post was also considered as an interactional step.

Importantly, as we draw on interactional framing theory, we were primarily interested in how meaning is created in the interactions between users. For example, framing differences were identified on the basis of the users' construction of reality rather than the researchers' perception. Accordingly, earlier research focusing on real life conversations showed that differences in issue framing were signaled by disagreements, opposing questions, and signs of surprise or confusion (Dewulf & Bouwen, 2012). Hence, we focused on such signs, but were also open to identifying new signs of framing differences. Subsequently, only the interaction sequences that contained at least one double interact were selected.

The final dataset was analysed in ATLAS.ti (version 8.3.20). Separate codes were created for the three framing category strategies and five framing interaction strategies, i.e. a total of eight codes. Each interactional step in the interaction sequences was closely analysed by applying the appropriate codes. The unit of analysis was the entire comment and not individual sentences. Thus, all sentences were understood in context. Moreover, separate memos were created, in which potential new findings were noted down. Subsequently, the first author engaged in an iterative process of data analysis, in order to acquire a deeper understanding of the data. Special attention was given to understanding how framing category strategies, framing interaction strategies, and the (non)resolution of framing differences interacted with one another.

Intermediate rounds were organized with all authors to discuss theoretical and methodological challenges and ambiguous interaction sequences. Prior to these meetings, all authors coded the ambiguous interaction sequences independently, after which the dissimilarities were discussed. These rounds guaranteed that the codes were reliable and applied consistently. For example, during the analysis, we identified an issue with the application of the 'identity and relationship framing' code. It was unclear whether the code should only be applied when it concerned the users of the respective interaction sequence or also when it concerned external actors. After discussion, we decided to only apply the code when it concerned the users of the respective interaction sequence itself (i.e. actor A and B). Similarly, we decided that process frames could only be applied when it concerned the ongoing interaction of the users itself, instead of references to interactions that other users were having. This latter theoretical decision implied by definition that a 'process framing' code could never be applied in the Act. Users cannot refer to the interpretations that disputants assign to their interaction process when there is no interaction yet.

6.4 Results

The following section presents our findings on how many and what kind of double interacts we identified in the user threads of *RealClimate* and Watts Up With That. Subsequently, we discuss the framing category strategies that users deployed when framing differences emerged and continued. Lastly, we discuss our findings on the framing interaction strategies that users deployed when they dealt with differences in framing. The findings are accompanied with extracts of the interaction sequences, which were selected because they clearly illustrate the results.

Frequency of double interacts

The final dataset contained 30 interaction sequences. The sequences ranged in length from three to six interactional steps, except one long interaction sequence comprising 23 steps. Only six interaction sequences were identified in the sample of comments of Watts Up With That. In fact, they were all identified in the user thread of one blog post. The other 24 interaction sequences were identified in user threads of all five blog posts of *RealClimate*. More framing differences are apparent in the sample of comments of *RealClimate*. Thus, there is more deliberation on this blog, since users engage with more alternative viewpoints. Table 14 and 15 present an overview of the results of the entire analysis on the basis of the length of the interaction sequences and the frequencies of the various framing category strategies and framing interaction strategies per blog. Please see Supplemental Material IX for an overview of the entire analysis.

Framing category strategies

Section 'Emergence of framing differences' discusses how framing differences emerge. Subsequently, section 'Shifts in framing category strategies' presents how actors can also shift their framing category strategy during a framing difference.

Emergence of framing differences

All interaction sequences started with issue framing. In two instances, the sequence also started with identity framing. We find that the majority of framing differences (20/30) that emerge in the *interact* are differences in issue framing. The majority of these differences in issue framing concerns climate science analyses and results. Some differences also relate to good scientific conduct, effective action to address climate change, science communication, and the moderation policy of *RealClimate*. Extract 1 is an example of a part of an interaction sequence sourced from *RealClimate*. The example shows how a difference in issue framing emerges that concerns climate science analyses and results.

EXTRACT 1

ACT Paul Pukite (13 April, 2019): 'This Bloomberg piece shows that the Earth's orbit has a slight but noticeable impact on the mean global temperature over the last 100 years: [www.bloomberg.com/graphics/2015-whats-warming-the-world](http://www.bloomberg.com/graphics/2015-whats-warming-the-world) (...)'

INTERACT Gordon M (14 April, 2019): '(...) From the graphic, orbital forcing appears to be about as close to net zero as it could possibly be.'

In Extract 1, a difference in issue framing emerges that is signaled by disagreement. Paul Pukite argues that the Earth's orbit has a slight but noticeable impact on the mean global temperature over the last 100 years. Gordon M disagrees with Pukite by arguing that the orbital forcing appears to be about as close to net zero as it could be, meaning that it does not have an impact. Thus, Gordon M challenges Pukite's framing by drawing on a piece of scientific data, rather than explicitly or overtly challenging the original issue framing. In this way, the extract shows how a framing difference can emerge subtly and without direct and overt disagreement.

Shifts in framing category strategies

27 out of 30 interacts consisted of issue framing. However, in nine out of the 30 instances actor B responds in the interact also or exclusively with an identity and relationship or process framing (see Table 14 and 15). Thus, we find that framing differences can emerge and continue while actors shift their framing category strategy. This finding adds to earlier research, where it was found that framing differences emerge when frames are incompatible within a framing category. In fact, in 22 of the 30 interaction sequences actors shift their framing category strategy during the sequence. See Table 16 for an example of an interaction sequence that shows how actors continuously shift their framing category strategy. In only eight of the 30 interaction sequences the actors maintain their initial issue framing strategy for the entire sequence.

If actors introduce identity and relationship framing, they most frequently do so in two contexts. First, the actor attributes expertise or a lack of expertise to oneself or the other. Second, the actor accuses the other of being either a denialist or alarmist. In general, the actors attribute more frequently meaning to the other actor than oneself or their mutual relationship. Moreover, these meanings are mostly negative denotations. This finding helps to understand why in ten of the 15 instances identity and relationship framing was introduced at a certain point, the interaction sequence was in the end left unresolved. Extract 2 is an interaction sequence sourced from *RealClimate*. The extract shows how actors shift from issue to identity and relationship framing during a framing difference and consequently how the framing difference is left unresolved.

TABLE 14 FREQUENCY COUNTS OF FRAMING CATEGORY STRATEGIES AND FRAMING INTERACTION STRATEGIES FOR INTERACTION SEQUENCES SOURCED FROM *REALCLIMATE*.

SEQUENCE NUMBER	1	2	3	4	5	6	7	8	9	10
Length of interaction SEQ	6	3	3	3	23	4	3	3	3	3
Issue	6	3	3	3	18	4	1	3	3	1
Identity & Relationship	2	-	-	-	10	2	1	2	1	-
Process	4	-	-	-	13	2	2	2	-	2
Incorporation	-	1	-	-	3	1	1	-	-	-
Accommodation	-	-	1	-	3	-	-	-	-	-
Disconnection	-	-	-	-	1	1	-	-	-	1
Polarization	4	-	-	1	16	2	-	1	1	-
Reconnection	-	-	-	-	1	-	-	-	-	-

TABLE 15 FREQUENCY COUNTS OF FRAMING CATEGORY STRATEGIES AND FRAMING INTERACTION STRATEGIES FOR INTERACTION SEQUENCES SOURCED FROM *WATTS UP WITH THAT*.

SEQUENCE NUMBER	25	26	27	28	29	30	TOTAL
Length of interaction SEQ	4	4	4	4	4	3	23
Issue	4	4	4	4	4	3	23
Identity & Relationship	-	-	1	-	2	-	3
Process	-	1	1	1	-	-	3
Incorporation	1	1	-	1	-	-	3
Accommodation	1	-	1	-	-	-	2
Disconnection	-	-	-	-	-	1	1
Polarization	-	-	1	1	2	-	4
Reconnection	-	1	-	-	-	-	1

11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
3	3	3	3	3	3	3	3	4	3	3	5	3	5	101
3	3	1	3	2	3	3	3	2	3	3	4	3	2	83
2	1	2	1	-	-	1	-	-	-	2	2	-	4	33
-	-	-	-	1	-	1	1	2	-	-	2	-	1	33
-	-	-	1	-	-	1	1	-	-	1	-	-	-	10
-	-	1	-	-	-	-	-	1	-	1	-	-	-	7
-	-	-	-	1	-	-	-	1	-	-	-	-	-	5
1	1	-	-	-	1	-	-	-	1	-	3	-	3	35
-	-	-	-	-	-	-	-	-	-	-	-	1	-	2

TABLE 16 FRAMING CATEGORY STRATEGIES OF INTERACTION SEQUENCE #5.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	P	P	R	I	R	P
			P		R		R	R	R	R	P			R	R	P			P	R	P	

Note: I = Issue framing; R = Identity & Relationship framing; P = Process framing.

EXTRACT 2

- ACT

James Charles (13 March, 2019): 'The 'basis' of neoliberalism? 'This 'equilibrium' graph (Figure 3) and the ideas behind it have been reiterated so many times in the past half-century that many observes [sic] assume they represent one of the few firmly proven facts in economics. Not at all. There is no empirical evidence whatsoever that demand equals supply in any market and that, indeed, markets work in the way this story narrates. (...)'
- INTERACT

Bart Paul Levenson (17 March, 2019): 'This reminds me of the frequent denier claim that 'there is no empirical evidence whatsoever that carbon dioxide affects temperatures.' Just because you're not aware of the evidence doesn't mean there's no evidence. To prove an enormous negative like the one you just advanced you would have to scour the economics journals to see that no one ever surveyed a market or calculated an elasticity. Good luck with that.'
- DOUBLE INTERACT

James Charles (17 March, 2019): 'Comprehension is not one of your strengths?'
- DOUBLE INTERACT

Bart Paul Levenson (18 March, 2019): 'I'm just fine on comprehension. Just because I disagree with you doesn't mean I don't understand what you're saying. I understand just fine, I just think you're wrong.'

Bart Paul Levenson (19 March, 2019): 'Economics is not one of yours.'
- DOUBLE INTERACT

James Charles (20 March, 2019): 'Since I was quoting a professor of economics this comment may be correct or incorrect and shows your complete lack of comprehension. As I say, comprehension is [definitely] not one of your strengths?'

Extract 2 shows that a difference in framing emerges, which is signaled by disagreement. James Charles argues that there is no empirical evidence whatsoever that demand equals supply in any market. Bart Paul Levenson disagrees with Charles' framing and argues that he cannot make that claim. Levenson argues that not being aware of the evidence does not mean there is no evidence. Thus, a difference in issue framing emerges about whether there is empirical evidence for the claim that demand equals supply in any market.

Moreover, Levenson also introduces identity and relationship framing as a category strategy. He argues that James Charles' claim is a 'denier' claim. As a result, the framing difference continues and James Charles now also shifts from issue framing to identity framing by suggesting that comprehension is not one of the strengths of Bart Paul Levenson. Thus,

while the framing difference started with a difference in issue framing, both actors shifted their framing category strategy to identity and relationship framing.

The shift in framing did not resolve the framing difference, as subsequently, Bart Paul Levenson responds with identity and relationship framing by arguing that he is fine on comprehension and James Charles' strength is not economics. Moreover, Levenson also introduces process framing. He refers to the interaction of James Charles and him by arguing that Charles' interpretation of their interaction is not correct. Levenson discusses that the correct interpretation of their interaction is that he understands what James Charles is saying, yet does not agree with him. Lastly, James Charles responds again with identity and relationship framing, upgrading his previous statement that comprehension is 'definitely' not one of Bart Paul Levenson's strengths. Thus, while the sequence started with a difference in issue framing, Levenson and Charles get caught in a difference in identity and relationship and process framing. The fact that both users attribute a lack of expertise to the other and accuse the other of being a denialist renders the framing difference unresolved. More specifically, after four double interacts including identity and relationship framing the framing difference is left unresolved.

If actors introduce process framing, they most frequently do so in two contexts. First, the actor accuses the other actor of solely criticizing other actors. Second, the actor argues that their words are misunderstood by the other. These findings help to explain why process framing was introduced after identity and relationship framing in six of the 13 instances that we identified. More specifically, the interactional sequences in which process framing is deployed subsequently to identity and relationship framing allows the actors to redirect the interaction away from personal attacks, thereby avoiding further potentially uncivil discourse (also see for example Table 16). Extract 3 shows the first three interactional steps of a sequence of six steps sourced from *RealClimate*. It illustrates how actors shift from issue to identity and relationship to process framing during a framing difference.

EXTRACT 3

- ACT

Snape (21 April, 2019): 'Here's a thought regarding Arctic ice: Low extent is like setting an open pot of water out under a cold, clear night. A ton of energy escapes to space, nothing is gained. Different in summer, when an open pot lets the sun in, more than compensating for the extra loss.'

....

So, low extent may reduce global OHC [ocean heat content] in Winter, even though it most certainly increases it in Summer. (...)'
- INTERACT

Zebra (24 April, 2019): '(...) Here's how someone with a science/quantitative background might say things: Low extent in the Arctic increases radiation



to space. But, that fact by itself tells us nothing about whether global OHC increases or decreases during that time period, because there is radiation and absorption going on everywhere else, over a much, much larger surface area. (...)'

DOUBLE INTERACT    Snape (27 April, 2019): 'It tells us that if global OHC increased during that time period, it may have increased even more if not for low extent in the Arctic. It tells us that if global OHC decreased during that time period, a small part of the decrease may have been due to low extent in the Arctic. I'm well aware, Z, that if one stock in the Dow moves up, that movement may not be reflected in the index as a whole. It would be nice if you could read between the lines a little, rather than looking for something to criticize. (...)'

Extract 3 shows that a difference in framing emerges, which is signaled by disagreement. In the interact, zebra disqualifies Snape's issue framing that the link between low extent of Arctic ice increases radiation to space and increases or decreases ocean heat content. Thus, a difference in issue framing emerges about whether the link between low extent of Arctic ice increases radiation to space and increases or decreases ocean heat content. Zebra also introduces identity and relationship framing. He conveys that his own issue framing is how someone with a scientific/quantitative background might say things. Zebra herewith attempts to establish a 'scientist' identity, someone who has a background in science/quantitative research and should therefore be qualified to make accurate statements on the topic. Yet, Snape does not attend to this identity, but responds with issue framing again. He puts his initial argument about low extent in the Arctic back on the table. On top of that, he also introduces process framing, by arguing that zebra could read between the lines a little, rather than looking for something to criticize. In this way, Snape redirects the interaction away from personal attacks, thereby avoiding further potentially uncivil discourse.

Finally, in contrast with the *double interact* dataset of *RealClimate*, all interactional steps from the *double interact* dataset of *Watts Up With That* included issue framing. Only six of the 23 interactional steps included identity and relationship or process framing.

Interaction strategies to deal with framing differences

Our results show that users' framing interaction strategies for dealing with framing differences are consistent with the strategies that Dewulf & Bouwen (2012) identified in their research. In general, users deployed most frequently interaction strategies that left the framing differences unresolved (45 instances). In contrast, 25 instances were documented in which the incompatible framings were aligned. The first section discusses the interaction strategies that were deployed and did not resolve the framing differences. The following section presents our findings on the interaction strategies that were deployed to align the incompatible framings.

Unresolved framing differences

In 45 out of 70 instances users deployed frame polarization and disconnection. Overall, frame polarization was the most frequently deployed framing interaction strategy (39 out of 70 instances).

In 23 out of 39 instances, climate science analyses and results were topic of discussion when users deployed frame polarization to reaffirm or upgrade their own issue framing. Yet, frame polarization was also frequently deployed in combination with identity and relationship and/or process framing. Accordingly, like these framing category strategies, frame polarization was mostly deployed in a context in which users attribute a lack of expertise to the other user, accuse the other of being either a denialist or alarmist, or blame the other user of solely criticizing others. Moreover, in all sequences in which frame polarization was introduced at a certain point, the last interactional step also included frame polarization. The double interacts of Extract 2 and 3 are illustrative examples of interaction sequences in which frame polarization was the deployed framing interaction strategy. Extract 4 shows an interaction sequence sourced from *RealClimate* that illustrates how an actor deploys frame polarization as his framing interaction strategy.

EXTRACT 4

ACT                    Killian (23 April, 2019): 'A better article than most on rapid climate change. (...) [hyperlink]'

INTERACT           MA Rodger (26 April 2019): '(...) Let us look at your 'better article than most on rapid climate change,' (...)

                         The 'scientists' quoted are but five in number bit [sic] with quite different messages. (...)

                         So I see this as an interesting collection but nothing which could be called alarming that sits well within the scence [sic]. Or am I missing something?

DOUBLE INTERACT    Killian (29 April, 2019): '(...) GreatAtNumbers BadAtAnalysis said **But it's not supported by data that's 3 or more years old!!!!**

                         Really, MA, stay out of analysis. That you think the IPCC reports, excepting the recent special on 1.5C, should be used as anything more than a backstop for current discussions of climate is exactly why you are always, always, always wrong in any forward-looking conversation.

                         (...)

                         Basically, you're really knowledgeable on the pure science side of climate,



really poor at analysis, but even your numbers strength goes to hell when you're trying to take someone down rather than doing objective analysis.

That is, your joy in taking people down, your allergy to being wrong, and others being right – or at least insightful – diminish the only value you have here.'

Extract 4 shows that a difference in framing emerges, which is signaled by disagreement. MA Rodger disqualifies Killian's issue framing that his article is a 'better article than most on rapid climate change'. Rodger argues that the article's findings could not be named alarming that sits well within science. Thus, a difference in issue framing emerges about whether the article shows that the climate is rapidly changing based on scientific facts. Consequently, Killian responds with issue framing to Rodger's issue framing. He disqualifies Rodger's framing that the article's findings are not sitting well within science by arguing that the IPCC reports serve as more than a backstop for current discussions of climate. Moreover, Killian also introduces identity and relationship framing, by (a) referring to Rodger as 'GreatAtNumbersBadAtAnalysis', (b) attributing a lack of expertise to Rodger by discussing how he is poor at analysis, and (c) portraying Rodger as someone who enjoys taking people down, is allergic to being wrong, and lastly does not have any value in user threads of *RealClimate*. Thus, Killian polarizes the initial framing difference between him and Rodger by upgrading his own issue framing about the article. Additionally, Killian also further polarizes the difference by introducing identity and relationship framing that attributes negative denotations to Rodger. Consequently, the framing difference is left unresolved.

In four of the six instances that frame disconnection was deployed as the framing interaction strategy, the user also deployed process framing as framing category strategy. Accordingly, like process framing, frame disconnection was mostly deployed in a context in which users argue that oneself did not mean or say that in their previous ongoing interaction.

Frame alignments

The framing interaction strategies incorporation, accommodation, and reconnection were deployed to align the different framings. Overall, frame incorporation was the most frequent deployed strategy to align framing differences (13 instances), followed by frame accommodation (9 instances), and lastly frame reconnection (3 instances).

In nine of the 13 instances in which users deployed frame incorporation, climate science analyses and results were topic of discussion. Similarly, in five out of nine instances in which users deployed frame accommodation, climate science analyses and results were topic of discussion. In line with this finding, in 12 of the 13 instances that frame incorporation was deployed and six of the nine instances that frame accommodation was deployed,

these framings were accompanied by issue framing. Moreover, in eight of the 13 instances that frame incorporation was deployed and five of the nine instances that frame accommodation was deployed, the interaction sequence ended with a resolved framing difference. Extract 5 provides an example of an interaction sequence sourced from Watts Up With That. The example illustrates how user A deploys frame incorporation and how user B subsequently deploys frame accommodation.

EXTRACT 5

ACT	Goldminor (April 30, 2019): 'What I have always thought about this phenomenon is that the oceans are the reason for the night time warming. Surface winds carry the warmed air over land in the form of water vapor. In the day-time that leads to a slight cooling, while at night it means warmer temps. I think the current offshore surface winds are an example of how this works.  Note how there are no clouds offshore until way down by Los Angeles area. The surface winds then turn eastward and clouds immediately form, and then move east across the US. I have been watching this for the last 5 days. Prior to that the surface winds flowed south to around Monterey approximately, before turning to the west. Clouds then formed and were driven back up the middle of the Pacific towards Alaska and the Aleutian islands. Thus the warmer Alaska which alarmists like to make a big deal over. That has also meant warmer air flowing in to the west side of the Arctic which has led to reduced sea ice extent mainly in the Bering Sea. Thus the alarmists crowing over sea ice loss. I would like to hear their explanation how CO2 can drive surface winds. (...)'
INTERACT	Mario Lento (April 30, 2019): 'We are talking about a warming trend. Given that the data shows a warming (nighttime) trend, that implies (not proves) something is changing that is causing that. One thing that we know is changing (increasing) is urban development. This factor cannot be ignored... (...)'
DOUBLE INTERACT	Goldminor (April 30, 2019): 'And so my comment that warmer oceans is what leads to warmer temps at night for rural areas such as where I live. There is no UHI [urban heat island] up here.  I agree that UHI around urban areas is a strong effect. (...)'
DOUBLE INTERACT	Mario Lento (April 30, 2019): '(...) I did miss that you have no U affect in your area. Your information is terrific! Wow... there seems to be a real trend that you have felt because you are tuned to it. (...)'

Extract 5 shows that a difference in issue framing emerges, which is signaled by disagreement. Mario Lento points out that goldminor should not forget about urban development as a factor that causes the nighttime warming trend that provides an explanation for sea ice loss in the Arctic. Thus, a difference in issue framing emerges about whether warmer oceans could lead to warmer temperatures at Alaska. Subsequently, goldminor deploys issue framing and frame incorporation. Goldminor agrees that the urban heat island effect around urban areas has a strong effect on nighttime warming trends and uses this challenging issue framing to reaffirm the framing that warmer oceans lead to nighttime warming trends in rural areas. Goldminor argues that there is no urban heat island effect in the rural area where goldminor is living. As a result, Mario Lento deploys frame accommodation, by accommodating his own issue framing about urban heat island effect as a factor to the challenging issue element of goldminor, in which urban heat island effect does not play a role. Thus, Mario Lento and goldminor resolved the framing difference through clarifying the facts without the need to resort to personal attacks.

Users rarely reconnected frames by taking both elements seriously and taking away the incompatibility between them. The three instances in which users deployed this framing interaction strategy varied in terms of framing category strategy and context. Two times frame reconnection was deployed accompanied by issue framing and one time accompanied by process framing.

Finally, no remarkable differences were identified in both *double interact* datasets when comparing the framing interaction strategies of users at *RealClimate* or *Watts Up With That*.

## 6.5 Discussion and Conclusion

The purpose of this research was to provide insight into whether and how people use polarizing interaction strategies when framing differences emerge. This paper focused on climate change blog comments. Overall, most users deployed issue framing as their framing category strategy, which as expected frequently concerned climate science analyses and results. We find that users can shift their framing category strategy while the framing difference continues. This result provides a novel perspective on interactional framing theory.

Frame polarization was the most common interaction strategy of users. Thus, most framing differences were further polarized as users reaffirmed or even upgraded their own framing. This finding adds to our understanding of polarization in the climate change blogosphere (Brüggeman et al., 2020; Elgesem, 2019; Elgesem et al., 2015; Van Eck et al., 2019). The risk of frame polarization is that users keep reinforcing their own framing and are therefore unable to resolve framing differences (Dewulf & Bouwen, 2012). Indeed, in all interaction sequences in which frame polarization was introduced, the interaction sequence also ended with frame polarization. Overall, our results demonstrate that meaning about climate change is co-constructed in interactions. This result is critical for future

climate change communications, as groups with opposing views might only drift further apart. Therefore, we suggest that scholars and practitioners should widen their scope on *frames* by developing and testing *framing* guidelines that seek to foster collective action on climate change (for examples, see Webster and Marshall, 2019).

Frame polarization was frequently deployed in combination with identity and relationship and/or process framing. When users shifted to identity and relationship framing, they predominantly attributed a negative denotation to the other's identity. In addition, when users shifted to process framing, they frequently assigned interpretations to their ongoing interaction that the other user was solely criticizing others or that their own words were misunderstood. Thus, these findings suggest that if users deploy these types of identity and relationship and process framings, they are more likely to further polarize the framing difference. In line with this finding, frame incorporation and frame accommodation were mostly deployed in combination with issue framing. This finding suggests that if users maintain issue framing throughout the entire interaction sequence, they are more likely to solve the framing difference. These two suggestions provide a starting point for developing effective framing guidelines.

A possible explanation for why users decide to use polarizing interaction strategies could be that users try to protect their cultural identity (Kahan et al., 2007), as the other users' framing challenges their cultures' posture on climate change (McCright & Dunlap, 2011a). This hypothesis would also explain why our results deviate from Collins and Nerlich's (2015) finding that user comments in the Guardian demonstrate incivility, but mostly show potential for deliberation. In contrast, our research shows that interaction sequences with well-reasoned argumentation and deliberation (issue framing) often engendered uncivil conversations (negative identity and relationship framing). Since audiences in the climate change blogosphere are known to be highly engaged (Lewandowsky, Oberauer, et al., 2013), critical comments could potentially form more easily a threat to climate change blog users' cultural identity, resulting in dismissal of conflicting frames (Kahan et al., 2007; McCright & Dunlap, 2011a).

Substantially more double interacts were identified in the user comments of *RealClimate* than *Watts Up With That*. This finding suggests that there is more deliberation in user threads of *RealClimate* as users engage with more alternative viewpoints (Collins & Nerlich, 2015). In contrast, *Watts Up With That* functions more as an echo-chamber, as users tend to agree with comments of previous users. We need to be cautious with comparing both datasets in terms of the deployed framing strategies, as the *RealClimate* dataset included more double interacts. Yet, the fact that users of *Watts Up With That* always deployed issue framing and were less inclined to use identity and process framing with negative denotations supports our argument; *Watts Up With That* functions more as an echo-chamber in which users feel safe and perceive comments less as a threat to their cultural identities. Overall, these observations are consistent with literature that on one hand user comments offer potential for deliberation and mobilization around climate change (Collins & Ner-

lich, 2015; Cooper et al., 2012; Graham & Wright, 2015; Uldam & Askanius, 2007), while also pointing to concerns about echo-chamber effects creating niches of denial and demonstrations of incivility (Collins & Nerlich, 2015; Walter et al., 2018).

For the first time, the interaction strategy framework of Dewulf & Bouwen (2012) was successfully applied to analyse identity and relationship and process framing differences, besides differences in issue framing. The interaction strategies of the current research were consistent with their framework and we did not identify any additional strategies. Also for the first time, interactional framing theory was successfully applied to the online realm. However, sometimes it proved difficult to correctly identify sarcastic intent with the absence of intonation and non-verbal cues. Moreover, moderation policies and anonymity of users most likely affected the results (e.g. presence of uncivility), which are in this research not accounted for. Hence, conducting interactive framing analyses on other online and offline media platforms to understand processes of climate change polarization is a critical future research direction. Another interesting future research direction would be analyzing whether framing interaction strategies are user-dependent (personal communication strategies) instead of, or, in addition to context-dependent, as this analysis revealed clues that this might be the case. Lastly, we recommend conducting a sequential analysis to examine patterns in the framing category and interaction strategies in more detail.

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## CHAPTER 7

# EMOTIONAL LANGUAGE IN THE CLIMATE CHANGE BLOGO- AND TWITTERSPHERE

## ABSTRACT

Over the last couple of years, online conversations about climate change seem to have shifted from the blogosphere to the Twittersphere. However, it is unknown how this shift has affected climate change communication. The current research set out to investigate the differences in emotional language in the English- language climate change blogo- and Twittersphere. We compared a dataset of climate change blog posts with a dataset of climate change tweets on the basis of several emotion categories of Empath. The results showed that more emotional language is used in the climate change Twittersphere than in the blogosphere. Moreover, the results showed that negative emotional language is more prevalent than positive emotional language in both the blogo- and Twittersphere. Last, the emotions sadness and fear are most frequently identified in both discourses. Future research and practical recommendations are provided.

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## 7.1 Introduction

Over the last two decades, blogs played a prominent role in the global climate discussion, influencing scientific, political, media, and public discourse (Edwards et al., 2011; H. Farrell & Drezner, 2007; Lewandowsky, Oberauer, et al., 2013; Nerlich, 2010). Especially since the 'climategate' episode in 2009, when blogs were leading the discussion about the hacked emails that, according to climate sceptics, suggested that climate change was a hoax (Nerlich, 2010; Schmidt, 2010). This event significantly influenced public trust and opinion (Leiserowitz et al., 2012).

However, over the last couple of years, online conversations about climate change seem to have shifted from the blogosphere to the Twittersphere. Many blogs have ceased to exist or do not publish blog posts as frequently as they used to do. Schmidt (2019, n.p.), blogger of the climate science blog *RealClimate*, discusses: 'The social media landscape has changed beyond recognition but yet the fever swamps of dueling blogs and comment threads has just been replaced by troll farms and noise-generating disinformation machines on Facebook and Twitter.' While the blogosphere has gained less traction, the Twittersphere has a 'global reach and growing number of users and posts', which makes the platform 'too important to ignore' (Veltri & Atanasova, 2017, p.724).

Yet, to date, it is unknown how this shift from the blogosphere to the Twittersphere affects discussions about climate change. Recent research discusses how platforms each have their own distinct technological features and communication practices (W. Pearce, Niederer, Özkula, & Sánchez Querubin, 2019; Yarchi et al., 2020). Consequently, each platform for example facilitates different polarization dynamics (Yarchi et al., 2020). Therefore, more research is needed that investigates how different platform cultures shape climate change communication (W. Pearce et al., 2019).

While the blogo- and Twittersphere both publish posts in reverse chronological order, both platforms differ significantly. First of all, blog posts are generally characterized as long-form content, typically between 300-600 words. In contrast, tweets are characterized as short-form content, currently limited to 280 characters. Second, the style of writing is different. Bloggers' tone is generally characterized as opinionated and considerate, while Twitter was designed as a platform to update users' friends about their day-to-day activities. Third, bloggers can moderate user comments themselves, whereas users cannot control the interactions on Twitter. Lastly, blogs are updated at the discretion of the blogger, while Twitter updates tweets minute-by-minute (Shah, n.d.).

In the current research, we will compare emotional language on these blogging and micro-blogging platforms. Academic scholarship on climate change communication is increasingly pointing to the important role of affect and emotions in shaping climate change risk perceptions (see e.g. Gustafson et al., 2020; Leiserowitz, 2006; Salama & Aboukou-

ra, 2018; Van der Linden, 2015; Xie, Brewer, Hayes, McDonald, & Newell, 2019). Van Eck, Mulder, & Van Der Linden, (2020) showed that affect is the most influential predictor of variances in blog audience members' climate change risk perceptions. In addition, Veltri & Atanasova, (2017) showed that climate change tweets that arouse emotions are more likely to be shared. Thus, overall, if one platform elicits more emotional language than the other platform, this might have far-reaching effects on how individuals engage with the issue and shape their climate change risk perceptions. Therefore, the main research question of the current research is: 'What are the differences in emotional language in the English-language climate change blogosphere and climate change Twittersphere?'

## 7.2 Theory, Research Questions, and Hypotheses

Ideally, emotional content elicits affective or emotional responses that foster climate change engagement (Bilandzic, Kalch, & Soentgen, 2017). However, Chapman et al. (2017, p.850) explain that scientists and practitioners should not view emotions as a magic bullet that guarantees climate change engagement, as for example much is unknown about the effects of emotions over time. Instead, they explain that emotions should be viewed as 'one integral component of a cognitive feedback system guiding response to challenging decision-making problems.'

It is important to distinguish between 'affect' and 'emotions'. Smith & Leiserowitz (2014) explain that affect refers to general positive or negative feelings, whereas emotions refer to distinct emotions, which are intense and short-lived, more complex, and less subtle. In the current research, bloggers' and Twitter users' affective and emotional responses potentially influence how they write a blog post or tweet. Moreover, since affect is a strong predictor of how individuals shape their climate change risk perceptions (Van der Linden, 2015b; Van Eck, Mulder, & Van der Linden, 2020; Xie et al., 2019), tweets and blog posts with affective language will likely elicit stronger affective responses amongst its readers than the messages without.

Van der Linden (2014, p.430) discusses how 'an *affective* response is usually defined as a fast, associative, and automatic reaction that guides information processing and judgment.' Blog posts are considerate long-reads that usually require multiple hours to write, partly because climate change bloggers are cautious about making errors (Van Eck et al., 2019). In contrast, tweets are short-form content, which usually allows Twitter users to write a tweet relatively fast. Thus, it is more likely that Twitter users rely more heavily on fast, associative and automatic reactions when they publish tweets in comparison to bloggers. Accordingly, we posit that it is more likely that tweets are emotional than blog posts. Hence, we have formulated the following hypothesis:

***H1: In the climate change Twittersphere more frequently emotional language is used than in the climate change blogosphere.***

Generally, both positive and negative emotions can play an important role in people's responses to climate change. Positive emotions can motivate people to engage with climate change, whereas negative emotions can motivate people to be on 'high-alert' (Salama & Aboukoura, 2018). Negative affective evaluations of climate change predict higher climate change risk perceptions (Anthony Leiserowitz, 2006; Smith & Leiserowitz, 2014; Van der Linden, 2015b; Van Eck, Mulder, & Van der Linden, 2020; Xie et al., 2019). However, it is important to couple content that elicits negative emotions with pragmatic solutions on how climate change can be addressed, if one wants to promote climate change engagement (Moser & Dilling, 2011).

Little research is conducted that analyzes affective language in the blogosphere. More research is available that analyzes affective language in the Twittersphere, by distinguishing between positive and negative emotions. Veltri & Atanasova's (2015) sentiment analysis of climate change tweets revealed that most tweets were categorized as neutral, followed by an equal number of negative and positive tweets. Walter, Lörcher, & Brüggemann (2019) found that the language of scientists in tweets is predominantly neutral. In addition, tweets in the news segment are more likely to go viral if they contain negative emotional content (Hansen, Arvidsson, Nielsen, Colleoni, & Etter, 2011). Further, Tyagi, Uyheng, & Carley (2020) provided evidence for affective polarization in climate change Twitter discourse between 'disbelievers' and 'believers'. They showed that disbelievers expressed more hostility towards believers. Thus, based on previous literature, we posit that the chances are greater that tweets contain negative emotional language instead of positive emotional language. Therefore, we have formulated the following two hypotheses:

***H2a: Negative emotional language is used more frequently than positive emotional language, both in the blogosphere and Twittersphere.***

***H2b: The ratio of negative to positive emotional language is higher in the Twittersphere than in the blogosphere.***

More specifically and beyond categorizing emotions as either 'positive' or 'negative', it is useful to investigate which distinct emotions are prevalent in the language in climate change blog posts and tweets. As for example, previous research showed that fear is generally ineffective in fostering climate change engagement, as individuals likely feel overwhelmed and distance themselves from the issue (Moser & Dilling, 2011; O'Neill & Nicholson-Cole, 2009). Further, Chu and Yang (2019) showed that anger, anxiety, and hope had a stronger impact on climate mitigation action and policy support than fear, guilt,



and shame. However, there is still little experimental evidence available to make broad, definitive claims about the role of emotions in climate change engagement (Chapman et al., 2017).

Virtually no research is conducted that focuses on distinct emotions in the language of blog posts. More research is, however, available that analyzes distinct emotions in the language of tweets. Pathak, Henry, & Volkova (2016) showed that emotional variations in climate change tweets around COP21 are dependent on non-personal versus personal accounts and the climate change topic. Further, Cody, Reagan, Mitchell, Dodds, & Danforth, (2015) showed with a sentiment analysis that sentiment is dependent on specific words. For example, they showed that natural disasters can decrease happiness, while climate rallies can increase happiness. Veltri & Atanasova's (2015) sentiment analysis of climate change tweets showed that anger was the most frequent identified emotion. Overall, especially in the blogosphere, much is still unknown about which distinct emotions are prevalent in online content. However, such research provides insight into current online climate change communication practices. Therefore, we pose the following research sub-question:

*Which emotions are especially prevalent in the language of climate change blog posts and tweets?*

## 7.3 Methods

We preregistered our research on AsPredicted (#49441).

### Data collection

The goal was to collect a tweet and blog post dataset that would be highly equivalent. We used the open access 'Climate Change Tweets Ids' dataset of Littman & Wrubel (2019), containing 39.63 million tweet IDs collected using the POST statuses/filter method of the Twitter Stream API, using the track parameter with the following keywords: '#climatechange', '#climatechangeisreal', '#actonclimate', '#globalwarming', '#climatechangehoax', '#climatedeniers', '#climatechangeisfalse', '#globalwarminghoax', '#climatechangenotreal', 'climate change', 'global warming', 'climate hoax'. The tweets were published between 21 September 2017 and 17 May 2019.

Based on the tweet IDs, we retrieved the content of the tweets from the Twitter API (v1) in a Python script. While retrieving the tweets, we filtered out retweets, resulting in a dataset of 8,192,222 tweets. However, there was a gap in data between 7 January 2019 and 17 April 2019. Therefore, we decided only to include the tweets that were published between 1 October 2017 and 30 September 2018, as this timeframe comprised exactly one year of tweets.

After the tweet dataset was collected, we aimed to collect a similar blog post dataset. First, 172 climate change blogs were identified on the basis of expert knowledge and snowball sampling. Then, blogs were selected that met the following preregistered criteria: 1) The blog needs to have a blog section, i.e. dated entries in reverse chronological order; 2) The blog needs to have published at least five blog posts between 1 October 2017-30 September 2018; 3) The blog needs to be hosted on Wordpress or Blogger (formerly Blogspot), as the large majority of climate change blogs is hosted on one of these platforms (Elgesem et al., 2015); 4) The blog's language is English; and lastly 5) 75% of the content of the blog needs to be concerned with climate change. Subsequently, of the 70 blogs that were selected, all blog posts that were published between 1 October 2017 and 30 September 2018 were collected from the Wordpress API using a script in Python. Unfortunately, the Blogger API was not working properly and some of the Wordpress blogs communicated a '404 error' and '406 error'. After data collection, blog posts were selected that contained at least one of the following preregistered keywords (based on tweet dataset keywords): 'climate change', 'global warming', 'climate hoax', 'climate denier', and 'act on climate', to make the dataset comparable with the tweets dataset. Finally, the final blog post dataset contained 2633 blog posts of 18 blogs. Please see Supplemental Material X for an overview of the final selection of blogs.

### Data analysis

First, we cleaned both datasets with pre-processing scripts in Python. The @usernames and URLs were removed from the tweets, after which all non-alphabetic characters were removed. For the blog posts, plain text was extracted from the HTML code using the BeautifulSoup package in Python, after which we applied the same cleaning process we used for the tweets.

Subsequently, the complete dataset was analyzed with the Empath package 0.89 in Python. Empath is a tool that can generate and validate new lexical categories. These categories can be used to analyze text. The developers of Empath explain it as follows: 'Empath learns word embeddings from 1.8 billion words of fiction, makes a vector space from these embeddings that measures the similarity between words, uses seed terms to define and discover new words for each of its categories, and finally filters its categories using crowds' (Fast, Chen, & Bernstein, 2016, p.11). In the current research, we used pre-validated emotional categories. More specifically, we tested hypothesis 1 by combining the 'Negative\_emotion' and 'Positive\_emotion' categories. We also used these categories for hypothesis 2a and 2b, however, not combined but separately. Lastly, on the basis of Ekman's (1992) 'basic emotions', we investigated sub-question 1 with the Empath categories 'anger', 'fear', 'sadness', 'joy', 'disgust', and 'surprise'. The Empath analysis provided us with scores for each category. These scores indicated how many times a category was counted in the text.

As Empath scores are normalized on the basis of word counts, it is important that both datasets include an approximately equivalent amount of words. On average, the blog

posts contained 954 words and tweets 15 words. Since the blog post dataset included 2633 blog posts, we needed to include approximately 167,000 tweets to have two datasets with a similar amount of words ((2633\*954)/15). In order to make sure that this subset of 167,000 tweets is representative of the full sample of  $N = 8,192,222$ , we drew five random samples of 167,000 tweets from the full dataset. Subsequently, we conducted a series of one-way Welch's ANOVAs with the five randomly sampled Twitter datasets as the grouping variable and each relevant Empath category as dependent variables. The results showed that there are no significant differences between the five random samples for all outcome variables of interest (all  $p$  values  $> 0.220$ , see Supplemental Material XI Table SX), indicating that our Twitter sample of  $n = 167,000$  is representative of the full dataset.

On the basis of the Empath scores, hypothesis 1 was tested by running an independent samples Welch's t-test between the Twitter- and blog post dataset for the combination of 'Negative\_emotion' and 'Positive\_emotion' categories. Hypothesis 2 was tested by running a Wilcoxon signed-rank test on the Empath categories 'Positive\_emotion' and 'Negative\_emotion' for both datasets. Further, sub-question 1 was tested by running a one-way ANOVA on the 6 basic emotion categories in Empath. In addition, we conducted several exploratory analyses, e.g. by distinguishing between climate sceptical and climate mainstream blogs (see Supplemental Material X for how we categorized each blog). All of the analyses were conducted in RStudio (version 1.2.5019) and Jamovi (version 1.6.6).

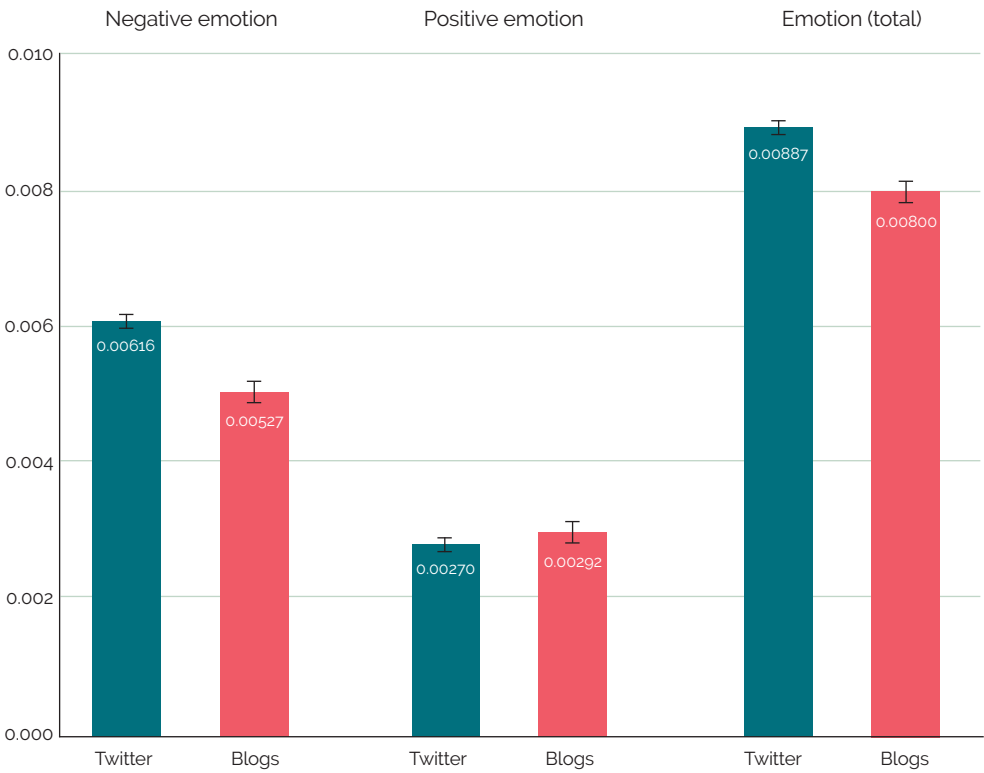
## 7.4 Results

The results of the between-groups Welch's  $t$ -tests and supplementary Mann-Whitney U-tests for the Positive\_emotion, Negative\_emotion and Emotion\_total categories are visualized in Figure 6 (see Supplemental Material XII for a table overview).

Figure 6 shows that emotional language (defined as the sum of the 'Positive\_emotion' and 'Negative\_emotion' categories) is used significantly more in the Twitter dataset than in the blog dataset ( $p < 0.001$ ,  $d = 0.042$ ). These results support hypothesis H1. In addition, language related to negative emotions is also used more on Twitter than in blogs ( $p < 0.001$ ,  $d = -0.054$ ), whereas positive emotions-related language is used marginally more on blogs ( $p = 0.037$ ,  $d = 0.02$ ).

The results of the Wilcoxon signed-rank tests for the 'Negative\_emotion' and 'Positive\_emotion' Empath categories are shown in Table 17. Table 17 shows that both on Twitter and blogs, language related to negative emotions is used significantly more than language related to positive emotions, in support of hypothesis H2a. To test hypothesis H2b, we conducted a Welch's  $t$ -test on the ratio of negative to positive language use (Empath scores for 'Negative\_emotion' minus scores for 'Positive\_emotion'), with dataset (Twitter-blog) as the independent variable. The results show that the ratio of negative to positive language use is significantly higher in the Twitter dataset than the blog dataset ( $M_{twitter} = 0.00346$  vs

FIGURE 6 BAR GRAPHS FOR THE NEGATIVE\_EMOTION, POSITIVE\_EMOTION AND EMOTION\_TOTAL EMPATH CATEGORIES, BY DATASET



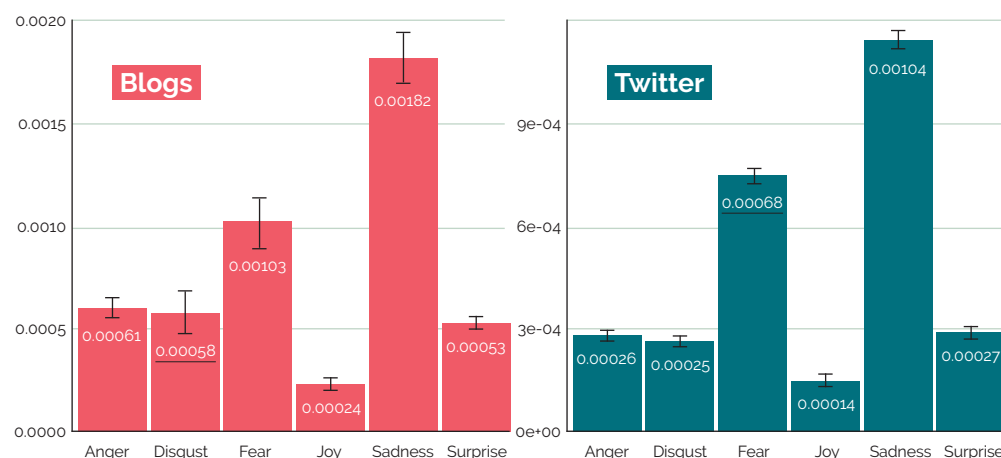
Note: Y axis shows normalised Empath scores. Error bars represent the standard error.

TABLE 17 WILCOXON SIGNED-RANK TESTS FOR NEGATIVE\_EMOTION VS POSITIVE\_EMOTION, BY DATASET

DATASET	Z	p	M <sub>diff</sub>	95%CI	EFFECT SIZE
Twitter	1.32E+08	<.001	0.0456	[0.0451, 0.0465]	0.466
Blogs	1.46E+06	<.001	0.00258	[0.00236, 0.00282]	0.516

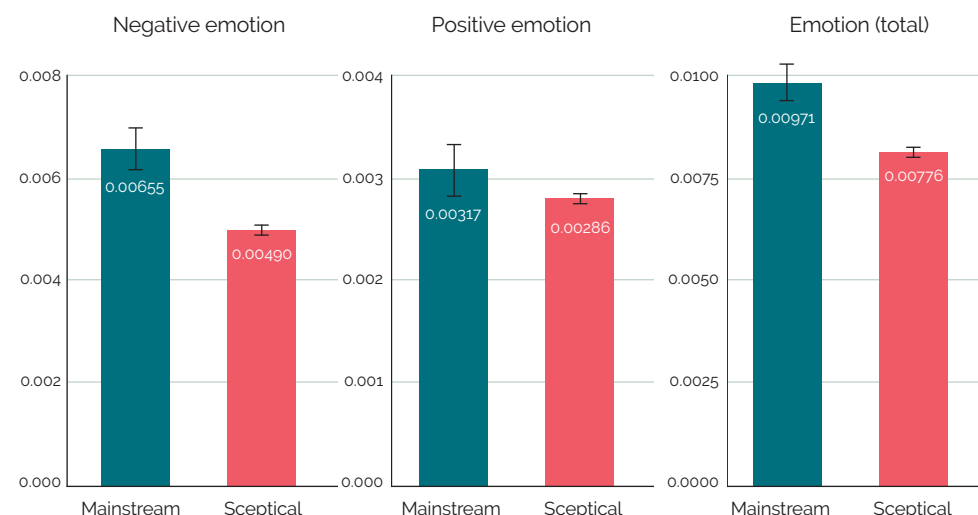
Note: 148051 pair(s) of values were tied for the Twitter dataset. 610 pair(s) of values were tied for the blog dataset. Effect size is displayed as rank biserial correlation.

**FIGURE 7 BAR GRAPHS FOR ANGER, DISGUST, FEAR, JOY, SADNESS, AND SURPRISE EMPATH CATEGORIES, SEPARATED BY DATASET**



Note: Y axis shows normalized Empath scores. Error bars represent standard error.

**FIGURE 8 BAR GRAPHS FOR THE NEGATIVE\_EMOTION, POSITIVE\_EMOTION AND EMOTION\_TOTAL EMPATH CATEGORIES, FOR MAINSTREAM AND SCEPTICAL BLOGS**



Note: Y axis shows normalized Empath scores. Error bars represent the standard error.

$M_{blog} = 0.00229$ ,  $M_{diff} = -0.00116$ ,  $t(2,3331) = -6.30$ ,  $p < 0.001$ ,  $d = -0.062$ ). These results support hypothesis H2b.

To answer sub-question SQ1, we conducted a series of Wilcoxon signed-rank tests between the anger, disgust, surprise, joy, and fear Empath categories, separately for the blog- and Twitter dataset. The results are visualized in Figure 7 (see Supplemental Material XIII and XIV for table overviews).

Figure 7 shows that in blog posts, of the six basic emotions, language related to sadness is used the most, before fear, disgust, anger, surprise, and joy. All differences are significant, except between anger and surprise ( $p = 0.156$ ). On Twitter, language related to sadness is used the most, before fear, surprise, disgust, anger, and joy. All differences are significant, except between anger and surprise ( $p = 0.520$ ), and disgust and surprise ( $p = 0.353$ ).

Finally, for our exploratory analysis of language use in climate mainstream versus climate sceptical blogs, we again conducted Welch's t-tests along with Mann-Whitney U-tests with the blog's position (mainstream or sceptical) as the independent variable and the 'Negative\_emotion', 'Positive\_emotion' and 'Emotion\_total' categories as dependent variables. The results are visualized in Figure 8 (see Supplemental Material XV for a table overviews).

Figure 8 shows that both emotional language in general ( $p = 0.004$ ,  $d = 0.17$ ) and language related to negative emotion ( $p = 0.002$ ,  $d = 0.17$ ) are used more in climate mainstream blogs than in climate sceptical blogs. For language related to positive emotion, a Welch's t-test showed no significant between-group differences ( $p = 0.416$ ); however, these results are somewhat ambiguous, as the Mann-Whitney U-test is significant ( $p < 0.001$ ) in that mainstream blogs appear to use language related to positive emotions marginally more than sceptical blogs.

## 7.5 Discussion

Over the last couple of years, online conversations about climate change seem to have shifted from the blogosphere to the Twittersphere. Academic scholarship increasingly discusses the importance of recognizing that platform cultures shape climate change communication (W. Pearce et al., 2019). In addition, academic scholarship is increasingly pointing to the important role of affect and emotions in shaping climate change risk perceptions (see e.g. Gustafson et al., 2020; Leiserowitz, 2006; Salama & Aboukoura, 2018; Van der Linden, 2015; Xie, Brewer, Hayes, McDonald, & Newell, 2019). Therefore, the current research set out to investigate the differences in emotional language in the English-language climate change blogo- and Twittersphere.

Our results support our first hypothesis, which means that emotional language is used significantly more in the climate change Twittersphere than in the climate change blogosphere. Thus, the technological features and communication practices of Twitter currently elicit more emotional language in comparison to blogs. This finding is congruent with current academic scholarship that discusses how different platform cultures shape different climate change communication (W. Pearce et al., 2019). In other words, this finding sheds light on how actors' shift from the blogosphere to the Twittersphere affects climate change communication. Individuals likely engage with climate change and shape their climate change risk perceptions more strongly on Twitter than on blogs, due to the presence of more emotional language (see e.g. Gustafson et al., 2020; Leiserowitz, 2006; Salama & Aboukoura, 2018; Van der Linden, 2015; Xie, Brewer, Hayes, McDonald, & Newell, 2019). Therefore, these results suggest that the Twittersphere is potentially more suitable for effective climate change communication than the blogosphere. However, more research is needed to investigate this claim.

The results of the current research also support our other hypotheses (H2a and H2b), which means that negative emotional language is used more frequently than positive emotional language, both in the blogosphere and Twittersphere. In addition, the ratio of negative to positive emotional language is higher in the Twittersphere than in the blogosphere. Since much was still unknown about the use of affective language in the blogosphere and Twittersphere, these results add to our understanding of climate change communication on these platforms. Negative emotions can foster engagement. Tweets in the news segment are more likely to go viral if they contain negative emotional content (Hansen et al., 2011). Previous research showed how negative emotions can motivate people to be on 'high-alert' (Salama & Aboukoura, 2018) and negative affective evaluations of climate change predict higher climate change risk perceptions (Anthony Leiserowitz, 2006; Smith & Leiserowitz, 2014; Van der Linden, 2015b; Van Eck, Mulder, & Van der Linden, 2020; Xie et al., 2019). Ideally, the content in the blogosphere and Twittersphere elicits affective or emotional responses that foster climate change engagement instead of disengagement. However, it is unknown whether this negative emotional language is coupled with pragmatic solutions on how climate change can be addressed, which is fundamental if one wants to promote climate change engagement (Moser & Dilling, 2011).

In this regard, the results of SQ1 provide an interesting additional insight. Previous research showed that especially fear-messaging is ineffective in fostering climate change engagement if the message is not coupled with pragmatic solutions (Moser & Dilling, 2011; O'Neill & Nicholson-Cole, 2009). Therefore, our finding that fear is the second-most identified emotion in blog posts and tweets is critical. However, there is still little experimental evidence available to make broad, definitive claims about the role of emotions in climate change engagement, e.g. the role of fear (Chapman et al., 2017). Further, the results showed that language related to sadness is used most and language related to joy is used least, in both the blogosphere and Twittersphere. In light of the findings of Cody, Reagan, Mitchell, Dodds, & Danforth (2015) who showed that sentiment is dependent on specific

words, our results potentially suggest that bloggers and Twitter users communicate more about negative events such as natural disasters instead of positive events like climate rallies. Remarkably, our results of climate change tweets deviate from the findings of Veltri & Atanasova's (2015) who showed that anger was the most frequent identified emotion.

Finally, the current research finds that climate mainstream blogs use both more emotional language in general and more negative emotional language specifically in comparison to climate sceptical blogs. Affect is the most influential predictor of variances in blog audience members' climate change risk perceptions (Van Eck, Mulder, & Van der Linden, 2020). From the perspective of risk perceptions and engagement, this finding suggests that climate mainstream bloggers are more effective communicators than climate sceptical bloggers, at least, as long as they appeal to emotions that ultimately foster climate change engagement.

Overall, the current research provides insight into the differences in emotional language in the English-language climate change blogosphere and Twittersphere. However, research on this topic is still in its infancy. Therefore, more research is needed that investigates (a) the use of emotional language on different online platforms, e.g. Facebook; (b) the role of emotional language in general, affective language, and distinct emotions in climate change engagement of readers; and (c) how internal affective and emotional feelings of individuals precisely shape climate change blog posts and tweets. Moreover, future research could also focus on investigating the relationship between emotional language and climate change polarization on these platforms.

In terms of practical recommendations, climate change communicators should carefully consider which platforms they use for their engagement strategies, as each platform has its own platform culture that affects the communication effort (W. Pearce et al., 2019). Moreover, it is crucial that communicators strategically write emotional content that meet intended audiences (Chapman et al., 2017). Chapman et al. (2017, p.852) explain that 'an audience-focused approach views the mix of emotions evoked in climate change communication as a factor to be understood rather than something that simplistically defines a particular communications strategy or piece of climate change communication as 'good' or 'bad'.

Of course, the current research also has limitations. First, only 18 blogs were included in the analysis and it is unknown to what extent these blogs represent the entire climate change blogosphere. However, since we selected these blogs on the basis of explicit and prespecified inclusion criteria, we are confident that we only selected blogs that are central to the climate change blogosphere. Second, due to our preregistered criteria for the selection of blog posts, some blogs dominated the discourse as they delivered more blog posts than other blogs. Yet, we may assume that these blogs are more representative for the climate change blogging discourse, since these blogs publish more frequently about climate change specifically. Third, while the goal was to collect a tweet and blog post data-

set that would be highly equivalent, the datasets are not truly equivalent as we are dealing with different types of content. It is unknown how this shortcoming has affected the results. Therefore, future research should investigate emotional language on each platform separately, e.g. conduct research with Empath in combination with a qualitative analysis of the data. Fourth, while we relied on Empath categories that were pre-validated, it is unknown what these categories precisely consist of. Last, our focus was on emotional language and not on neutral language. Previous research, however, showed that most tweets are neutral (Veltri & Atanasova, 2015; Walter et al., 2019). Therefore, it is recommended to conduct similar research with Empath and also include a category 'neutral language'.

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## CHAPTER 8

# GENERAL DISCUSSION



In the current thesis, I aimed to understand the role of the blogosphere in climate change polarization. The current thesis took a multi-dimensional approach to climate change polarization, by distinguishing between positional, interactional, and affective climate change polarization. Chapters 2-7 presented the results of six mixed methods studies. In this final chapter, the following section will answer the sub-questions, explicate the theoretical and methodological contributions, and ultimately provide a general conclusion. Subsequently, section 8.2 discusses the significance of these findings. Section 8.3 outlines the limitations and future research directions. Finally, section 8.4 provides closing remarks.

## 8.1 Synthesis

### The blogosphere's role in positional climate change polarization

This section provides an answer to sub-question 1 of the current thesis:

***What is the role of bloggers' journalistic norms and discourses, and audiences' climate change risk perceptions in positional climate change polarization?***

Chapter 2 showed that climate change bloggers all support similar journalistic norms. However, how these bloggers consequently operationalize these journalistic norms *reflects and shapes* positional climate change polarization. First, climate sceptical and climate mainstream bloggers' divergent operationalization of journalistic norms reflects their opposing climate change positions. For example, both bloggers support the journalistic norm of 'truth'. Yet, not surprisingly, climate mainstream bloggers' truth is that climate change is human-caused, opposed to climate sceptical bloggers' truth that climate change is not human-caused. Moreover, climate mainstream and climate sceptical bloggers perceive other persons and institutions as their 'authorities'. Both also have different ideas about whether 'social order' should be reassured in their writing, as climate mainstream bloggers believe that climate change is dangerous, in contrast to climate sceptical bloggers. Further, both actively 'contextualize' and evaluate the other group's arguments in line with their own perspective of 'the truth'. Second, climate sceptical and climate mainstream bloggers' operationalization of journalistic norms shapes polarized climate change content, as these norms inform the selection and composition of blog posts. Thus, Chapter 2 showed how climate sceptical and climate mainstream bloggers' divergent operationalization of journalistic norms reflects their opposing climate change positions, which consequently shape the selection and composition of polarized blog content.

Congruent with these findings, Chapter 3 showed how climate sceptic and climate activist bloggers' discourses around COP15 and COP21 *reflect* positional climate change polarization. Thus, the analysis showed how the discourses are polarized around bloggers'

positions. However, more broadly, these polarized positions are grounded in divergent discursive realities of climate sceptical and climate activist bloggers. The discourses in blog content showed how climate sceptic and climate activist bloggers both describe the issue in diverging terms, recognize different basic entities, disagree on natural relationships, assign differing motives to the key agents, and make different use of normative guidance. Climate activist bloggers produce a discursive reality that engages their readers with climate change, while climate sceptical bloggers produce a world that achieves the opposite. Thus, Chapter 3 showed how bloggers' discourses reflect extreme opposing climate change positions, which are grounded in divergent discursive realities.

Chapter 4 showed how the Climate Change Risk Perception Model+ can explain 84% of the variance in risk perceptions amongst audience members. More specifically, if audience members are female; have a lower income; hold more liberal political views; have more knowledge about the impacts, responses, and the scientific consensus on climate change; have stronger negative affective evaluations of climate change; more personal experiences with extreme weather events; hold stronger biospheric values; have higher perceptions of being surrounded by people who believe it is important that you take personal action to tackle climate change; more trust in scientists and climate mainstream blogs as a source of information; and lastly less trust in climate sceptical blogs as a source of information they are more likely to have increased risk perceptions of climate change, and vice versa. Affect is the strongest predictor of variance in climate change risk perceptions. Surprisingly, the relative importance of social norms and value orientations is minimal. Thus, a range of socio-psychological factors shape audience members' climate change risk perceptions. Therefore, increases in positional climate change polarization amongst this unique media audience can *potentially be explained* by the CCRPM+, which primarily points to affect as a strong predictor.

Overall, the current research finds evidence for how the blogosphere reflects, shapes, and potentially can explain positional climate change polarization. Bloggers' operationalization of journalistic norms reflects and shapes positional climate change polarization. Further, bloggers' discourses reflect positional climate change polarization, which is grounded in divergent discursive realities. Lastly, the CCRPM+ can potentially explain positional climate change polarization amongst audience members.

### Theoretical contributions

The majority of research that focused on 'climate change polarization' actually investigated 'positional climate change polarization', e.g. investigating individuals' climate change risk perceptions (see e.g. Kahan, Jenkins-Smith, Tarantola, Silva, & Braman, 2015; Kahan et al., 2012), attitudes (see e.g. Corner, Whitmarsh, & Xenias, 2012; Newman, Nisbet, & Nisbet, 2018; Zhou, 2016), and ideologies (see e.g. Dunlap, McCright, & Yarosh, 2016; Fisher, Waggle, & Leifeld, 2013). Chapter 2 contributes to this existing research, as it showed how investigating online actors' journalistic norms provided insight into how positional climate polarization is reflected and shaped online. Moreover, the findings challenge the

framework of journalistic norms of traditional journalists' reporting on climate change (J. Boykoff & Boykoff, 2004; M. T. Boykoff, 2007c, 2007b; M. T. Boykoff & Boykoff, 2007; M. T. Boykoff & Mansfield, 2008) and confirm and elaborate on previous research focusing on journalistic practices in the blogosphere (Blood, 2002; CyberJournalist.net, 2013; Patterson et al., 2018; Singer, 2005, 2007).

Further, Chapter 3 complements earlier research that investigated – what is in the current thesis defined as– positional climate change polarization in climate change blog content (see e.g. Elgesem et al., 2015; Harvey et al., 2018; Poberezhskaya, 2018), as it also investigated discourses in blog post content. However, the findings of Chapter 3 provided a more detailed analysis of discourses in the blogosphere, by adopting and refining the general discourse analytical framework of Dryzek (2013) and Carvalho's (2000) conceptualization of environmental discourse. This comprehensive framework enabled us to show how positional climate change polarization is grounded in constructed discursive realities.

Lastly, previous research investigating positional climate change polarization in the blogosphere predominantly focused on bloggers and their content (see e.g. Elgesem et al., 2015; Sharman, 2014). Therefore, Chapter 4 adds to existing literature, as we for the first time systematically assessed audiences' climate change risk perceptions and the socio-psychological factors that explain these perceptions. Accordingly, the research adds to our understanding of who the audiences of the climate change blogosphere are (Lewandowski et al., 2019; Lewandowsky, Oberauer, et al., 2013; Matthews, 2015).

### Methodological contributions

Most research that is currently being conducted that focuses on polarization in the online realm uses novel computational methods (Yarchi et al., 2020), e.g. probabilistic topic modelling (Elgesem et al., 2015). The advantage of employing interviews and surveys is that the actors are asked directly about their motives, reasoning, perceptions, etc. Accordingly, the current research revealed that employing more traditional research methods to investigate positional climate change polarization could provide complementary insights into how other polarization dynamics are shaped online.

### The blogosphere's role in interactional climate change polarization

This section provides an answer to sub-question 2 of the current thesis:

***How is interactional climate change polarization enacted in audiences' blog consumption patterns and commenters' discursive interactions?***

Chapter 5 showed how interactional climate change polarization is enacted in audiences' blog consumption patterns. Audience members with high climate change risk perceptions primarily consume climate mainstream blogs and audience members with low climate

change risk perceptions primarily consume climate sceptical blogs. Thus, interactional climate change polarization is enacted in audiences' blog consumption patterns, as audience members are largely disengaged from blogs that hold opposing climate change positions.

In line with these findings, Chapter 6 showed how interactional climate change polarization is enacted in commenters' interactions. The climate sceptical blog *Watts Up With That* functions as an echo chamber where commenters are disengaged from opposing climate change positions, as merely no framing differences were identified in the comment threads. However, in contrast, Chapter 6 also showed how framing differences were identified in the comment threads of the mainstream blog *RealClimate*, meaning that commenters did engage with opposing climate change positions. Having said that, the results showed that if there were such interactions, the commenters primarily deployed polarizing interaction strategies where they further polarized the framing differences. In fact, in all interactions in which commenters introduced polarizing interaction strategies, the framing difference was ultimately left behind unresolved. Thus, interactional climate change polarization is enacted in how often framing differences are identified in the comment threads, as *Watts Up With That* commenters are largely disengaged from opposing climate change positions. Moreover, interactional climate change polarization is also enacted in how commenters deploy polarizing interaction strategies in the comment threads, as in the discursive interactions commenters of *RealClimate* are mostly contrasting others with opposing climate change positions.

Overall, the current research finds evidence for how the blogosphere enacts two forms of interactional climate change polarization. On the one hand, audience members' blog consumption patterns and *Watts Up With That* commenters' user threads showed how these audience members and commenters are disengaged from others who hold opposing positions. On the other hand, *RealClimate*'s user threads showed how commenters are increasingly contrasting others who hold opposing positions, by deploying polarization interaction strategies in their discursive interactions.

### Theoretical contributions

Little research is available that investigated interactional climate change polarization in the blogosphere. The research that is available all focused on bloggers and their content (Elgesem, 2019; Elgesem et al., 2015; Sharman, 2014) and not on commenters and audience members. In fact, in general few researchers investigated climate change blog commenters and their comments (Lewandowsky et al., 2019; Matthews, 2015) and virtually no studies investigated audiences and their climate change blog consumption patterns. Therefore, Chapters 5 and 6 contribute to academic scholarship, as we investigated for the first time interactional climate change polarization amongst commenters and audience members.

Further, the majority of research, also on the climate change blogosphere (Bekkers et al., 2018; Harvey et al., 2018; Nerlich, 2010; Poberezhskaya, 2018; Sharman, 2014), considers frames from a cognitive perspective. Moreover, previous research on interactional climate change polarization mostly focuses on polarization as a state (Elgesem, 2019; Elgesem et al., 2015; Sharman, 2014) instead of a process. Therefore, Chapter 6 adds to existing literature, as we considered frames from an interactional perspective (Aarts & Woerkum, 2006; Dewulf, 2006; Dewulf et al., 2009).

### Methodological contributions

Previous research predominantly employed computational methods to understand interactional climate change polarization online (Elgesem, 2019; Elgesem et al., 2015; Sharman, 2014). Therefore, the current research complements existing research, as it showed how a survey (Chapter 5) and an interactional framing analysis (Chapter 6) could also reveal insights into interactional climate change polarization. The survey was an effective method to obtain data about both audience members' climate change risk perceptions and their blog consumption patterns. Further, the interactional framing analysis provided qualitative insight into how interactional climate change polarization is enacted in discursive interactions.

### The blogosphere's role in affective climate change polarization

This section provides an answer to sub-question 3 of the current thesis:

*What is the role of bloggers' discourses and emotional language, and commenters' discursive interactions in affective climate change polarization?*

Chapter 3 showed how climate sceptical and climate activist bloggers' discourses reflect affective climate change polarization. On the one hand, climate sceptical bloggers portrayed all scientists, politicians, and climate activists that supported the climate mainstream perspective as 'villains'. They portrayed this coalition of actors that allegedly wants to impose costly climate policies as 'bad' guys. On the other hand, climate activist bloggers portrayed all businesses, politicians, and industrialized nation states that did not support a climate treaty as 'villains'. Thus, bloggers discursively portrayed actors of opposing groupings as villains, which reflects affective climate change polarization.

Consistent with these results, Chapter 6 showed how commenters' discursive interactions *reflect* affective climate change polarization. Commenters often deployed identity & relationship framing in their discursive interactions if there was a framing difference. They predominantly deployed this framing to attribute a negative denotation to the other commenter's identity. Importantly, negative identity & relationship framing was often coupled with frame polarization as interaction strategy. This result suggests that when commenters deployed identity & relationship framing, they also further polarized the framing

difference. Thus, how commenters discursively deployed identity frames to attribute a negative denotation to the other commenter's identity reflects affective climate change polarization.

Chapter 7 showed how in the climate change Twittersphere more emotional language is used than in the climate change blogosphere. However, when bloggers use affective language, this language is predominantly negative. Of the six basic emotions, language related to sadness is used the most, before fear, disgust, anger, surprise, and joy. In addition, climate mainstream blogs use both more emotional language in general and more negative emotional language specifically in comparison to climate sceptical blogs. The predominantly negative emotional content *potentially reflects* hostility towards opposing climate change groupings.

Overall, the current research finds evidence for how the blogosphere (potentially) reflects affective climate change polarization. The predominantly negative emotional language in blog posts potentially reflects hostility towards opposing climate change groupings. Indeed, both bloggers and commenters discursively portray opposing climate change groupings as either bad, negative, or villains.

### Theoretical contributions

The findings in Chapters 3 and 6 are consistent with previous research that already showed that actors in the blogosphere negatively label opposing climate change groupings (Brüggeman et al., 2020; Elgesem et al., 2015). Yet, these chapters also add to this line of research, as it was for the first time that specifically climate activist bloggers and commenters were subject of investigation. Moreover, the theoretical refinement of the environmental discourse framework of Dryzek (2013) provided a detailed analysis of which actors climate activist and climate sceptical bloggers discursively portrayed as either heroes, villains, and victims.

Further, Chapter 6 contributes to academic scholarship on interactional framing theory, by showing how users can shift their 'framing category strategy' while the framing difference continues. This refinement revealed that negative identity & relationship framing is frequently accompanied with frame polarization as interaction strategy.

In addition, Chapter 7 adds to academic scholarship that discusses how different platform cultures shape different climate change communication (W. Pearce et al., 2019). Moreover, Chapter 7 also contributes to the relatively young field of study that investigates the role of affect and emotions in climate change communication and climate change risk perceptions (see e.g. Gustafson et al., 2020; Leiserowitz, 2006; Salama & Aboukoura, 2018; Van der Linden, 2015; Xie, Brewer, Hayes, McDonald, & Newell, 2019).

### Methodological contributions

Previous research predominantly investigated affective climate change polarization on

the basis of content analyses (Brüggeman et al., 2020; Elgesem et al., 2015). While the discourse analysis of Chapter 3 was a content analysis too, it provided, however, more detailed insight into affective climate change polarization. The inductive coding strategy allowed us to explore which actors are portrayed as opposing climate change groupings, while a deductive coding strategy would have required us to pre-specify the opposing climate change groupings before the actual research. Moreover, the Empath tool that was employed in Chapter 7 is a novel tool, which we applied for the first time to a climate change communication context. The tool allowed us to conduct content analyses broader and deeper than other similar tools (Fast et al., 2016).

### General conclusion

This section provides an answer to the main research question of the current thesis:

***What is the role of the blogosphere in positional, interactional, and affective climate change polarization?***

The current thesis investigated the role of the blogosphere in reflecting, shaping, enacting, and potentially explaining either positional, interactional, or affective climate change polarization. Evidence is provided for how bloggers' journalistic norms reflect and shape positional climate change polarization, bloggers' discourses reflect positional climate change polarization that is grounded in divergent discursive realities, and the CCRPM+ can potentially explain positional climate change polarization. Further, evidence is provided for how audience members' blog consumption patterns and commenters' discursive interactions enact interactional climate change polarization. Lastly, evidence is provided for how bloggers' discourses and emotional language, and commenters' discursive interactions (potentially) reflect affective climate change polarization. Thus, bloggers, commenters, and audience members are all (consciously or unconsciously) partaking in climate change polarization. Overall, climate change polarization is deeply ingrained in the blogosphere.

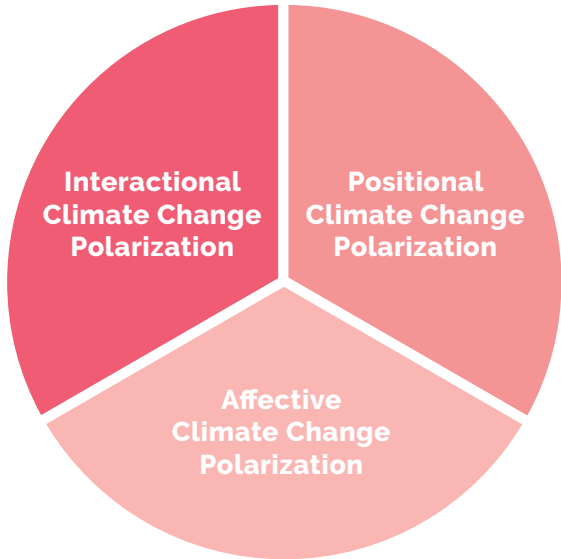
### Theoretical contributions

Since previous research on 'climate change polarization' all started from different ontological and epistemological premises, the phenomenon was not operationalized consistently across several academic fields (see e.g. Corner et al., 2012; Kahan et al., 2012; McCright & Dunlap, 2011). While one might regard this inconsistency as a problem, the current thesis revealed that considering climate change polarization as a multi-dimensional phenomenon is rather valuable. One attains a comprehensive overview of the phenomenon. In fact, considering climate change polarization as multi-dimensional is congruent with general theory on group polarization (DiMaggio et al., 1996). For example, Isenberg (1986) and Sunstein (2017) discussed how there are different mechanisms that are all mediating processes, operating simultaneously, which are all an alternative explanation for general theory on group polarization. Thus, the current thesis adds to academic scholarship on group polarization, climate change communication, climate politics, and climate psychology, by

showing how defining and operationalizing climate change polarization as a multi-dimensional phenomenon is valuable.

However, to date, a theoretical framework that conceptualized 'climate change polarization' as multi-dimensional was lacking. The current thesis proposed a theoretical framework that conceptualized climate change polarization as a multi-dimensional phenomenon (Chapter 1), which proved useful (please see Figure 9). The framework is useful for (a) acquiring a comprehensive view of climate change polarization; (b) investigating online and offline contexts; (c) discursive and non-discursive communication; and (d) analyzing processes and states of polarization. Moreover, the framework allows academics to operationalize the phenomenon as they see fit, e.g. by applying different theories. Therefore, the current thesis contributes to academic scholarship, by providing clarity to the blurry concept of climate change polarization.

**FIGURE 9 A MULTI-DIMENSIONAL APPROACH TO CLIMATE CHANGE POLARIZATION**



**Methodological contributions**

The theoretical framework also allows academics to employ a wide range of methods as they see fit to investigate the phenomenon. The majority of employed methods to investigate climate change polarization by previous research is situated in the positivist paradigm (see e.g. Aasen, 2017; Ross et al., 2019; Zhou, 2016). The mixed methods approach of the current research showed, however, how both quantitative and qualitative methods provide complementary insights into climate change polarization. Both the confirmatory (verifying knowledge) and exploratory (generating knowledge) research (Ivankova & Wingo, 2018) shed light on the role of the blogosphere in climate change polarization. Overall, this mixed methods approach provided a comprehensive answer to the main research question.

**8.2 Discussion**

This section discusses the significance of the findings of the current research. First, I posit that climate change polarization in the blogosphere should be taken seriously. Second, I contend that academia should now start focusing on how different polarization dynamics interact with another. Finally, I postulate that the blogosphere platform facilitates different polarization dynamics.

**The dangers of climate change polarization in the blogosphere**

The group polarization hypothesis explains how groups will generally become more extreme in their pregroup preferences (Myers, 1975). The current thesis points out that different polarization dynamics are at play in the blogosphere between climate sceptical and climate mainstream groups. While climate mainstream groups in the blogosphere effectuate collective climate action, climate sceptical groups in the blogosphere simultaneously engender climate inaction. Thus, climate sceptical groups undermine the efforts of the climate mainstream. As such, the blogosphere obstructs and delays collective action on climate change.

The impacts of climate change are anticipated to get worse (IPCC, 2014), which raises the stakes for both groups. Therefore, they will likely continue to move toward more extreme opposing poles. I do not define what the ultimate 'extremes' are of climate change polarization on purpose, as that is unknown. It is plausible that the debates become even more heated and that social conflict ultimately will ensue that puts social stability in society at greater risk (DiMaggio et al., 1996; Sunstein, 2017). All in all, taking these considerations into account, I posit that the blogosphere's role in climate change polarization should be taken extremely seriously.

Academic scholarship has been documenting how bloggers influenced scientific, media, political, and public discourse (H. Farrell & Drezner, 2007; Lewandowsky, Oberauer, et al., 2013; Nerlich, 2010). However, to date, much is unknown about the potential negative spillover effects of the blogosphere to other online and offline realms in society. The climate change blogosphere community is not living in isolation, as bloggers, commenters, and audience members are all members of society. Therefore, in order to assess the dangers of climate change polarization in the blogosphere more comprehensively, it is essential that future research focuses on these potential spillover effects.

Future research could focus on the role of social norms and group identity. Individuals are likely to follow the norms of individuals that they consider to be their in-group (Fielding & Hornsey, 2016). If individuals self-identify with a group, the chances are extremely high that group polarization will increase. In contrast, if individuals consider themselves to be different from a group, the chances are small that they are susceptible to the viewpoints of the group (Sunstein, 2017). While the current research surprisingly showed that the influ-



ence of social norms on audience members' climate change risk perceptions was minimal (Chapter 4), it might well be that others around these audience members are more sensitive to social norms. Thus, if individuals self-identify with members of the climate sceptical or climate mainstream community in the blogosphere, there are greater chances that they will adopt their norms and climate change risk perceptions accordingly.

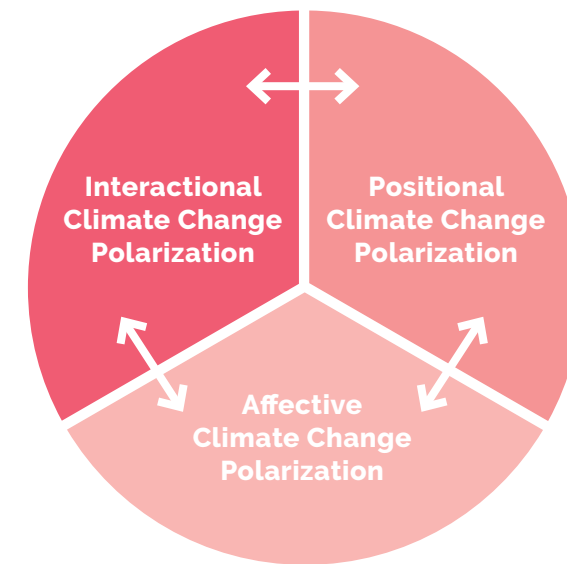
### Interactions between polarization dynamics

Overall, the current thesis showed that recognizing climate change polarization as a multi-dimensional phenomenon is important, as different polarization dynamics were identified in the blogosphere. I contend that academia should now start focusing on the question how the various dimensions of polarization interact with one another. The theoretical framework of the current thesis could serve as a starting point for this investigation (see Figure 10). More specifically, how do positional, interactional, and affective climate change polarization interact with one another? Such research is important, as it could provide a road map on how polarization could be addressed, also in other contexts than climate change. To date, little research is available that explores the directionality of various climate change polarization dynamics. Perhaps this lack of research can also be explained by the fact that it is difficult to clarify the directionality, given that it is a chicken and egg problem (Layman, Carsey, & Horowitz, 2006). Albeit, there seem to be two perspectives in academic scholarship on how the different dimensions on climate change polarization interact with one another.

The first perspective involves that if bloggers are positionally polarized, that commenters would adopt these extreme positions, and in turn the audience members. The underlying theory is based on the premise of regarding exposure to content as a polarizing factor, which is validated in earlier research (Levendusky, 2013; Stroud, 2010), also in the context of climate change (Feldman, 2016; Newman et al., 2018; Van der Linden, 2015a). Moreover, Iyengar et al. (2019) explain that many assume that a lack of balanced content leads audience members to adopt extreme positions (i.e. positional polarization), which in turn increases affective polarization. Thus, in this first perspective, positional polarization is *facilitated* by interactional polarization and *causes* affective polarization.

The second perspective involves that actors are to start with affectively polarized, which could aggravate positional polarization, and motivates them to select news that confirms these pre-existing views (Iyengar et al., 2019). Confirmation bias underlies this perspective (Del Vicario et al., 2017; McPherson et al., 2001). Moreover, it is also based on the premise of regarding actors as affectively polarized pre-exposure, due to experiential processing mechanisms. This theory is validated in previous research (Arceneaux & Johson, 2013), also in the context of climate change (Anthony Leiserowitz, 2006; Roeser, 2012). Thus, in this second perspective, affective polarization *causes* positional polarization and interactional polarization is a *logical result*.

**FIGURE 10 INTERACTIONS BETWEEN CLIMATE CHANGE POLARIZATION DIMENSIONS**



With regards to the findings of the current research, the first perspective would imply that the lack of balanced content in the blogosphere (Chapters 2 and 3) potentially causes audience members to adopt extreme positions (Chapter 5), which in turn causes affective polarization amongst blog audience members. Alternatively, the second perspective would imply that audience members' affective evaluations of climate change could cause them to adopt more extreme climate change risk perceptions (Chapter 4) and therefore consume blogs that are in line with their pre-existing risk perceptions (Chapter 5). Moreover, the second perspective would also imply that bloggers' affective evaluations of climate change (Chapters 3 and 7) could cause them to adopt more extreme climate change positions and therefore select and write about content that confirms these pre-existing views (Chapters 2 and 3).

The precise relationships between these different polarization dynamics is not well understood yet (Iyengar et al., 2019). Most likely, both perspectives provide explanations for how the different dimensions of climate change polarization interact with one another. Lewandowsky et al., (2019) for example demonstrated in an experiment how audience members' perceived social consensus on climate change is shaped by how widely an opinion is expressed in blog posts, and in turn, endorsed by commenters. Further, Van der Linden (2014) showed how risk perception and affect reciprocally influence one another. Therefore, this study suggests that positional climate change polarization and affective climate change polarization are potentially reciprocally influencing each other. In line with this reasoning, other studies showed how audience members that are already polarized pre-exposure become more extremely polarized after being exposed to unbalanced media content (Levendusky, 2013; Newman et al., 2018). Thus, in all likelihood, the relationship



between the various polarization dynamics is inherently interactive (Jacobson, 1999) and mutually reinforcing (Van der Linden, 2014). Yet, more research is needed to gain a better understanding of the interactions between the various polarization dynamics.

### The platform matters

Most research that has been concerned with the question whether the internet has the potential to become an extension of the traditional public sphere and whether this potential has been realized (Dahlgren, 2005; Rauchfleisch & Kovic, 2016) relied on Twitter's open API (Yarchi et al., 2020). However, recent academic scholarship points out that there are significant differences between online media platforms in terms of the platform structure and communication practices (Kligler-Vilenchik et al., 2020; W. Pearce et al., 2019; Yarchi et al., 2020). Indeed, Chapter 7 showed how the blogo- and Twittersphere shaped different climate change communication. Therefore, it is important to understand how each of these platforms' features potentially facilitate different polarization dynamics. Overall, I postulate that the blogosphere's platform structure currently facilitates different polarization dynamics for several reasons.

Online media provide a wide variety of citizens with the opportunity to voice their opinion, which has been celebrated by scholars as one of the advantages of the internet (Sunstein, 2017). The platform structure in the blogosphere is organized in such a way that a wide range of individuals can voice their opinions about climate change in the blog posts and comment sections. However, the current research showed how these structures facilitated positional and affective climate change polarization. Specifically, climate sceptical and climate mainstream bloggers, and commenters discursively voiced their opposing climate change viewpoints and affective or emotional evaluations that reflect hostility towards opposing climate change groupings (Chapters 2, 3, and 6).

Having said that, one may argue that having a wide range of alternative viewpoints available in the climate change blogosphere could contribute to the quality of deliberation about climate change. One of the arguments of cyber optimists is that audience members can customize their own media diets to a greater extent online and expose themselves to a range of alternative viewpoints (Manovich, 2009). However, this argument is invalid with regards to the climate change blogosphere, as the current research showed how blog audience members customized their own blog diets in such a way that they were minimally exposed to alternative positions (Chapter 5).

Meanwhile, the comment sections of the blogosphere could potentially facilitate interactions with alternative viewpoints (Collins & Nerlich, 2015). While the current research showed that interactions with alternative viewpoints were present, these interactions were rather polarizing than deliberative (Chapter 6). The interactions were for example hostile, which might be explained by the fact that in user threads commenters can remain anonymous. Consequently, commenters might feel safe to express more extreme opinions, without feeling judged (Coleman & Moss, 2012; Sunstein, 2017; Walter et al., 2018).

All in all, the current research showed how the platform structure and communication practices of the climate change blogosphere primarily facilitated different polarization dynamics. Yarchi et al., (2020) showed how different social media platforms indeed each contributed to different polarization dynamics. They found that Twitter was the only platform on which all their hypothesized aspects of polarization (positional, interactional, and affective) were present. However, the blogosphere was excluded from this analysis. The current thesis therefore adds to this area of research on how online platforms facilitate different polarization dynamics (Yarchi et al., 2020) and shape different climate change communication (W. Pearce et al., 2019).

Nevertheless, the blogosphere is not by definition destined to failure and offers potential to be an extension of the traditional public sphere. Future research should therefore focus on how the blogosphere can reach its full potential to function as an extension of the traditional public sphere. More research is needed that focuses on studying and enacting online deliberative citizenship (Coleman & Moss, 2012), also in the blogosphere. More specifically, what do these 'open forums' (Williams et al., 2015) in the blogosphere look like and how are they created?

## 8.3 Limitations and Future Research

In the Discussion section, three critical future research agendas were outlined. More specifically, it is recommended to investigate 1) the potential spillover effects of the blogosphere to other realms of society; 2) the interactions between different polarization dynamics; and 3) how the blogosphere could reach its full potential to function as an extension of the traditional blogosphere. In the following text, limitations of the current research are discussed, and additional future research agendas are identified. First, the theoretical limitations are discussed, followed by the methodological limitations that are categorized as limitations pertaining to the validity, reliability, and generalizability of the research.

### Theory on group polarization

In the current thesis, group polarization is based on the premise of binary groups. However, in reality, the climate debate is much more diverse. For example, while climate scientists and climate activists both support 'the climate mainstream' position, their functions in society are very different. Indeed, previous research showed that there are several 'accepter' communities in the blogosphere. However, it also confirmed that there is a divide in the blogosphere across climate sceptics and the climate mainstream (Elgesem et al., 2015). Therefore, applying the theory of group polarization to the blogosphere seems justified. One needs to bear in mind, however, that in reality the positions in the blogosphere are much more complex.

Another potential problem with this binary format is that it frames the climate debate as 'inherently dualistic and combative debate', which potentially reinforces current polarization dynamics (Howarth & Sharman, 2015, p.246). However, in all empirical research chapters,

evidence that contradicts the polarization concept was also regarded as relevant evidence. In other words, the common ground, similarities, and alignments between climate sceptics and the climate mainstream were expressed if identified. For example, Chapter 2 showed how climate sceptical and climate mainstream bloggers both adhere to similar journalistic norms. Another example is that Chapter 3 showed how both climate sceptical and climate activist bloggers portrayed developing countries as 'victims'. Having said that, it is important to repeat that the labels applied in the current thesis are solely intended for academic purposes and not beyond, as there is the risk that these labels do not contribute to a more inclusive dialogue about climate change (Howarth & Sharman, 2015). Moreover, more research is needed that focuses on the identification of common ground as a starting point for depolarizing the blogosphere.

### **A comprehensive view on polarization, not a complete view**

The current thesis provides a comprehensive view on the role of the blogosphere in climate change polarization. However, it is not claimed that this view is complete. Since climate change polarization can take on different shapes and forms, there are still many future research agenda items.

While the theoretical framework of the current thesis allowed for investigating processes of climate change polarization (Chapter 6), it mostly focused on investigating states of climate change polarization (Chapters 2 - 5, and 7). Moreover, all the cases that were selected had different time frames, varying from 2009 to 2019. In fact, little research is available that documents change over time in the blogosphere. Such research, however, could provide insight into how positional, interactional, and affective polarization are subject to change. Thus, investigating processes of climate change polarization over time is paramount.

Moreover, the current research did not analyze all platform features of the blogosphere, which means that it remains unclear whether and how these features facilitate different polarization dynamics. For example, no attention has been paid to climate imagery on blogs, the blog rolls, frequency of posting, tags, and blog stats. Therefore, it is recommended to investigate these features in future research.

Further, Chapter 7 showed how in the blogosphere primarily negative emotional language is used. However, it did not shed light on to what extent this negative emotional language represents affective climate change polarization. Thus, future research could couple the analysis of Chapter 7 with qualitative research that analyses to whom and what these negative emotions are directed.

Finally, more mixed methods research is needed to investigate climate change polarization. Most online research is quantitative in nature (Yarchi et al., 2020), and although this is not a problem, it needs to be complemented with qualitative research. Researchers need to adopt a 'pragmatic' attitude, in which both quantitative and qualitative research is appreciated (Onwuegbuzie & Leech, 2005).

### **Validity**

The data of Chapters 2, 4, and 5 are self-reported. Thus, this data is subject to social desirability and memory biases and might therefore defer from reality. For example, in Chapter 2, the bloggers report the journalistic norms that they adhere to. A critical future research direction would be investigating whether these norms are congruent with the journalistic norms that can be identified in blog posts based on a content analysis.

In addition, affective climate change polarization was only investigated in Chapters 3, 6, and 7 by conducting discursive analyses, while 'affect' is essentially an internal evaluative feeling (Van der Linden, 2014). Also considering that affect and emotions are increasingly recognized as important factors in how people shape their climate change risk perceptions (see e.g. Salama & Aboukoura, 2018), a critical future research agenda is investigating the emotions of actors in the blogosphere, for example with multimodal emotion recognition.

Further, while we aimed to collect a tweet and blog post dataset that would be highly equivalent in Chapter 7, the datasets are not truly equivalent as we are dealing with different types of content. It is unknown how this shortcoming has affected the results. Therefore, future research should conduct similar research for each platform separately.

### **Reliability**

For the research in Chapters 3 and 6, inter-rater reliability tests were conducted, in order to determine whether there was agreement about the application of codes amongst two or more observers. While these tests significantly improved the reliability of the codes, it is recommended to use in future research statistics that express the joint-probability of agreement, e.g. Cohen's kappa or Krippendorff's alpha.

Even though most measures in Chapters 4 and 5 were highly reliable, the natural cause and human cause-knowledge scales of Chapter 4 were less reliable. Therefore, it is recommended to restructure the items of these scales and develop scales that are reliable in different contexts.

### **Generalizability**

Overall, most samples of the current research were focused on the English-language blogosphere. Although this blogosphere is most influential and there are significantly less climate change blogs in other languages, future research could investigate whether the observed polarization dynamics in the current research are also representative for blogospheres beyond the English-language one.

Moreover, it is recommended to conduct similar analyses as in Chapters 3 and 6, however, with samples that include other blogs. For example, it is recommended to conduct a discourse analysis of climate science blogs, in order to know to what extent the climate

activist discourse findings of Chapter 3 are also representative for the broader climate mainstream discourse. In addition, it is recommended to conduct an interactional framing analysis of blog comment threads other than *RealClimate* and *Watts Up With That*, in order to know to what extent the results of Chapter 6 are also representative for other climate mainstream and climate sceptical blogs.

Further, the survey of Chapters 4 and 5 was not published on any climate sceptical blogs. Moreover, the samples were self-selected. As a result, audience members with high climate change risk perceptions were overrepresented in both research samples. Therefore, the samples were not representative of the entire blog audience population. However, with regards to the findings of Chapter 4, since the sample included audience members with low risk perceptions, we were able to evaluate what socio-psychological factors explain the variance in climate change risk perceptions of blog audiences. Yet, an interesting future research direction would be getting more insight into the population of audience members of the climate change blogosphere as a whole. Moreover, with regards to the findings of Chapter 5, we believe that including more audience members with low risk perceptions would strengthen, not weaken, the associations that we found. However, more research is needed to provide evidence for this claim.

Finally, the current thesis shed light on the role of the blogosphere in climate change polarization. As explained in Chapter 7, a development is observed that actors of the blogosphere move to Twitter. The question is therefore to what extent the results of the current thesis are generalizable to other online platforms. Moreover, various polarization dynamics are not only observed around climate change, but in society at large (e.g. American politics, corona, Black Lives Matter). Hence, it is interesting to investigate to what extent the insights about polarization are transferrable to other issues. Therefore, I conclude with a recommendation of Yarchi et al. (2020, p.19): 'Future studies will need to examine polarization in different political contexts, over different issues, on different platforms, and in different time horizons, adding detail and refining our theoretical knowledge.'

## 8.4 Recommendations for Practice: Depolarizing the Blogosphere

Besides the polarization dynamics that the blogosphere facilitates, it also contributes to scientific debate about climate change and effectuates collective climate action. The blogosphere provides bloggers, commenters, and audience members with a platform to exchange their work, further scientific discussion, enhance the relevance of science in public life, and engage people with climate change (Sajeev et al., 2019; Schäfer, 2012; Schmidt, 2008). For these reasons the blogosphere should be celebrated. However, the blogosphere has much greater potential to become an extension of the traditional public sphere if efforts are made to depolarize the climate change blogosphere.

I will provide four recommendations to depolarize the climate change blogosphere based on the findings of the current research. I will rely on the ideals of 'deliberative democracy' in my first three recommendations. Fishkin & Luskin, (2005, p.40) describe the characteristics of a deliberative democracy as follows:

1. *'Informed* (and thus informative). Arguments should be supported by appropriate and reasonably accurate factual claims.
2. *Balanced*. Arguments should be met by contrary arguments.
3. *Conscientious*. The participants should be willing to talk and listen, with civility and respect.
4. *Substantive*. Arguments should be considered sincerely on their merits, not how they are made or who is making them.
5. *Comprehensive*. All points of view held by significant portions of the population should receive attention.'

Important to note is that recommendations 1 and 2 can only be implemented successfully if they are implemented simultaneously. Further, I will rely on general climate change communication theory in my last recommendation. Overall, the set of recommendations is intended to reduce positional, interactional, and affective climate change polarization in the blogosphere.

Important though to realize is that depolarizing the blogosphere is not easy. First of all, whereas surveys and experiments might provide supportive evidence for certain strategies, in reality, these strategies can fail in the 'messy environment of real-world politics' (Iyengar et al., 2019, p. 141). Second, Sunstein (2017, p.90) argues that 'no shift should be expected from people who are quite confident about what they think, and who are simply not going to be moved by what they hear from other people.' Nevertheless, he (2017, p.97) adds 'but for many issues, people aren't all that sure what they think. They start with a degree of open-mindedness. They're searching. They don't begin with intensely held convictions, and even if they tend to know what they think, they're willing to listen.' On that note, the current thesis proposes the following four recommendations to depolarize the climate change blogosphere.

### Recommendation 1: Promote an exchange of views

The current research showed how climate mainstream and climate sceptical groups in the blogosphere are positionally, interactionally, and affectively polarized around climate change. The group polarization hypothesis explains that if communities in the blogosphere solely consist of like-minded individuals, these communities likely become more extreme in their viewpoints (Sunstein, 1999, 2017). However, *persuasive arguments* theory, one of the underlying mechanisms that explain group polarization, also implies that groups will depolarize if new persuasive arguments are presented that oppose the favored direction by group members. Academics have provided evidence for this phenomenon. Moreover, not only having a mix of arguments could have a depolarizing effect, also having an equal mix of individuals that support opposing viewpoints could facilitate depolarization (Sun-

stein, 1999). Thus, it is important that individuals are exposed to alternative viewpoints, in order to develop mutual understanding, and better thinking as a result (Sunstein, 2017). Williams, McMurray, Kurz, & Hugo Lambert (2015) define communities in which individuals are exposed to a wide range of views as 'open forums'. Yet, how such open forums can be created in the blogosphere is largely unexplored.

Sunstein (2017, p.231) suggests that bloggers could promote in their blog roll blogs that promote alternative viewpoints, which 'reflects a healthy degree of mutual respect'. Bloggers could also invite individuals that have alternative viewpoints than themselves to write a guest blog. Further, they could hyperlink to sources that they do not necessarily agree with. Besides bloggers promoting alternative viewpoints on their own blogs, they could also reach out to other blogs or platforms that promote an exchange of views. Moreover, new websites could be launched that are intended to provide a platform for a wide range of views on climate change. Such websites are especially useful for individuals that are searching for information about climate change and do not have intensely held convictions yet. These websites could be hosted on a blog platform, as, in fact, blog posts and comment sections hold deliberative potential.

### **Recommendation 2: Counter misinformation**

The current research showed how climate sceptics and the climate mainstream support opposing climate change positions. Previous research showed, however, how a range of climate sceptical positions that would engender climate inaction lacks merit (see for an example in the blogosphere Harvey et al., 2018; see for an overview of arguments SkepticalScience, 2020), whilst one of the characteristic of deliberative democracy is that arguments should be supported by appropriate and reasonably accurate factual claims (Fishkin & Luskin, 2005). Therefore, the dilemma of promoting an exchange of views is that potentially arguments will circulate that are based on false premises. However, silencing these viewpoints is a threat to the Freedom of Speech and therefore unconstitutional (Sunstein, 2017). Hence, it is of critical importance to train audience members to recognize misinformation themselves.

One strategy to counter misinformation comes from a branch of psychological research and is called inoculation theory (Cook, 2019). Cook (2019) explains that the approach adopts the vaccination metaphor: 'Just as biological vaccination neutralizes viruses by exposing people to a weak form of the virus, misinformation can be neutralized by exposing people to a weak form of misinformation.' Inoculation interventions consist of (a) 'a warning of the threat of misinformation' and (b) 'counter-arguments refuting the myth' (Cook, 2019), prior to the exposure to misinformation (Cook, Lewandowsky, & Ecker, 2017). Misleading argumentation techniques include using fake experts, impersonating fake accounts, invoking emotions, deflecting blame, trolling people online, posing logical fallacies, setting impossible expectations, cherry picking, spreading conspiracy theories, and fostering polarization (Cook, 2020; Roozenbeek & Van der Linden, 2019). Applying inoculation theory to counter misinformation on climate change has been validated in previous research (Cook

et al., 2017; Van der Linden, Leiserowitz, Rosenthal, & Maibach, 2017) and is therefore a promising strategy.

There are a number of practical strategies to apply inoculation theory in the blogosphere. Van der Linden et al., (2017) recommend communicating the scientific consensus on human-caused climate change. This message should be accompanied by a disclaimer that actors may seek to undermine the findings of climate science and a basic explanation of how disinformation campaigns work. In addition, Cook et al., (2017) recommend to craft messages that convey how scientific content can be distorted and include pre-emptive inoculation messages that communicate the misleading argumentation techniques. These messages could be communicated via bloggers in blog posts, but also via commenters in comments. In addition, also alternative communication tools could be explored, such as promoting the Cranky Uncle smartphone game of John Cook (Cranky Uncle, 2020).

Another strategy to counter misinformation can be found in technological solutions. Exposure to fact-checkers, forced or unforced, provides potential to counter misinformation without having to overcome the barrier of selective exposure (Hameleers & van der Meer, 2020). For example, the major blogging platform hosts (e.g. *Wordpress* and *Blogger*) could design fact-checkers that label misinformation. Moreover, effective tools could be designed that detect social bots in the blogosphere (Torusdag, Kutlu, & Selcuk, 2020). Important though, research showed that these technological strategies can also have unintended backfire effects. Therefore, it is important that such technological solutions are informed by psychological research (Cook, 2019).

### **Recommendations 3: Introduce deliberative norms and facilitators**

While Chapters 3 and 6 showed how blog posts and comment sections now mainly facilitate different polarization dynamics, these spaces in the blogosphere could potentially provide an arena for deliberation. The risk of open forums is that individuals become even more extreme in their views, as they do not feel listened to or a sense of group identity (Hobson & Niemeyer, 2013; Sunstein, 2017). Based on their findings of an experiment, Strandberg et al. (2019) therefore recommend to introduce deliberative norms and facilitators that uphold these rules to alleviate group polarization. Interestingly, deliberative norms can even alleviate group polarization in like-minded groups (Grönlund, Herne, & Setälä, 2015). On the basis of rules for deliberation (Strandberg et al., 2019), civility (Dennett, 2013), and dialogue (Aarts, 2015), and the findings of the current research, the following deliberative norms are recommended to introduce in the blogosphere:

1. Bloggers, commenters, and audience members should all be able to take part in the discussion on an equal basis;
2. Everyone is encouraged to express their views in a clear, vivid, and fair manner. Moreover, everyone should always try to justify their views;
3. Everyone should be open to others' arguments by actively listening to others and being prepared to change its own viewpoints after others provide valid arguments;
4. Everyone is encouraged to ask questions, in order to get a better understanding of the

others' arguments;

5. Agreements should be expressed;
6. Everyone should act respectful towards others. For example, everyone could thank the other if they have learned something from them;
7. Rebuttals and criticism are allowed if all above rules are upheld. Moreover, in their criticism, everyone should stick to the issue without negatively referring to the identity of others;
8. Finally, there are no right or wrong answers and no one in the conversation has a final truth on the matter.

These deliberative norms can be listed on the blog. Furthermore, it is important that a facilitator monitors the conversation to see whether the rules are upheld (Coleman & Moss, 2012; Strandberg et al., 2019). In the blogosphere, this role seems to be reserved for moderators. Moderators can be the bloggers themselves, but not necessarily. Coleman & Moss (2012, p.8) discuss: 'Moderators can help to maintain civility by warning participants of infractions of a site's rules of discussion, by removing offending posts, and by temporarily blocking repeat offenders from participating. The moderator also plays a broader role in facilitating deliberation, acting as a 'helper' and 'facilitator,' not just a 'filter': they can recruit new participants to join deliberation, introduce new topics, encourage alternate viewpoints, and respond to participants' questions and complaints'. Thus, it is recommended to train the moderator, so that he or she can truly function as a skilled facilitator.

Moreover, anonymity online allows individuals to express themselves, without feeling judged. However, the downside of anonymity is that it might encourage incivility. On the flipside, if individuals use their real names, it encourages them to take responsibility for their contributions (Coleman & Moss, 2012). Therefore, it is recommended to let the moderator encourage (not force) individuals to use their real names, which helps the moderator and others to judge the sincerity of others' arguments.

#### **Recommendation 4: Communicate effectively about climate change**

The insights of the current thesis provide a starting point for effective risk communication on climate change. Combining this knowledge with academic scholarship on climate change communication about core principles of public engagement (Clarke, Webster, & Corner, 2020; Corner & Clarke, 2017), six recommendations are outlined on how actors in the blogosphere could communicate more effectively.

##### **1. Appeal to audience members' emotions**

Chapter 7 showed that emotional language is used more in the Twittersphere than blogosphere. Chapter 4 showed, however, how affect is the most important determinant in how audience members form their climate change risk perceptions. Even though blogging scientists might feel more comfortable to merely share scientific findings, all bloggers are encouraged to be 'emotionally honest, talking openly about their hopes, fears, and anxieties, and willing to tell personal stories' (Salama & Aboukoura,

2018, p.377). For example, Gustafson et al., (2020, p.131) suggest to 'use personal stories about the impacts of global warming on relatable people and places'. Important though is that these affective and emotional stories are coupled with pragmatic solutions on how to address climate change, so that individuals do not feel overwhelmed by anxiety (Moser & Dilling, 2011; O'Neill & Nicholson-Cole, 2009);

##### **2. Use narratives that resonate with audiences' values, worldviews, and realities**

Chapter 3 showed how positional climate change polarization is grounded in divergent discursive realities. Thus, communicators should tailor their communication attempt not only to the audiences' climate change positions. Instead, their communication should resonate with the reality that these audiences are living in. For example, Chapter 4 showed that audience members' biospheric values was a significant predictor of how they form their risk perceptions in contrast to their egoistic values. Therefore, speak to audience members' 'biospheric' instead of 'egoistic' values, e.g. by using narratives about one's concern about the environment.

##### **3. Look for common ground, do not focus on differences and divides**

If members of a group recognize that the other group is much more similar than expected, affective polarization is likely to decrease (Iyengar et al., 2019). Bloggers and commenters could stress the identities that both groups share. For example, Chapter 3 showed that both climate sceptical and climate activist bloggers are concerned about the fate of development countries. Examples of common identities could include that actors are Americans, parents, etc.

##### **4. Explain how others are taking action to help reduce the risk of climate change, without directly socially pressuring audience members**

Chapter 4 showed that descriptive norms was a significant predictor of how audience members shape their climate change risk perceptions, but prescriptive norms was not. Therefore, directly socially pressuring audience members is likely ineffective and might even cause psychological reactance.

##### **5. Continue educating audiences about the impacts, responses, and scientific consensus on climate change in narrative form**

Chapter 4 showed how knowledge about the impacts, responses, and scientific consensus were all significant predictors of how audience members shape their climate change risk perceptions. Further, communicate the uncertainties in science effectively, for example by consulting the Uncertainty Handbook of Climate Outreach (Corner, Lewandowsky, Philips, & Roberts, 2015);

##### **6. Use climate visuals**

Consult the Seven Principles for Visual Climate Change Communication of Climate Outreach (Corner, Webster, & Teriete, 2016). In addition, use images from the project Climate Visuals of Climate Outreach, which provides an evidence-based climate change imagery bank to communicate effectively about climate change (Climate Visuals, 2020).



## 8.5 Closing Remarks

The current thesis set out to understand the role of the blogosphere in climate change polarization. A multi-dimensional approach to climate change polarization was taken, by distinguishing between positional, interactional, and affective climate change polarization. The current thesis investigated the role of the blogosphere in reflecting, shaping, enacting, and potentially explaining either positional, interactional, or affective climate change polarization. More specifically, actors in the blogosphere hold extreme opposing climate change positions, have interactions where they either are disengaged or are increasingly contrasting others who hold opposing climate change positions, and affectively and emotionally evaluate opposing climate change groupings in a way that reflects hostility. Overall, climate change polarization is deeply ingrained in the blogosphere. Accordingly, the current thesis contributes to our understanding of climate change polarization dynamics in the online realm.



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# SUMMARIES

## Summary

The climate change blogosphere is polarized, with on one side 'the climate mainstream' who support the mainstream scientific position on climate change, and on the other side 'climate sceptics' who reject this position. While it is difficult to quantify the impact of the blogosphere, several instances have been documented where climate change bloggers significantly impacted scientific, media, political, and public discourse (e.g. climategate). Blogs are central to climate sceptics' communication strategy, which means that the mainstream scientific perspective on climate change is underrepresented in the blogosphere. Previous research already provided some evidence of climate change polarization in the blogosphere. However, academic scholarship on the blogosphere and in general conceptualizes climate change polarization differently. Therefore, it is unknown what the precise role is of the blogosphere in climate change polarization. Such research could, however, provide insight into how the platform structure and communication practices in the blogosphere contribute to climate change polarization. Consequently, it could shed light on how the blogosphere could potentially obstruct and delay collective action on climate change. Therefore, the current thesis set out to investigate the role of the blogosphere in positional, interactional, and affective climate change polarization.

The current thesis conceptualized climate change polarization by distinguishing between positional, interactional, and affective climate change polarization:

1. *Positional climate change polarization*: extreme climate change opposition or increasingly opposing climate change positions;
2. *Interactional climate change polarization*: interactions in which participants are either disengaged from or increasingly contrasting others who hold opposing climate change positions;
3. *Affective climate change polarization*: extreme or increasingly affective or emotional evaluations that reflect hostility toward opposing climate change groupings.

Chapters 2-7 presented the results of six mixed methods studies that each provided answers to the sub-questions.

Chapters 2-4 provided an answer to sub-question 1: *What is the role of bloggers' journalistic norms and discourses, and audiences' climate change risk perceptions in positional climate change polarization?*

Chapter 2 showed how climate sceptical and climate mainstream bloggers' divergent operationalization of journalistic norms that they adhere to reflects their opposing climate change positions, which consequently shape the selection and composition of polarized blog content. Chapter 3 showed how climate sceptical and climate activist bloggers' discourses reflect extreme antagonistic climate change positions, which are grounded in divergent discursive realities. Chapter 4 showed how a range of socio-psychological factors can explain 84% of the variance in risk perceptions amongst audience members. There-

fore, increases in positional climate change polarization amongst audience members in the blogosphere can potentially be explained by this climate change risk perception model, which primarily points to affect as a strong predictor.

Chapters 5-6 provided an answer to sub-question 2: *How is interactional climate change polarization enacted in audiences' blog consumption patterns and commenters' discursive interactions?*

Chapter 5 showed how interactional climate change polarization is enacted in audiences' blog consumption patterns. Audience members with high climate change risk perceptions primarily consume climate mainstream blogs and audience members with low climate change risk perceptions primarily consume climate sceptical blogs. Chapter 6 showed how interactional climate change polarization is enacted in how commenters of the climate sceptical blog *Watts Up With That* are largely disengaged from opposing climate change positions. Moreover, interactional climate change polarization is also enacted in how commenters of the mainstream blog *RealClimate* are mostly contrasting others with opposing climate change positions in their discursive interactions.

Chapters 3, 6, and 7 provided an answer to sub-question 3: *What is the role of bloggers' discourses and emotional language, and commenters' discursive interactions in affective climate change polarization?*

Chapter 3 showed how climate sceptical and climate activist bloggers' discourses around COP15-21 reflect affective climate change polarization, as they discursively portrayed opposing actors as 'villains'. Chapter 6 showed how commenters' discursive interactions reflect affective climate change polarization, as they frequently deployed identity frames to attribute a negative denotation to the other commenter's identity. Chapter 7 showed how bloggers primarily use negative emotional language instead of positive, which potentially reflects hostility towards opposing climate change groupings.

All in all, the current thesis investigated the role of the blogosphere in reflecting, shaping, enacting, and potentially explaining either positional, interactional, or affective climate change polarization. The results showed that climate change polarization is deeply ingrained in the blogosphere. Bloggers, commenters, and audience members are all (consciously or unconsciously) partaking in climate change polarization. Overall, the current thesis showed how climate change polarization is a multi-dimensional phenomenon that is operating in the blogosphere. Therefore, the theoretical framework and findings of the current thesis contribute to our understanding of (online) climate change polarization dynamics.

The thesis concludes with four recommendations to depolarize the blogosphere:

1. Promote an exchange of views
2. Counter misinformation
3. Introduce deliberative norms and facilitators
4. Communicate effectively about climate change



## Publiekssamenvatting

In de klimaatblogosfeer, het netwerk van klimaatblogs, wordt er verschillend over klimaatverandering gecommuniceerd. Er is sprake van een zekere polarisatie. Aan de ene kant is er de 'klimaatmainstream', die uitgaat van de wetenschappelijke mainstreampositie die accepteert dat klimaatverandering wordt veroorzaakt door de mens en dat deze gevaarlijke gevolgen zal hebben. Aan de andere kant zijn er de 'klimaatseptici' die de wetenschappelijke mainstreampositie verwerpen. Klimaatblogs spelen een belangrijke rol in wetenschappelijke, politieke, media- en publieke debatten rondom klimaatverandering. Er is al enig wetenschappelijk onderzoek gedaan naar de klimaatblogosfeer, maar het is nog onduidelijk wat precies de rol is van de blogosfeer bij klimaatpolarisatie. Hierbij speelt mee dat in de wetenschappelijke literatuur klimaatpolarisatie verschillend wordt geconceptualiseerd.

In dit proefschrift is onderzocht welke rol de blogosfeer bij klimaatpolarisatie speelt. Voor dit onderzoek is een theoretisch raamwerk ontworpen waarin klimaatpolarisatie wordt geconceptualiseerd. Het proefschrift volgt een multidimensionale benadering waarbij onderscheid wordt gemaakt in positionele, interactionele en affectieve klimaatpolarisatie. Deze drie dimensies van klimaatpolarisatie zijn als volgt gedefinieerd:

1. *Positionele klimaatpolarisatie*: Groepen mensen nemen tegengestelde posities in rondom klimaatverandering.
2. *Interactionele klimaatpolarisatie*: Groepen mensen gaan nagenoeg geen interacties aan met groepen mensen die tegengestelde posities rondom klimaatverandering innemen. Of ze gaan wel interacties aan, maar communiceren op zo'n manier dat ze alleen hun eigen standpunt herhalen of upgraden en niet open staan voor de inbreng van de ander.
3. *Affectieve klimaatpolarisatie*: Groepen mensen ervaren vijandige emoties naar groepen mensen die tegengestelde posities innemen rondom klimaatverandering.

Op basis van dit raamwerk is in dit proefschrift gekeken naar wat de rol is van de blogosfeer bij positionele, interactionele en affectieve klimaatpolarisatie.

In de hoofdstukken 2-4 is positionele klimaatpolarisatie onderzocht.

- In hoofdstuk 2 wordt beschreven hoe klimaatseptische en klimaatmainstream bloggers weliswaar met dezelfde journalistieke normen werken (bijvoorbeeld 'waarheid', 'nieuwheid', 'dramatisering'), maar dat ze deze normen verschillend uitwerken. Met andere woorden, positionele klimaatpolarisatie is niet zozeer zichtbaar in welke journalistieke normen beide groepen bloggers volgen, maar meer in hoe bloggers deze normen uitwerken wanneer ze hun blog posts schrijven.
- Hoofdstuk 3 laat zien dat zowel klimaatseptische als klimaatactivistische bloggers in hun blog posts verschillende posities innemen over klimaatverandering rondom de klimaattoppen van 2009-2015 (COP15 Kopenhagen – COP21 Parijs). Klimaatseptische

en klimaatactivistische bloggers beschrijven klimaatverandering in verschillende termen; men is het niet altijd eens over de natuurwetenschappelijke aannames; er worden verschillende motieven toegekend aan de belangrijkste actoren; men gebruikt verschillende retoriek; normatieve kaders worden verschillend gebruikt. Dit onderzoek laat zien dat klimaatactivistische bloggers een discursieve realiteit creëren die hun lezers betreft bij klimaatverandering, terwijl klimaatseptische bloggers klimaatverandering en beleid beschrijven op een manier die ver van de lezers vandaan blijft.

- In hoofdstuk 4 wordt beschreven dat aan de hand van een model met verschillende sociaalpsychologische factoren nagegaan kan worden of bloglezers hoge of lage risicopercepties hebben ten aanzien van klimaatverandering. Emoties blijken de sterkste voorspeller te zijn van hoge of lage risicopercepties. Dit model kan dus mogelijk gebruikt worden om positionele klimaatpolarisatie te verklaren.

In de hoofdstukken 5 en 6 staat interactionele klimaatpolarisatie centraal.

- Hoofdstuk 5 laat zien dat bloglezers met lage risicopercepties hoofdzakelijk klimaatseptische blogs lezen, terwijl bloglezers met hoge risicopercepties hoofdzakelijk klimaatmainstream blogs lezen. Dit betekent dat mensen met name blogs lezen die aansluiten bij hun reeds bestaande standpunten rondom klimaatverandering. Ze worden hierbij telkens bevestigd in hun meningen over klimaatverandering. Dit wordt het echo-kamereffect genoemd.
- Hoofdstuk 6 gaat over framing verschillen, hiermee wordt bedoeld dat in de interacties tussen mensen frames worden gebruikt die onverenigbaar zijn. Het onderzoek laat zien dat er in de commentaarsecties van het klimaatseptische blog Watts Up With That weinig framing verschillen zijn. Met andere woorden, deze commentaarsectie funktioneert als een echokamer. In de commentaarsectie van het klimaatmainstream blog RealClimate zijn er daarentegen wel framing verschillen aanwezig. Als een dergelijk framing verschil zich voordoet, dan gebruiken de commentatoren veelal polariserende interactiestrategieën. Bij zo'n strategie herhalen of upgraden ze hun eigen standpunt en staan ze niet open voor het standpunt van de andere commentator, met als gevolg dat het framing verschil uiteindelijk vaak niet wordt opgelost.

In de hoofdstukken 3, 6 en 7 wordt onderzoek beschreven naar affectieve klimaatpolarisatie.

- Hoofdstuk 3 laat zien dat zowel klimaatseptische als klimaatactivistische bloggers actoren die een ander standpunt vertegenwoordigen neerzetten als 'de slechterik'.
- In hoofdstuk 6 wordt beschreven dat wanneer er framing verschillen zijn in de commentaarsecties van blogs, de commentator vaak degene waar ze het framing verschil mee hebben in diskrediet brengt, in plaats van dat er op het argument van deze commentator wordt ingegaan. Wanneer commentatoren de ander in diskrediet brengen, wordt het framing verschil nooit opgelost.
- Hoofdstuk 7 laat zien dat er op blogs minder gebruik wordt gemaakt van taal die met emoties geladen is dan dat op Twitter het geval is. Als er in blogs wel gebruik wordt gemaakt van taal die met emoties geladen is, dan zijn dit hoofdzakelijk negatief geladen emoties. Deze negatieve emoties wijzen mogelijk op affectieve klimaatpolarisatie.



Dit proefschrift laat zien hoe positionele, interactionele en affectieve klimaatpolarisatiedynamieken aanwezig zijn in de klimaatblogosfeer. Klimaatpolarisatie is diep doorgedrongen in de blogosfeer. Bloggers, commentatoren in commentaarsecties en bloglezers zijn allen min of meer bewust onderdeel van deze klimaatpolarisatie.

In dit proefschrift worden vier aanbevelingen gedaan die bij kunnen dragen aan depolarisatie van de blogosfeer:

1. Bevorder het uitwisselen van gedachten met groepen mensen die verschillend denken over klimaatverandering. Zo wordt voorkomen dat mensen in een echokamer leven.
2. Als mensen in gesprek gaan met mensen die anders denken over klimaatverandering is het belangrijk dat mensen in staat zijn desinformatie en nepnieuws te herkennen.
3. Introduceer op het blog randvoorwaarden die bijdragen aan respectvolle gesprekken. Bloggers kunnen facilitators aanstellen die ervoor zorgen dat aan deze voorwaarden wordt voldaan.
4. Effectieve communicatie over klimaatverandering op blogs wordt bevorderd door verhalen te gebruiken die resoneren met de waarden van bloglezers, hun wereldbeeld en leefwereld en die appelleren aan hun emoties. Ook wordt aangeraden te zoeken naar overeenkomsten en niet te focussen op verschillen. Bloggers wordt geadviseerd hun bloglezers te informeren over de impact, aanpak van en wetenschappelijke consensus over klimaatverandering. Ze kunnen uitleggen welke acties er al ondernomen worden om klimaatverandering tegen te gaan, zonder dat ze daarbij de bloglezer onder druk zetten, want het onderzoek laat zien dat dit averechts kan werken. Ten slotte worden bloggers aangemoedigd om afbeeldingen te gebruiken die bijdragen aan het betrekken van mensen bij het nadenken over klimaatverandering.

**ABOUT  
THE AUTHOR**

## Curriculum Vitae



Christel van Eck was born on 19 February 1993 in Amsterdam, the Netherlands. She grew up in Amersfoort living with her parents and sister. In 2010, Christel started with her Bachelor of Business Administration called Global Project and Change Management, at the Windesheim Honours College. She specialized in Communication & Media and soon developed a strong research interest in climate change communication. In 2012, she did an internship at the Media Alliance in Bangkok, where she worked on the Redraw the Line climate change awareness campaign in Asia. In 2013-2014, Christel completed her two electives at Wageningen University, by following courses in the area of project management, research methods, and climate change communication. Her second research internship was at Climate Outreach in Oxford, to conduct research on how the IPCC could improve its communications by interviewing key figures. This thesis received two best thesis nominations of Windesheim and of the Netherlands and Flanders. After graduating from the Windesheim Honours College, Christel started with her master Applied Communication Sciences, at Wageningen University. She followed elective courses in the area of environmental science and governance. Her third research internship was at ClimateContact-Consultancy, where she mapped the Dutch climate debate by interviewing key figures. In 2017, Christel was selected as one of the 100 Most Sustainable Young Leaders of the Netherlands. Also in 2017, Christel was awarded the Research Talent grant of the Dutch Research Council (NWO) to conduct her own PhD research (2017-2021). During her PhD, Christel was also involved in teaching, supervising thesis students, and presenting her work at international conferences. In 2020, she worked for two months at the Social-Decision Making Lab at the University of Cambridge. Christel finds it important to bridge science and practice on climate change communication. Therefore, in 2020, she started together with Hans van Tuin the podcast A Cup of Climate, in which they talk with guests about how to communicate effectively about climate change.



[www.christelvaneck.com](http://www.christelvaneck.com)



[www.researchgate.net/profile/Christel-Van-Eck-2](https://www.researchgate.net/profile/Christel-Van-Eck-2)



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[twitter.com/ChristelvanEck](https://twitter.com/ChristelvanEck)

## Publications

- Van Eck, C.W., Mulder, B.C. & Van der Linden, S. (2020). Echo Chamber Effects in the Climate Change Blogosphere. *Environmental Communication*, 15 (2), 145-152.  
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## WASS Training and Supervision Certificate

Christel Willemijn van Eck

Wageningen School of Social Sciences (WASS)

Completed Training and Supervision Plan



Name of the learning activity	Department/Institute	Year	ECTS*
<b>A) Project related competences</b>			
Writing of the PhD research proposal	Strategic Communication, Wageningen University & Research	2016-2017	6
Contemporary approaches to digital cultures: platforms, politics, performances, and people	Research school for Media Studies	2018	6
Reviewing papers for New Media & Society, Public Understanding of Science, Geoforum, and Food Security	Strategic Communication, Wageningen University & Research	2017-2021	3
Researching Media Use	Research school for Media Studies	2019	1
Research visit Social Decision-Making Lab	Department of Psychology, University of Cambridge	2020	6
Oral conference presentation of PhD research	ScienceBattle, Synergy conference, NWO, Bussum	2019	0.5
Oral presentation of PhD research	Department of Psychology, University of Cambridge	2020	0.5
'Climate Change Risk Perceptions of Audience Members in the Climate Change Blogosphere'	18 <sup>th</sup> Swiss Geoscience Conference, online	2020	0.5
<b>B) General research related competences</b>			
Introduction course	WASS	2017	1
Podcast interview	Podcast Ecosofie	2019	0.5
Founding and hosting the podcast A Cup of Climate	Podcast A Cup of Climate	2020-2021	4
Podcast interview about PhD research	Podcast A Cup of Climate	2021	0.5
Radio interview about PhD research	Extinction Rebellion Radio	2021	0.5
Expert panel member	Extinction Rebellion, Interactive XR-Webinar: The Science Behind Effective Climate Activism	2021	0.5
Developing professional webpage	www.acupofclimate.com	2019-2021	1
<b>C) Career related competences/personal development</b>			

Teaching, examination, and gamification at the course Communication & Policymaking; Annual guest lectures at the courses Internet-Based Communication and Learning for Social Change, Research Methods for Effective Communication, and Scientific Advocacy; BSc thesis supervision	Wageningen University & Research and VU University Amsterdam	2018 – 2021	4
Gamified Design	Education Support Centre, Wageningen University & Research	2019	0.3
Brain-friendly Working	Wageningen Graduate Schools, Wageningen University & Research	2018	0.1
Organizing monthly seminar sessions	Strategic Communication, Wageningen University & Research	2019-2021	2
Competence Assessment	Wageningen University & Research	2017	0.3
<b>Total</b>			<b>38.2</b>

\*One credit according to ECTS is on average equivalent to 28 hours of study load

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# **SUPPLEMENTAL MATERIALS**

Overview of climate change bloggers

	NAME BLOGGER	NAME BLOG
1	Sture Astrom <sup>1</sup>	Klimatsans
2	Ugo Bardi <sup>2</sup>	Cassandra's Legacy
3	Geoff Beacon <sup>2</sup>	Brussels blog
4	Krispijn Beek <sup>2</sup>	Krispy's blog & Sargasso
5	Rasmus Benestad <sup>2</sup>	RealClimate
6	Adam Corner <sup>2</sup>	The Guardian & NewScientist
7	Judith Curry <sup>1</sup>	Climate Etc.
8	Arnaud Delebarre <sup>2</sup>	Le blog de Arnaud Delebarre
9	Paul Driessen <sup>1</sup>	Various blogs
10	Willis Eschenbach <sup>1</sup>	Watts Up With That
11	John Gibbons <sup>2</sup>	ThinkOrSwim.ie
12	Hans Labohm <sup>1</sup>	Climategate.nl
13	Johan Lorck <sup>2</sup>	global-climat
14	Paul Luttikhuis <sup>2</sup>	Klimaat of the Dutch newspaper NRC
15	Jakub Malecki <sup>2</sup>	Glacjoblogia
16	Jelmer Mommers <sup>2</sup>	Klimaat & Energie of The Correspondent
17	Miriam O'Brien <sup>2</sup>	HotWhopper
18	Ranjan Panda <sup>2</sup>	climatecrusaders
19	John Pratt <sup>2</sup>	JPRATT27
20	Ken Rice <sup>2</sup>	... and Then There's Physics
21	Gavin Schmidt <sup>2</sup>	RealClimate
22	Mike Shanahan <sup>2</sup>	UNDER THE BANYAN
23	Peter Sinclair <sup>2</sup>	Climate Denial Crock of the Week
24	David Thorpe <sup>2</sup>	The Low Carbon Kid
25	Michael Tobis <sup>2</sup>	Planet 3.0
26	Bart Verheggen <sup>2</sup>	Klimaatverandering & My view on climate change
27	Theo Wolters <sup>1</sup>	Climategate.nl

Note: 1 = climate sceptical blogger, 2 = climate mainstream blogger.

Overview of the profiles of the selected blogs

1. [www.globalclimatescam.com](http://www.globalclimatescam.com)  
The 'about' page of Global Climate Scam states among other things: 'we oppose the alarmist agenda employed by most global warming 'evangelists'. In many cases, their agendas are based upon questionable scientific data and erroneous claims about global climate change. They claim the 'science is settled' when, in fact, it is not. Scientists do not agree on the cause of climate change, the role of carbon dioxide (CO<sub>2</sub>), the degree to which man contributes to atmospheric CO<sub>2</sub>, and whether global warming is anything other than a naturally occurring phenomenon' and 'Global Climate Sam was created by Minnesota Majority in 2007 and is now operated by Minnesotans for Global Warming.'
2. [wattsupwiththat.com](http://wattsupwiththat.com)  
The 'about' page of WattsUpWithThat states that Anthony Watts is the founder and editor of WattsUpWithThat and that he is a former AMS Television Seal Holder television meteorologist. It also states among other things that WattsUpWithThat provides: 'News and commentary on puzzling things in life, nature, science, weather, climate change, technology, and recent news by Anthony Watts'. The blog features content of Watts as well as guest bloggers.
3. [www.climate-skeptic.com](http://www.climate-skeptic.com)  
The website climate-skeptic is run by Warren Meyer, who has a degree in mechanical and aerospace engineering. At the website is mentioned 'he originally started to help report climate developments in layman's terms, particularly the science of skeptic's position.' The blog only features content from Meyer himself.
4. [www.drroyspencer.com](http://www.drroyspencer.com)  
Roy W. Spencer holds a Ph.D. in meteorology, is a former NASA scientist, and is author of several books. He claims at his website 'Dr. Spencer's research has been entirely supported by U.S. government agencies: NASA, NOAA, and DOE. He has never been asked by any oil company to perform any kind of service. Not even Exxon-mobile.' The blog only features content from Spencer himself.
5. [bishophill.squarespace.com](http://bishophill.squarespace.com)  
Andrew Montford runs the blog Bishop Hill. Besides, he is an editor, chartered accountant, and author of the book The Hockey Stick Illusion. According to the Smog Blog, his stance on climate change is 'I believe that CO<sub>2</sub>, other things being equal, will make the planet warmer. The six million dollar question is how much warmer. I'm less of a skeptic than people think. My gut feeling is still skeptical but I don't believe it's beyond the realms of possibility that the AGW hypothesis might be correct. It's more the case that

we don't know and I haven't seen anything credible to persuade me there's a problem.' The blog only features content from Montford himself.

6. **[blogs.wwf.org.uk](https://blogs.wwf.org.uk)**

WWF UK reports on their website 'Our ultimate goal has always been 'people living in harmony with nature' – so we're about respecting and valuing the natural world and finding ways to share the Earth's resources fairly'. The content that is featured at their separate blog is written by several authors, such as staff from the media & communications department as well as the director of WWF Scotland.

7. **[www.greenpeace.org.uk/blog](https://www.greenpeace.org.uk/blog)**

Greenpeace is an independent global campaigning organization and argues: 'We defend the natural world and promote peace by investigating, exposing and confronting environmental abuse, and championing environmentally responsible solutions'. The content that is featured at their blog is authored by different Greenpeace UK staff members, such as an ocean's campaigner as well as an online campaigner.

8. **[www.foe.co.uk/news\\_events/green\\_blog\\_26301](https://www.foe.co.uk/news_events/green_blog_26301) & [www.foe.co.uk/news\\_events/policy\\_blog](https://www.foe.co.uk/news_events/policy_blog)**

Friends of the Earth UK campaigns for a beautiful world, a good life, and a positive relationship with the environment. The organization runs a Policy & Politics blog and a Green blog. The content that is featured at their blog is written by a wide range of authors.

9. **[www.climatenetwork.org/CAN-blog](https://www.climatenetwork.org/CAN-blog)**

The Climate Action Network (CAN) is a worldwide network of over 950 NGOs, such as Avaaz and 350.org. They are 'working to promote government and individual action to limit human-induced climate change to ecologically sustainable levels'. The content of the blog is written by a wide range of authors, such as the head of global campaign coordination or the communications coordinator.

10. **[policy-practice.oxfam.org.uk/blog](https://policy-practice.oxfam.org.uk/blog)**

Oxfam is 'a global movement of people working towards a world without poverty'. They work on long-term projects with communities and campaign for change, for example climate change. Their blog is a hub for news, analysis, and debate targeted at humanitarian professionals both in-and outside the organization. The content featured is authored by staff members of Oxfam GB.

# Identifying Climate Discourses in Blogs

## *Coding Handbook*

Christel W. van Eck

October 2017

## 1. Sample Preparation

1. The climate sceptic blogs that are included in the sample are:

- Global Climate Scam (GCS)
- WattsUpWithThat (WUWT)
- Climate-skeptic (CS)
- Dr Roy Spencer (DRS)
- Bishop Hill (BH)

And, the climate activist blogs that are included in the sample are:

- WWF UK BLOG (WWF)
- Greenpeace UK (GRP)
- Friends of the Earth UK (FOE)
- Climate Action Network (CAN)
- Oxfam UK (OX)

2. The blog posts that are included in the sample adhere to the following criteria:
  - The blog post was published one week before, during, or after every annual COP between 2009 and 2015.
  - The blog post needed to feature at least a generic term ('climate change', 'global warming', 'greenhouse effect'); a term that referred to the conference ('COP', 'climate summit', 'UN climate conference', 'Copenhagen', 'Cancun', 'Durban', 'Doha', 'Warsaw', 'Lima', or 'Paris'); or a term that reflected the controversy ('sceptic', 'skeptic', 'conspiracy', 'hoax', 'propaganda', 'climate science') in their title or lead. If the blog posts did not have a bold lead, the first paragraph was considered as the lead.
3. The blog posts are copied and pasted into single Word documents. On top of the document is a tag applied that combines the abbreviation of the corresponding blog and the identification number in the sample. In addition, on top of the document is a tag applied that presents the number of words in the blog post.
4. Duplicates are removed from the sample. The selection process resulted in a corpus of 357 blog posts (253 from climate change sceptic and 104 from climate activist blogs).

## 2. Coding Preparation and Technical Requirements

1. Download the licensed version of ATLAS.ti on the desktop of the computer.
2. Open ATLAS.ti.
3. Create a new Hermeneutic Unit and save it on the computer as 'Climate Discourse Analysis of Blogs'.
4. Open all the blog posts in chronological order one per one in the Primary Doc Manager.
5. Insert all the codes that are provided in Chapter 4 one per one in the Code Manager.
6. Save the project.

## 3. General Coding Rules

1. There are six categories of codes, which are presented in Chapter 4. The codes are categorized as follows:
  - *Surface Descriptors* specify the website, author, date, section, word count, title of the blog post, and whether it is cross-posted.
  - *Basic Entities Recognized or Constructed* represent the ontology of the discourse; this includes how climate change phenomena are understood, the authority given to different sources of information, and the role of science and scientific evidence. The basic entities that are recognized or constructed are categorized as either a social, natural, technological, or transcendent ontology.
  - *Assumptions about Natural Relationships* include the causes and consequences of changes in the climate and the scale of impacts of climate change.
  - Representations of *Agents and their Motives* of a discourse determine who the key actors are, their interests and their motives (framing them as heroes, villains, victims, or ignorant actors).
  - *Key Metaphors and other Rhetorical Devices* are deployed to convince readers by putting a situation in a particular light. The metaphors and rhetorical devices are categorized as either rhetorical devices related to science, COPs, judgments, or commitments.
  - *Normative Judgments* propose what should be done, and by whom, to solve climate change, and the extent to which these issues should be given priority.
2. For the analysis, the blog post first needs to be scanned briefly. Second, all the words and/or sentences that link to one of the categories should be coded. After that, the blog post needs to be reviewed again to check whether all the relevant codes are applied. Lastly, save the project.
3. After every 30 blog posts, the coder should review all the blog posts again to see whether the codes are applied consistently.
4. Code all the words and/or sentences that are relevant for a specific code. *For example:* if a blogger states: 'It is great that President Obama invests his time in climate politics', the entire sentence should be coded as '4.1 Heroes: Politicians' instead of only coding the actor's name.
5. The unit of analysis for the surface descriptors and ontologies is the blog post. Every blog post needs to have at least one and not more than one code for the website, date, word count, title, and ontology. Please note that the author, section descriptor, and references to cross-posting are not necessarily coded, since these descriptors are not always present. If they are present, they should only be coded once per blog post.
6. The unit of analysis for the assumptions about natural relationships, agents, rhetorical devices, and normative judgments is a sentence. Please note that if the subject itself did not change but is discussed in multiple sentences, the text should only be coded once.  
*For example:* if a blogger portrays President Obama as a hero in a sentence, it should



- be coded as '4.1 Heroes: Politicians'. If the blogger continues portraying Obama as a hero in the remainder of the blog post, the text should not be coded again. However, if the blogger portrays Secretary-General of the UN Ban Ki-moon in the same sentence about Obama as a hero as well, the text should be coded as '4.1 Heroes: Politicians' only once, but if the blogger portrays Ban Ki-moon in another sentence as a hero, the text should be coded as '4.1 Heroes: Politicians' again.
7. Text can be linked to multiple codes. In these cases, the text should be coded with multiple codes.
  8. Each time consequences of anthropogenic climate change (code 3.4) or non-human consequences of climate change (code 3.5) are coded, the code should be linked to a code that identifies the scale of impacts (code 3.1.1; 3.1.2; 3.1.3; or 3.1.4).
  9. In case agents are portrayed as heroes, villains, victims, or ignorant actors, they should only be coded as specific actors if the blogger assigns that role to them explicitly in the blog post. If a blogger does not explicitly assign a role in the blog post, the agent should be coded as 'Other'.  
*For example:* a blogger portrays Obama as hero but does not explicitly mention anywhere in the text that he is a politician, the text should be coded as 'Other'.
  10. Only the explicit normative judgments of bloggers themselves, and not judgments of other actors that the blogger cites, should be coded.
  11. Quotes that are cited by the blogger to support their argument, should be coded, including the agent who is being quoted. If this is not explicitly the case, the quote and agent should not be coded.
  12. Text that is copy pasted from other sources into the blog post and not explicitly endorsed by the blogger should not be coded.
  13. Text that does not refer to any aspects of climate change should not be coded.
  14. Only text is coded. Images are not included in the coding and should not be considered in the analysis.
  15. Coding is an ambiguous process. Please only code the text that explicitly links to the codes, which means that you should not code implicit text. Note down in a separate Word document the blog posts or codes that are too ambiguous to code and demand discussion with your fellow coders.
  16. Make agreements with your fellow coders about when you meet and discuss issues that came up during the coding process. Also agree in advance on how many and which blogs each coder needs to code before each meeting.

#### 4. Codes

The codes are organized according to the six categories. Each code is explained in the description section and additional comments are made in the remarks section. Please note that all the codes in italics are not actual codes, but serve as umbrella categories of codes.

##### 1. Surface Descriptors

Unit of analysis: blog post.

CODE	DESCRIPTION	REMARKS
1.1 Website	On top of the document is a tag applied that combines the abbreviation of the corresponding blog and the identification number in the sample.	
1.2 Author	The name of the person who has written the blog post.	<ul style="list-style-type: none"> <li>• Sometimes the document contains two names: one of the author and one of the person who uploaded the blog post. Only code the name of the person who has written the blog post.</li> <li>• Not each blog post has an author. In that case, do not code.</li> </ul>
1.3 Date	The date the blog post is written.	
1.4 Section	The section(s) where the blog post has been uploaded.	<ul style="list-style-type: none"> <li>• Not each blog post has a description of the sections. In that case, do not code.</li> </ul>
1.5 Word count	On top of the document is a tag applied that presents the number of words in the blog post.	
1.6 Title	The title of the blog post.	
1.7 Cross-posted	The blog post is published on more than one location.	<ul style="list-style-type: none"> <li>• Not each blog post is cross-posted. In that case, do not code.</li> </ul>

4.2 Basic Entities Recognized or Constructed

Unit of analysis: blog post.

CODE		DESCRIPTION	REMARKS
2.1	Social		
2.1.1	Legislation & Regulation	Statutory law and the processes of monitoring and enforcing these, and, written instruments that contain rules.	Including: Laws; Policies; Declarations; Political Programs; Loss & Damage mechanism; Human Rights; (Draft) Agreements; Carbon Targets; Adaptation & Mitigation Measures.
2.1.2	Economic & Financial Activities	Activities that are undertaken to achieve economic or financial goals.	Including: Climate Finance; Green Climate Fund; Economic Growth; Economic Recession; Green Economy; Economic Risks; Financial Investments; Financial Divesting; Competition; Financial Sector (e.g. Pension Funds); Prices; Carbon Trading; Jobs; Taxes; Government Budgets and Expenses.
2.1.3	Behaviour Changes to address climate change	Any sort of changes in people's behaviour in order to address climate change.	Including: Energy Consumption Behaviours; Energy Waste Behaviours; Food Consumption Behaviours; Food Waste Behaviours; Changing Diets.
2.1.4	Human Wellbeing	Indicators of people's physical, emotional, and mental wellbeing.	Including: Poverty; Vulnerability; Public Health; Health Risks; Diseases; Human Wellbeing.
2.1.5	Knowledge	The theoretical or practical understanding of a subject.	Including: Absence, Uncertainty or Ignorance of Knowledge; Advice Reports; Scientific Knowledge; Climate Science; Theories; Models; Observations; Studies; Scientific Consensus; Graphs; Charts; Stats; Uncertainty; IPCC reports; Science Presentations; Data; Evidence; Journals; Papers; Claims; Assumptions; Education.

2.1.6	Politics	The process of making decisions applying to all members of a group.	Including: Historic and Differentiated Responsibility; Conferences; Political Power Investments (money, time, energy, leadership); Government Agenda's; Climate Negotiations; Conflict; Conspiracy; Climate Scepticism as a Phenomenon; Climate Sceptics.
2.1.7	Media	Communication outlets that provide information.	Including: Newspapers; Television Broadcasting; Radio; Social Media; Books; Websites.
2.1.8	Events & Activities	Social events or activities that take place, especially ones of importance.	Including: Campaigns; Projects; Protests; Public Performances, Civic disobedience.
2.1.9	Culture	The ideas, customs, and social behaviour of particular people or society's.	Including: Religion.
2.2	Natural		
2.2.1	Ecology	Organisms and their environment.	Including: Natural Habitats; Animals; Species; Soils; Plants; Trees.
2.2.2	Causes of Climate Change	Factors that cause changes in the climate, both anthropogenic and non-human.	Including: Carbon Dioxide; Human Activities; Natural Aerosols, Ozone, CFCs; Cosmic Rays; (Cloud) Feedbacks; Waves.
2.2.3	Consequences of Climate Change	Consequences of changes in the climate, both anthropogenic and non-human.	Including: Extreme Weather Events; Tempering Effects of the Oceans; Changes in Sea Ice; Changes in Sea Levels; Changes in Antarctic Ice Shelves.
2.3	Technology		
2.3.1	Transportation	Vehicles that transport people from one location to another.	Including: Cars; Airplanes, Ships; Trains; Public Transport.
2.3.2	Energy Technologies	Technologies that are concerned with energy generation.	Including: Energy Generation; Energy Efficiency; Renewable Energy; Renewable Technologies; Coal Power Plants; Fossil Fuels; Biomass; Nuclear Power.

2.3.3	Industrial Systems	Tools, systems, or equipment that are deployed in industrial contexts.	Including: Unsustainable fishing gear; Storage Systems.
2.4	Transcendence		
2.4.1	Priorities	Preferential ratings.	Including: Priorities of Politicians; Prioritization of Problems (the problem of climate change versus other problems); 'The Most Important' Actions; Main Concerns.
2.4.2	Ethics	Moral principles.	Including: Right or Wrong (Scientific Conduct); Morals; Inhumane Behaviour.
2.4.3	Risk Perceptions	People's perceptions about the causes, consequences and risks of climate change.	Including: Beliefs; Attitudes; Opinion; Risk Perceptions; The Act of Engagement.
2.4.4	Ideology	A system of ideas and ideals that form the basis of economic or political theory and policy.	Including: Republicans; Democrats; Liberal; Political Parties; Conservative; Communist; Environmentalism; Greens; Right Wing; Left Wing; Radical Visions; Western Capitalists; Socialists.

#### 4.3 Assumptions about Natural Relationships

Unit of analysis: sentences.

CODE	DESCRIPTION	REMARKS
3.1	Scale of Impacts	
3.1.1	Global Level Impact	Consequences of climate change, both anthropogenic and non-human, on a global scale. Including: Continental level.
3.1.2	National Level Impact	Consequences of climate change, both anthropogenic and non-human, on a national scale.
3.1.3	Regional Level Impact	Consequences of climate change, both anthropogenic and non-human, on a regional scale. Including: the Arctic and Antarctic; Regions and States within a Country.
3.1.4	Local Level Impact	Consequences of climate change, both anthropogenic and non-human, on a local scale. Including: Communities; Villages; Cities.
3.1.5	Undefined Level Impact	Consequences of climate change, both anthropogenic and non-human, of which the scale is undefined. Including: 'the impacts of climate change.'; Detailed description of the consequences without reference to where these will occur.

3.2	The Causes of Anthropogenic Climate Change	Assumptions that anthropogenic factors cause changes in the climate.	Including: CO2 causes Anthropogenic Climate Change (ACC); Human Activities cause ACC.
3.3	Non-Human Causes of Climate Change	Assumptions about what non-human factors cause changes in the climate.	Including: No link between CO2 and global warming; Cosmic rays and solar radiation cause global warming; CFCs cause global warming; It is natural variability, not climate change; Other activities than CO2 drive a rise in atmospheric water vapour; World has always been warming; It is sublimation, not climate change; High feedbacks greatly over-predict past warming; Human activities do not cause global warming; CO2 is not a greenhouse gas; Waves play a role in the future of sea ice; Internal, chaotic variability in the ocean and atmosphere circulation causing small changes in cloud cover, which causes warming or cooling; Total energy output cause natural variability; Global warming pause; Land use changes and urbanization cause warming.
3.4	The Consequences of Anthropogenic Climate Change	Assumptions about the consequences of anthropogenic climate change.	Including: Extreme Weather Events; Sea ice vanishes; Sea temperatures are rising; Oceans acidify; Rainforests suffer dieback; Oceans are getting warmer; Declining specie populations, Increasing surface air temperature; Moving vegetation zones.
3.5	Non-Human Consequences of Climate Change	Assumptions about non-human changes in the environment that are thus not caused by human activities.	Including: Extreme Weather Events are not caused by global warming; Recovering sea ice; Dropping sea levels; Absorbed heat by oceans has little impact on the temperatures of the oceans to depth; Declining species populations do not reflect global warming; Surface air temperature has dropped; Global cooling.

#### 4.4 Key Agents and their Motives

Unit of analysis: sentences.

	CODE	DESCRIPTION	REMARKS
4.1	Heroes: Politicians	Politicians who are being portrayed as heroes.	Including: Presidents; Ministries; United Nation: European Union; Governments.
4.2	Heroes: Scientists	Scientists who are being portrayed as heroes.	Including: Intergovernmental Panel on Climate Change (IPCC); Scientific Organizations; Academies; 'UN Scientists'.
4.3	Heroes: Nation States	Nation States that are being portrayed as heroes.	Including: Countries; Europe; the West; Developing countries; Emerging Economies; Industrialized Countries.
4.4	Heroes: Businesses	Businesses that are being portrayed as heroes.	Including: Policy Organizations; Investors; Funders; Industries; Associations.
4.5	Heroes: Media	Media that are being portrayed as heroes.	Including: Television Broadcasters; Television Hosts; Radio Channels; Newspapers; Websites; Authors; Journalists; Press Agencies; Columnists.
4.6	Heroes: General Public	Members of the general public who are being portrayed as heroes.	Including: 'You'; Civil Society; People; Representatives of People; Communities; Young People; Children; The Public; Individuals.
4.7	Heroes: Celebrities	Celebrities who are being portrayed as heroes.	Including: Royalties.
4.8	Heroes: Climate Sceptics	Climate Sceptics who are being portrayed as heroes.	Including: Climate Sceptic Bloggers Themselves.
4.9	Heroes: Climate Activists	Climate Activists who are being portrayed as heroes.	Including: Climate Activist Bloggers Themselves; Environmentalists; Environmental Movement.
4.10	Heroes: Religious Leaders	Religious Leaders who are being portrayed as heroes.	

4.11	Heroes: Others	People who are being portrayed as a hero, but the blogger does not explicitly assign a role to them or none of the other 'Heroes' codes cover their role.	
4.12	Villains: Politicians	Politicians who are being portrayed as villains.	Including: Presidents; Ministries; United Nation: European Union; Governments; Bureaucrats.
4.13	Villains: Scientists	Scientists who are being portrayed as villains.	Including: Intergovernmental Panel on Climate Change (IPCC); Scientific Organizations; Academies; 'UN Scientists'.
4.14	Villains: Nation States	Nation States that are being portrayed as villains.	Including: Countries; Europe; the West; Developing countries; Emerging Economies; Industrialized Countries.
4.15	Villains: Businesses	Businesses that are being portrayed as villains.	Including: Policy Organizations; Investors; Funders; Industries; Associations.
4.16	Villains: Media	Media that are being portrayed as villains.	Including: Television Broadcasters; Television Hosts; Radio Channels; Newspapers; Websites; Authors; Journalists; Press Agencies; Columnists.
4.17	Villains: General Public	Members of the general public who are being portrayed as villains.	Including: 'You'; Civil Society; People; Representatives of People; Communities; Young People; Children; The Public; Individuals.
4.18	Villains: Celebrities	Celebrities who are being portrayed as villains.	Including: Royalties.
4.19	Villains: Climate Sceptics	Climate Sceptics who are being portrayed as villains.	Including: Climate Sceptic Bloggers Themselves.
4.20	Villains: Climate Activists	Climate Activists who are being portrayed as villains.	Including: Climate Activist Bloggers Themselves; Environmentalists; Environmental Movement.

4.21	Villains: Religious Leaders	Religious Leaders who are being portrayed as villains.	
4.22	Villains: Others	People who are being portrayed as a villain, but the blogger does not explicitly assign a role to them or none of the other 'Villains' codes cover their role.	Including: 'Propagandists and Prophets'.
4.23	Victims: Politicians	Politicians who are being portrayed as victims.	Including: Presidents; Ministries; United Nation: European Union; Governments; Bureaucrats.
4.24	Victims: Scientists	Scientists who are being portrayed as victims.	Including: Intergovernmental Panel on Climate Change (IPCC); Scientific Organizations; Academies; 'UN Scientists'.
4.25	Victims: Nation States	Nation States that are being portrayed as victims.	Including: Countries; Europe; the West; Developing countries; Emerging Economies; Industrialized Countries.
4.26	Victims: Businesses	Businesses that are being portrayed as victims.	Including: Policy Organizations; Investors; Funders; Industries; Associations.
4.27	Victims: Media	Media that are being portrayed as victims.	Including: Television Broadcasters; Television Hosts; Radio Channels; Newspapers; Websites; Authors; Journalists; Press Agencies; Columnists.
4.28	Victims: General Public	Members of the general public who are being portrayed as victims.	Including: 'You'; Civil Society; People; Representatives of People; Communities; Young People; Children; The Public; Individuals.
4.29	Victims: Celebrities	Celebrities who are being portrayed as victims.	Including: Royalties.
4.30	Victims: Climate Sceptics	Climate Sceptics who are being portrayed as victims.	Including: Climate Sceptic Bloggers Themselves.

4.31	Victims: Climate Activists	Climate Activists who are being portrayed as victims.	Including: Climate Activist Bloggers Themselves; Environmentalists; Environmental Movement.
4.32	Victims: Religious Leaders	Religious Leaders who are being portrayed as victims.	
4.33	Victims: Others	People who are being portrayed as a victim, but the blogger does not explicitly assign a role to them or none of the other 'Victims' codes cover their role.	Including: 'Propagandists and Prophets'.
4.34	Ignorant Actors: Politicians	Politicians who are being portrayed as ignorant.	Including: Presidents; Ministries; United Nation: European Union; Governments; Bureaucrats.
4.35	Ignorant Actors: Scientists	Scientists who are being portrayed as ignorant.	Including: Intergovernmental Panel on Climate Change (IPCC); Scientific Organizations; Academies; 'UN Scientists'
4.36	Ignorant Actors: Nation States	Nation States that are being portrayed as ignorant.	Including: Countries; Europe; the West; Developing countries; Emerging Economies; Industrialized Countries.
4.37	Ignorant Actors: Businesses	Businesses that are being portrayed as ignorant.	Including: Policy Organizations; Investors; Funders; Industries; Associations.
4.38	Ignorant Actors: Media	Media that are being portrayed as ignorant.	Including: Television Broadcasters; Television Hosts; Radio Channels; Newspapers; Websites; Authors; Journalists; Press Agencies; Columnists.
4.39	Ignorant Actors: General Public	Members of the general public who are being portrayed as ignorant.	Including: 'You'; Civil Society; People; Representatives of People; Communities; Young People; Children; The Public; Individuals.
4.40	Ignorant Actors: Celebrities	Celebrities who are being portrayed as ignorant.	Including: Royalties.

4.41	Ignorant Actors: Climate Sceptics	Climate Sceptics who are being portrayed as ignorant.	Including: Climate Sceptic Bloggers Themselves.
4.42	Ignorant Actors: Climate Activists	Climate Activists who are being portrayed as ignorant.	Including: Climate Activist Bloggers Themselves; Environmentalists; Environmental Movement.
4.43	Ignorant Actors: Religious Leaders	Religious Leaders who are being portrayed as ignorant.	
4.44	Ignorant Actors: Others	People who are being portrayed as an ignorant actor, but the blogger does not explicitly assign a role to them or none of the other 'Ignorant Actors' codes cover their role.	Including: 'Propagandists'; 'Prophets'.

#### 4.5 Metaphors and Rhetorical Devices

Unit of analysis: sentences.

	CODE	DESCRIPTION	REMARKS
5.1	Rhetorical Devices related to Science		
5.1.1	No Evidence for Climate Change	Claims that there is no evidence for anthropogenic climate change or a consensus.	Including: '97% of the scientists agree statement is inaccurate'; Uncertainty; Reality Disproves Science.
5.1.2	Evidence for Climate Change	Claims that there is evidence or a consensus that anthropogenic climate change is happening.	Including: '97% of the Scientists Agree'; 'Scientists Agree'; 'Underpinning Science'; 'According to the Science'; 'Overwhelming Evidence'.



5.1.3	The Science is Not Sound	Claims that assert that the science is not sound.	Including: Contradicting evidence; Scientific Illiteracy; Unreliable Models; Misleading Models; Scientific Objectivity versus Subjectivity; Errors; Bad Science; Questioning the Reliability and Validity; Flaws in the Global Warming Theory; Pseudo-Science; Cherry-picking.
5.1.4	The Science is Sound	Claims that assert that the science is sound.	Including: 'Prestigious journal'; 'Peer-Reviewed paper'; 'Actual Empirical Evidence'; 'Well-Tested'; 'Truly Representative'; 'Not Cherry-Picked'.
5.1.5	Climate Change is a Conspiracy	Claims that assert that the consensus on climate change is based on conspiracies to produce false data or suppress dissent.	Including: 'Conspiracy'; 'Fraudulent'; 'Misleading'; 'Manipulating'; Propaganda'; 'Circus'; 'Propagandists'; 'Fabricated'; 'Quackery'; 'Massaging the Science'.
5.1.6	Climate Change is not a Conspiracy	Claims that assert that the consensus on climate change is not based on conspiracies to produce false data or suppress dissent.	
5.1.7	Climate Change is a Religion	Claims that assert that climate change is a religion rather than science.	Including: 'Prophets'; 'Evangelize'; Climate Orthodoxy.
5.1.8	Climate Change is not a Religion	Claims that assert that climate change is not a religion.	
5.1.9	Climate Change is Real	Claims that assert that climate change is real and therefore part of reality.	
5.1.10	Climate Change is Fictional	Claims that assert that climate change is fictional and therefore not part of reality.	Including: References to Fairy Tales; Imagination.
5.2	Rhetorical Devices related to Conferences		

5.2.1	Conference is an Opportunity	Claims that assert that the conference is an opportunity.	
5.2.2	Conference is a Threat	Claims that assert that the conference is a threat.	
5.2.3	Conference is Not Well Organized	Claims that indicate that the conference itself or conference process is not well organized or ineffective.	
5.2.4	Conference is Well Organized	Claims that indicate that the conference itself or conference process is well organized and effective.	
5.2.5	Reaching an agreement is negative	Claims that indicate that failing to reach or having an unambitious agreement is positive, or, claims that indicate that reaching an agreement or having an ambitious agreement is negative.	
5.2.6	Reaching an agreement is positive	Claims that indicate reaching or having an ambitious agreement is positive, or, claims that indicate that failing to reach an agreement or having an unambitious agreement is negative.	
5.2.7	Effective time management is crucial	Claims that assert that effective time management is crucial.	Including: 'Urgent'.
5.2.8	No rush	Claims that assert that people should not rush, but instead take the time.	
5.2.9	Conference is a success	Claims that assert that the conference's outcome was a success.	

5.2.10	Conference is a failure	Claims that assert that the conference's outcome was a failure.	
5.3	Rhetorical Devices related to Judgments		
5.3.1	Worrying about climate change is unnecessary, as it is not dangerous	Claims that assert that worrying about climate change is unnecessary, as it is not dangerous.	Including: Spreading unrighteous alarmism and hysteria; 'climate alarmists'; Unnecessarily Scaring People.
5.3.2	Worrying about climate change is necessary, as it is dangerous	Claims that assert that worrying about climate change is necessary, as it is dangerous.	Including: Apocalyptic Framing; 'Catastrophic'; 'Dangerous'; 'Crisis'; 'Threat'; 'Climate Chaos'.
5.3.3	Climate change is a joke	Jokes about statements that 'climate change is a serious problem', which assert that climate change cannot be taken	Including: Sarcasm and Jokes about Climate Change; Making Fun of People who 'Believe in' Climate Change.
5.3.4	Climate change is serious	Claims that assert that climate change is serious.	Including: Most Important Issue.
5.3.5	Acting upon climate change is morally wrong	Claims that assert that acting upon climate change is wrong by appealing to one's moral standards.	Including: 'Immoral' to act upon climate change; 'Irresponsible' to act upon climate change; 'Unfair' to act upon climate change; 'Unethical' to act upon climate change.
5.3.6	Acting upon climate change is morally right	Claims that assert that acting upon climate change is right by appealing to one's moral standards or frame climate change as a social justice issue.	Including: 'Morally right' to act upon climate change; 'Responsible' to act upon climate change; 'Fair' to act upon climate change.
5.3.7	Future generations are not affected if we do not act upon climate change	Claims that assert that future generations will not be affected if climate action remains absent.	
5.3.8	Future generations are affected if we do not act upon climate change	Claims that assert that future generations will be affected if climate action remains absent.	Including: 'Tell my children and grandchildren'; 'Affect children and grandchildren'.

5.3.9	It is economically not beneficial to act upon climate change	Claims that assert that it is economically not beneficial to act upon climate change.	Including: Halts Economic Growth; Hurts the Economy; Change the Economy for the Worse; The West Will Pay for Everything; It will Destroy Jobs.
5.3.10	It is economically beneficial to act upon climate change	Claims that assert that it is economically beneficial to act upon climate change.	Including: Good for the Environment, Good for the Economy; Benefits; Expensive Nuclear; Shifting Saves Costs; Strong Economic Argument to Take Action.
5.3.11	The state of affairs around climate change is pessimistic	Claims about the future that the worst will happen.	Including: Pessimistic.
5.3.12	The state of affairs around climate change is optimistic	Claims that assert hopefulness or confidence about the future.	Including: Optimistically; Good Things are Happening; On the Bright Side; A More Positive Note.
5.3.13	Climate change campaigns are bad	Claims that assert that climate change campaigns are bad.	Including: 'Illegal'; 'Criminal'; 'Harmful'.
5.3.14	Climate change campaigns are good	Claims that assert that climate change campaigns are good.	Including: 'Peaceful'.
5.4	Rhetorical Devices related to Commitment		
5.4.1	Empty promises are positive	Claims that assert that empty promises of actors are positive.	
5.4.2	Empty promises are negative	Claims that assert that empty promises of actors are negative.	Including: 'Instead of Just Talking About It'; 'The Words Rang Hollow'; No Action, Just Promises; Meaningless if Action does Not Follow.
5.4.3	Little support for climate action	Claims that assert that there is little or a loose of support for climate action.	

5.4.4	A lot of support for climate action	Claims that assert that there is a lot of or growing support for climate action.	Including: 'Hundreds of Protests'; People are calling for climate action; 'Thousands of People'.
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#### 4.6 Normative Judgments

Unit of analysis: sentences.

	CODE	DESCRIPTION	Remarks
6.1	Social Normative Judgments		
6.1.1	We/They need an agreement	Claims about the need of a (legal) satisfactory agreement.	Including: Fair, Ambitious, and Binding (FAB) targets; Treaty; Carbon Budget; Assessment Indicators; Emission Reduction Targets.
6.1.2	We/They need long-term commitments on finance	Claims about the need of commitments on finance.	Including: Long-Term Commitments.
6.1.3	We/They need to suspend climate target until other countries commit as well	Claims about the need to suspend climate targets until other countries commit on climate targets as well.	
6.1.4	We/They need to take action	Claims about the need to take any sort of climate action.	Including: Precautionary Action; Effective Action; Loss & Damage Programs; Mitigation & Adaptation Measures; Resilience Building.
6.1.5	We/They need to act now/fast	Claims about the need to act upon climate change now, rapidly or urgently.	
6.1.6	We/They should stop organizing COPs or change the organization	Claims that COPs should not be organized anymore or should be organized differently.	
6.1.7	We/They need to move away from fossil fuels and invest in renewable energies	Claims about the need to move away from fossil fuels and instead invest in renewable energies.	
6.1.8	We/They need to change our consumption and waste behaviours	Claims about the need to change (any specific) consumption and waste behaviours.	

6.1.9	We/They need to invest in nuclear power	Claims about the need to invest in nuclear power.	
6.1.10	We/They need to revisit the science	Claims about the need to revisit the science.	Including: 'Scientists must be sceptics'
6.1.11	We/They need more public debates between sceptics and activists	Claims about the need to have more public debates between sceptics and activists.	
6.1.12	We/They need to share information about climate change measures	Claims about the need to share information about climate change measures.	Including: Sharing Techniques.
6.1.13	We/They need to invest research into the development of new techniques	Claims about the need to invest research into the development of new techniques.	
6.1.14	We/They need political commitment and leadership	Claims about the need for political commitment and leadership.	
6.1.15	We/They need to campaign and work together	Claims about the need to campaign for climate change and/or work together on action for climate change.	
6.1.17	We/They should hold people accountable for their actions	Claims about the need to hold the people accountable for their actions.	
6.1.17	Organizations should direct efforts towards measures that solve 'real' problems other than climate change	Claims that organizations should direct efforts towards measures that solve 'real' problems other than climate change.	

6.1.18	We/They should boycott organizations advocating for climate change	Claims about the need to boycott organizations that advocate for climate change.	
6.1.19	Businesses should not mislead children by secretly advocating for climate change	Claims that businesses should not mislead children by secretly advocating for climate change.	
6.1.20	Bloggers and commenters should be appropriate	Claims that bloggers and commenters should behave appropriately in their posts and comments.	
6.1.21	Climate sceptics need education or are wrong	Claims about the need that sceptics need education or should be corrected since they are wrong.	
6.1.22	Everyone should have access to good nutrition	Claims that everyone should have access to good nutrition.	
6.1.23	We/They need to communicate with the public about climate change	Claims about the need to communicate with the public about climate change.	
6.1.24	We/They should not spend any money on climate change	Claims that there should not be spend any money on climate change.	
6.1.25	We/They should shut the United Nations down	Claims that the United Nations should be shut down.	
6.2	Normative Judgments related to Nature		
6.2.1	Nature should be protected	Claims that nature should be protected.	

6.2.2	Forest should not be deforested and degraded	Claims that forests should not be deforested and degraded.
6.2.3	Global temperature should not rise more than 2 degrees	Claims that global temperature should not rise more than 2 degrees.
6.2.4	Global temperature should not rise more than 1.5 degrees	Claims that global temperature should not rise more than 1.5 degrees.
6.3	Technological Normative Judgments	
6.3.1	The moon should be industrialized	Claims about the need to industrialize the moon.
6.4	Transcendent Normative Judgments	
6.4.1	Developing Countries should not suffer more	Claims that developing countries should not suffer more.
6.4.2	Developed countries should not suffer more	Claims that developed countries should not suffer more.
6.4.3	Campaigns should not be inappropriate	Claims that campaigns should not be inappropriate.
6.4.4	We/They should take it easy and share this planet in good faith	Claims about the need to take it easy and share the planet in good faith.
6.4.5	We/They must reflect on the dangers of climate change	Claims about the need to reflect on the dangers of climate change.
6.4.6	We/They should speak up for equity and climate justice	Claims about the need to speak up for equity and climate justice.

6.4.7	We/They should create a world where the poor live a lifestyle that is great	Claims about the need to create a world where the poor live a lifestyle that is great.
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## Description of blogs

### 1. ... and Then There's Physics

This blog is run by Ken Rice, a Professor of Computational Astrophysics at the University of Edinburgh. While the blog's initial goal was to address climate science claims made on *Watts Up With That*, the blog now has a wider scope on climate change. In 2019, the blog published 100 blog posts. A typical post receives between 50-200 comments approximately.

Link to survey: [andthentheresphysics.wordpress.com/2019/10/09/a-survey-of-blog-audiences](https://andthentheresphysics.wordpress.com/2019/10/09/a-survey-of-blog-audiences)

### 2. Brussels Blog

The *Brussels Blog* is run by Geoff Beacon, who mostly writes about climate science and the need for climate change adaptation and climate mitigation. In 2019, the blog published 32 blog posts. A typical blog post receives between 0-5 comments approximately.

Link to survey: [www.brusselsblog.co.uk/a-survey-for-research-at-cambridge-and-wageningen-universities](https://www.brusselsblog.co.uk/a-survey-for-research-at-cambridge-and-wageningen-universities)

### 3. Climate Action Australia

*Climate Action Australia* is run by John Pratt, who mostly writes about the need for climate change action and posts about different climate events. A typical blog post receives between 0-5 comments approximately.

Link to survey: [climateactionaustralia.wordpress.com](https://climateactionaustralia.wordpress.com)

### 4. Climate Denial Crock of the Week

This blog is run by Peter Sinclair, a videographer specializing in issues of climate change and renewable energy solutions. Sinclair has produced more than 100 videos on his blog, which are 'sharply satirical and scientifically rigorous responses to the many bits of climate science misinformation, and disinformation, often seen on the internet, which Mr. Sinclair calls the 'Climate Cocks'. A typical blog posts receives between 0-20 comments approximately.

Link to survey: [climatecrocks.com/2019/10/08/take-the-climate-blog-survey](https://climatecrocks.com/2019/10/08/take-the-climate-blog-survey)

### 5. ClimateSight

*ClimateSight* is run by Dr Kaitlin Naughten, who is an ocean modeller at the British Antarctic Survey in Cambridge. The blog is a record of her research as a young climate scientists, which was initially setup to help address the gap between climate science and public understanding. On 16/09/2020, *ClimateSight* had 641,421 hits. In 2019, four blog posts were published on the blog. A typical blog post receives between 0-20 comments.

Link to survey: [climatesight.org/2019/10/21/we-need-your-help-share-your-views-on-climate-change-with-us](https://climatesight.org/2019/10/21/we-need-your-help-share-your-views-on-climate-change-with-us)

### 6. Don't look now

The blog *Don't look now* is run by Geoff Beacon, who mostly writes about climate science and the need for climate change adaptation and climate mitigation. In 2019, the blog published 17 blog posts. A typical blog post receives between 0-5 comments approximately.

Link to survey: [dontlooknow.org/2019/10/11/a-survey-for-research-at-cambridge-and-wageningen-universities](https://dontlooknow.org/2019/10/11/a-survey-for-research-at-cambridge-and-wageningen-universities)

### 7. The Green New Wave

This blog is run by Thomas Fuller. The blog aims to show how the *Green New Deal* could work in practice. In the blog posts, analyses and opinions about the Green New Deal are shared. In 2019, the blog published 26 blog posts. On 17/09/2020, *The Green New Wave* had 1,702 hits. A typical blog post receives between 0-5 comments approximately.

Link to survey: [thegreennewwave.com/2019/10/11/a-climate-survey-not-mine](https://thegreennewwave.com/2019/10/11/a-climate-survey-not-mine)

### 8. HotWhopper

The blog *HotWhopper* is run by Sou (pseudonym), a woman with an interest climate science. The blog is about climate, with humor, and solid science. In 2019, the blog published 25 blog posts. A typical blog post receives between 10-50 comments approximately.

Link to survey: [blog.hotwhopper.com/2019/10/do-your-bit-help-with-survey-of-climate.html](https://blog.hotwhopper.com/2019/10/do-your-bit-help-with-survey-of-climate.html)

### 9. RealClimate

*RealClimate* is run by working climate scientists. The blog aims to provide quick commentary on climate science by contextualizing mainstream commentary. In 2019, the blog published 44 blog posts. A typical blog post receives between 20-500 comments approximately.

Link to survey: [www.RealClimate.org/index.php/archives/2019/10/do-you-want-to-share-your-views-on-climate-change-and-reading-blog](https://www.RealClimate.org/index.php/archives/2019/10/do-you-want-to-share-your-views-on-climate-change-and-reading-blog)

### 10. Stoa

Stoa is run by William M. Connolley, who was formerly a climate modeller and currently a software engineer for Cambridge Silicon Radio (see Wikipedia). The blog publishes about climate issues. On 17/09/2020, Stoa had 7,970 hits last month. In 2019, the blog published 31 blog posts. A typical blog post receives between 0-75 comments approximately.

Link to survey: [mustelid.blogspot.com/2019/10/a-survey-of-blog-audiences.html](https://mustelid.blogspot.com/2019/10/a-survey-of-blog-audiences.html)



11. Under The Banyan

Under the Banyan is run by Mike Shanahan, who is a rainforest biologist, journalist, and author of the book Ladders to Heaven. The blog is about the environment and in particularly climate change and biodiversity loss. On 17/09/2020, 4,276 people subscribed to the blog to receive notification via email. In 2019, the blog published 6 blog posts. A typical blog post receives between 0-5 comments approximately. The survey was published in a text box on top of the website.

12. 3000 Quads

This blog is run by Thomas Fuller, who mostly writes about energy. On 17/09/2020, 3000 Quads had 60,786 hits. In 2019, the blog published 2 blog posts. A typical blog post receives between 0-10 comments approximately.  
Link to survey: [3000quads.com/2019/10/10/a-climate-survey-and-its-not-even-mine](https://3000quads.com/2019/10/10/a-climate-survey-and-its-not-even-mine)

SUPPLEMENTAL MATERIAL V

Survey items

MEASUREMENT SCALE	RISK PERCEPTION INDEX ITEMS (M = 5.73, SD = 1.40, $\alpha$ = 0.95)
1 = Not concerned at all, 7 = Very concerned	How concerned are you about climate change?
1 = Very unlikely, 7 = Very likely	In your judgment, how likely are you, sometime during your life, to experience serious threats to your health or overall well-being, as a result of climate change?
1 = Very unlikely, 7 = Very likely	In your judgment, how likely do you think it is that climate change will have very harmful, long-term impacts on society?
1 = Not serious at all, 7 = Very Serious	How serious of a threat do you think that climate change is to the natural environment?
1 = Not serious at all, 7 = Very Serious	How serious would you rate current impacts of climate change around the world?
1 = Not serious at all, 7 = Very Serious	How serious of a threat do you believe that climate change is, to you personally?
1 = Not serious at all, 7 = Very Serious	How serious would you estimate the impacts of climate change for your country of residence?
1 = Very Rarely, 7 = Very Frequently	How often do you worry about the potentially negative consequences of climate change?
MEASUREMENT SCALE	KNOWLEDGE ABOUT CLIMATE CHANGE
1 = Major, 2 = Minor, 3 = No Contribution to Climate Change, 4 = I really don't know	Natural Cause-Knowledge Index Items (M = 0.85, SD = 0.19, $\alpha$ = 0.40) The sun, Volcanic eruptions, Influence of other planets, Flat earth, Natural variability (e.g. El Niño).
1 = Major, 2 = Minor, 3 = No Contribution to Climate Change, 4 = I really don't know	Human Cause-Knowledge Index Items (M = 0.86, SD = 0.12, $\alpha$ = 0.45) Burning fossil fuels (coal, oil, gas) for heat and electricity, Flying/Commercial air travel, Toxic waste, Steadily rising CO2 emissions (carbon dioxide), Smoking cigarettes, Nuclear power plants, Driving a fossil fuel based car, Rising global sea level, Agricultural activities such as cattle breeding (cows raised for meat consumption), Acid rain, Deforestation (e.g. deconstruction of rainforests), Aerosol spray cans (containing CFCs).

1 = Likely to Decrease 2 = No Change, 3 = Likely to Increase, 4 = I really don't know	Impact-Knowledge Index Items (M = 0.86, SD = 0.16, $\alpha$ = 0.77) Global sea level, Melting of glaciers and polar ice caps, Areas in the world experiencing drought, Global spread of infectious disease, Light pollution, Global average temperature, Extreme weather events (e.g. flooding, hurricanes, etc.), Global biodiversity (i.e. variety of plants and animals), Volcanic eruptions, Household waste, Frequency of hot days and nights, Global fresh water supply.
1 = Reduce climate change a lot, 2 = Reduce climate change a little, 3 = Not going to reduce climate change at all, 4 = Don't know	Response-Knowledge Index Items (M = 0.85, SD = 0.16, $\alpha$ = 0.68) Switching from fossil fuels to renewable energy (wind, solar, geothermal), Generating less toxic waste (nuclear, chemical), Recycling paper, glass, and plastic, Stop drinking sugar calories, Insulating buildings, Reducing the amount of (commercial) airline flights, Conserving energy, Fixing the hole in the ozone layer, Switching from petrol to electric cars, Eating less meat, Using more public transportation, Planting trees.
0%-100%	Scientific Consensus (M = 93.68, SD = 13.69) To the best of your knowledge, what percentage of climate scientists have concluded that human-caused climate change is happening?
<b>MEASUREMENT SCALE</b>	<b>AFFECT INDEX ITEMS</b> (M = 6.55, SD = 0.82, $\alpha$ = 0.94)
1= Very unpleasant, 7 = Very pleasant	I see climate change as something that is...
1 = Very unfavourable, 7 = Very favourable	Overall, I think that climate change is...
1 = Strongly disagree, 7 = Strongly agree	I believe that climate change is something very positive...
<b>MEASUREMENT SCALE</b>	<b>PERSONAL EXPERIENCE WITH EXTREME WEATHER ITEM</b> (M = 0.81, SD = 0.39)
1 = Never, 2 = Once, 3 = Twice, 4 = More than three, 5 = Can't remember	Considering roughly the last 5 years, how often (in total) have you personally experienced any type of extreme weather event in your local area within your country of residence? For example, flooding, severe heat waves, droughts, freak storms or hurricanes?
<b>MEASUREMENT SCALE</b>	<b>SOCIAL NORMS ITEMS</b>
1 = Strongly disagree, 7 = Strongly agree	<b>Descriptive Norm (Index)</b> (M = 4.01, SD = 1.46, $\alpha$ = 0.87) Most people who are important to me, are personally doing something to help reduce the risk of climate change.

1 = Strongly disagree, 7 = Strongly agree	Most people I care about are doing their bit to help slow climate change.
1 = Very unlikely, 7 = Very likely	How likely do you think it is that people close to you are taking personal action to address climate change?
1 = Strongly disagree, 7 = Strongly agree	<b>Prescriptive Norm (Index)</b> (M = 5.05, SD = 1.24, $\alpha$ = 0.79) It is generally expected of me that I do my bit to help reduce the risk of climate change.
1 = Strongly disagree, 7 = Strongly agree	People that are important to me, would support me if I decided to help reduce climate change.
1 = Strongly disagree, 7 = Strongly agree	People whose opinion I value, think that I should personally act to reduce climate change.
1 = Strongly disagree, 7 = Strongly agree	I feel that helping to tackle climate change is something that is NOT expected of me.
<b>MEASUREMENT SCALE</b>	<b>BROAD VALUE ORIENTATIONS ITEMS</b>
1 = Opposed to my values, 9 = Of Supreme Importance	<b>Biospheric Values (Index)</b> (M = 7.22, SD = 1.50, $\alpha$ = 0.90) Respecting the Earth (harmony with other species), Protecting the Environment (preserving nature), Preventing Pollution (protecting natural resources), Unity with Nature (fitting into nature).
1 = Opposed to my values, 9 = Of Supreme Importance	<b>Socio-Altruistic Values (Index)</b> (M = 7.19, SD = 1.36, $\alpha$ = 0.82) Peace (a world free of war and conflict), Equality (equal opportunity for all), Helpful (working for the welfare of others), Social Justice (correcting injustice, care for the weak).
1 = Opposed to my values, 9 = Of Supreme Importance	<b>Egoistic Values (Index)</b> (M = 3.58, SD = 1.06, $\alpha$ = 0.57) Authority (the right to lead or command), Influential (having an impact on people and events), Social Power (control over others, dominance), Wealth (material possessions, money).
<b>MEASUREMENT SCALE</b>	<b>TRUST IN SOURCES OF INFORMATION ABOUT CLIMATE CHANGE ITEMS</b>
1 = Strongly distrust, 7 = Strongly trust	<b>Trust in scientists</b> (M = 6.38, SD = 1.16) How much do you trust scientists as a source of information about climate change?
1 = Strongly distrust, 7 = Strongly trust	<b>Trust in climate mainstream blogs</b> (M = 5.70, SD = 1.31) How much do you trust blogs that support evidence for human-caused climate change as a source of information?

1 = Strongly distrust, 7 = Strongly trust	<b>Trust in climate sceptical blogs</b> (M = 6.30, SD = 1.19) How much do you trust blogs that <i>reject</i> evidence for human-caused climate change as a source of information?
MEASUREMENT SCALE	SOCIO-DEMOGRAPHIC ITEMS
1 = Male, 2 = Female, 3 = Not listed, ..., 4 = Prefer not to answer	Gender Female: 10.4% Male: 89.6%
1 = 24 or younger, 2 = 25-34, 3 = 35-44, 4 = 45-54, 5 = 55-65, 6 = 66 or older	Age 24 or younger: 2.2% 25-34: 5.9% 35-44: 8.8% 45-54: 17.8% 55-65: 32.8% 66 or older: 32.5%
1 = no qualification, 2 = High school degree or equivalent, 3 = Vocational degree or equivalent, 4 = Bachelors' degree or equivalent, 5 = Master's degree or equivalent, 6 = Doctoral degree (e.g. PhD), 7 = Prefer not to answer	Education No qualification: 1.3% High school degree or equivalent: 5.6% Vocational degree or equivalent: 5.5% Bachelor's degree or equivalent: 27.6% Master's degree or equivalent: 32.2% Doctoral degree: 26.9% Prefer not to answer: 0.9%
List of countries alphabetically ordered	Country of Residence United States: 44.7% United Kingdom: 12.3% Australia: 9.2% Canada: 7.4% The Netherlands: 4.5% Other: 21.9%
1 = Far below average, 2 = Below average, 3 = Somewhat below average, 4 = Average, 5 = Somewhat above average, 6 = Above average, 7 = Far above average	Income Far below average: 6.4% Below average: 7.7% Somewhat below average: 9.3% Average: 11.4% Somewhat above average: 17.5% Above average: 37.4% Far above average: 10.2%
0 = Left-wing, 7 = Right-wing	Political Views Left-wing: 85.8% Right-wing: 14.2%

OVERVIEW COEFFICIENTS OF MULTIPLE REGRESSION CCRPM+

MODEL	UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS
	B	STD. ERROR	BETA
1 (Constant)	4.105	.250	
Gender	.374	.153	.082
Income	-.087	.027	-.107
Political views	1.894	.134	.474
2 (Constant)	.796	.368	
Gender	.518	.114	.113
Income	-.066	.020	-.081
Political views	.657	.112	.164
Human causes	-2.132	.312	-.185
Impact	3.457	.318	.435
Responses	1.249	.331	.141
Scientific consensus	.020	.004	.200
3 (Constant)	-3.498	.302	
.000	-4.091	-2.905	
Gender	.323	.079	.071
Income	-.033	.014	-.040
Political views	.221	.079	.055
Human causes	-.893	.221	-.077
Impact	.897	.239	.113
Responses	.883	.229	.100
Scientific consensus	.010	.002	.099
Affect	1.034	.041	.608
Personal experience with extreme weather events	.449	.065	.126
4 (Constant)	-3.899	.308	
Gender	.287	.077	.063
Income	-.035	.014	-.043
Political views	.155	.080	.039
Human causes	-.715	.217	-.062
Impact	.882	.232	.111
Responses	.806	.223	.091

t	SIG.	95.0% INTERVAL FOR LOWER BOUND	CONFIDENCE B UPPER BOUND	COLLINEARITY STATISTICS	
				TOLERANCE	VIF
16.406	.000	3.613	4.596		
2.442	.015	.073	.674	.995	1.005
-3.189	.001	-.140	-.033	.994	1.006
14.172	.000	1.632	2.157	.993	1.007
2.161	.031	.073	1.519		
4.550	.000	.294	.741	.963	1.038
-3.247	.001	-.105	-.026	.964	1.037
5.863	.000	.437	.876	.758	1.319
-6.841	.000	-2.743	-1.520	.816	1.225
10.866	.000	2.832	4.082	.372	2.689
3.769	.000	.599	1.900	.425	2.352
5.829	.000	.014	.027	.504	1.984
-11.586					
4.098	.000	.168	.478	.954	1.048
-2.341	.020	-.060	-.005	.955	1.047
2.796	.005	.066	.376	.726	1.377
-4.046	.000	-1.326	-.460	.776	1.289
3.749	.000	.427	1.366	.314	3.189
3.850	.000	.433	1.333	.423	2.363
4.128	.000	.005	.015	.491	2.036
24.951	.000	.952	1.115	.478	2.093
6.913	.000	.321	.576	.858	1.166
-12.678	.000	-4.503	-3.295		
3.717	.000	.135	.439	.934	1.071
-2.534	.011	-.062	-.008	.921	1.086
1.937	.053	-.002	.311	.667	1.499
-3.297	.001	-1.141	-.289	.753	1.328
3.802	.000	.426	1.338	.312	3.202
3.608	.000	.367	1.245	.418	2.393

MODEL	UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS
	B	STD. ERROR	BETA
Scientific consensus	.010	.002	.103
Affect	.945	.043	.556
Personal experience with extreme weather events	.401	.064	.112
Biospheric values	.090	.023	.097
Egoistic values	.001	.023	.001
Altruistic values	.012	.025	.012
Descriptive norm	.057	.021	.059
Prescriptive norm	.008	.026	.007
5 (Constant)	-3.595	.291	
Gender	.290	.073	.063
Income	-.036	.013	-.044
Political views	.097	.075	.024
Human causes	-.673	.204	-.058
Impact	.518	.222	.065
Responses	.555	.212	.063
Scientific consensus	.006	.002	.061
Affect	.765	.045	.450
Personal experience with extreme weather events	.358	.060	.100
Biospheric values	.068	.021	.073
Egoistic values	-.010	.021	-.008
Altruistic values	.023	.023	.022
Descriptive norm	.050	.020	.052
Prescriptive norm	-.001	.025	-.001
Trust in scientists	.093	.028	.077
Trust in climate mainstream	.145	.024	.137
Distrust in climate sceptical blogs	.100	.029	.085

Note: Dependent variable is risk perceptions. Entries are standardized beta coefficients.

t	SIG.	95.0% INTERVAL FOR LOWER BOUND	CONFIDENCE B UPPER BOUND	COLLINEARITY STATISTICS	
				TOLERANCE	VIF
4.387	.000	.006	.015	.485	2.063
22.081	.000	.861	1.030	.419	2.385
6.301	.000	.276	.526	.837	1.194
3.971	.000	.046	.135	.450	2.224
.067	.947	-.043	.046	.919	1.088
.495	.621	-.037	.061	.451	2.219
2.694	.007	.015	.099	.547	1.828
.317	.751	-.044	.060	.485	2.062
-12.354	.000	-4.167	-3.024		
3.979	.000	.147	.433	.928	1.078
-2.782	.006	-.062	-.011	.920	1.087
1.291	.197	-.051	.245	.662	1.510
-3.291	.001	-1.074	-.271	.749	1.336
2.334	.020	.082	.953	.302	3.313
2.621	.009	.139	.971	.411	2.434
2.623	.009	.002	.011	.430	2.325
16.994	.000	.676	.853	.335	2.983
5.951	.000	.240	.476	.827	1.210
3.165	.002	.026	.110	.444	2.253
-.469	.639	-.052	.032	.914	1.094
.981	.327	-.023	.069	.450	2.224
2.518	.012	.011	.089	.546	1.831
-.044	.965	-.050	.048	.484	2.068
3.273	.001	.037	.149	.422	2.372
5.951	.000	.097	.193	.445	2.246
3.476	.001	.043	.156	.395	2.530

Survey items

MEASUREMENT SCALE	RISK PERCEPTION INDEX ITEMS (M = 5.73, SD = 1.40, $\alpha$ = 0.95)
1 = Not concerned at all, 7 = Very concerned	How concerned are you about climate change?
1 = Very unlikely, 7 = Very likely	In your judgment, how likely are you, sometime during your life, to experience serious threats to your health or overall well-being, as a result of climate change?
1 = Very unlikely, 7 = Very likely	In your judgment, how likely do you think it is that climate change will have very harmful, long-term impacts on society?
1 = Not serious at all, 7 = Very Serious	How serious of a threat do you think that climate change is to the natural environment?
1 = Not serious at all, 7 = Very Serious	How serious would you rate current impacts of climate change around the world?
1 = Not serious at all, 7 = Very Serious	How serious of a threat do you believe that climate change is, to you personally?
1 = Not serious at all, 7 = Very Serious	How serious would you estimate the impacts of climate change for your country of residence?
1 = Very Rarely, 7 = Very Frequently	How often do you worry about the potentially negative consequences of climate change?

MEASURES	BLOG CONSUMPTION
1 = Yes, 0 = No	<b>Mainstream Blog Visit Item</b> (M = 0.94, SD = 0.23) Do you visit blogs that support evidence for human-caused climate change? (e.g. RealClimate, ...and Then There's Physics)
0 = 0 days, (...), 31 = 31 days	<b>Mainstream Blog Visits a Month Item</b> (M = 17.66, SD = 10.40) During the last month, how many days have you visited blogs that support evidence for human caused climate change?
0 = 0 hours, (...), 12 = 12 hours	<b>Mainstream Blog Duration of Visits Item</b> (M = 1.11, SD = 1.39) On a day that you visit a blog supporting evidence for human-caused climate change, how much time do you typically spend?
1 = Yes, 0 = No	<b>Sceptical Blog Visit Item</b> (M = 0.48, SD = 0.50) Do you visit blogs that reject evidence for human-caused climate change? (e.g. WattsUpWithThat, Dr. Roy Spencer)
0 = 0 days, (...), 31 = 31 days	<b>Sceptical Blog Visit a Month Item</b> (M = 8.76, SD = 9.78) How many days have you visited blogs that reject evidence for human-caused climate change last month?
0 = 0 hours, (...), 12 = 12 hours	<b>Sceptical Blog Duration of Visits Item</b> (M = 0.87, SD = 1.42) On a day that you visit a blog rejecting evidence for human-caused climate change, how much time do you typically spend?



### Climate change blogs that published the survey

1. **... and Then There's Physics**  
[andthentheresphysics.wordpress.com/2019/10/09/a-survey-of-blog-audiences](http://andthentheresphysics.wordpress.com/2019/10/09/a-survey-of-blog-audiences)
2. **Brussels Blog**  
[www.brusselsblog.co.uk/a-survey-for-research-at-cambridge-and-wageningen-universities](http://www.brusselsblog.co.uk/a-survey-for-research-at-cambridge-and-wageningen-universities)
3. **Climate Action Australia**  
[climateactionaustralia.wordpress.com](http://climateactionaustralia.wordpress.com)
4. **Climate Denial Crock of the Week**  
[climatecrocks.com/2019/10/08/take-the-climate-blog-survey](http://climatecrocks.com/2019/10/08/take-the-climate-blog-survey)
5. **ClimateSight**  
[climatesight.org/2019/10/21/we-need-your-help-share-your-views-on-climate-change-with-us](http://climatesight.org/2019/10/21/we-need-your-help-share-your-views-on-climate-change-with-us)
6. **Don't look now**  
[dontlooknow.org](http://dontlooknow.org)
7. **The Green New Wave**  
[thegreennewwave.com/2019/10/11/a-climate-survey-not-mine](http://thegreennewwave.com/2019/10/11/a-climate-survey-not-mine)
8. **HotWhopper**  
[blog.hotwhopper.com/2019/10/do-your-bit-help-with-survey-of-climate.html](http://blog.hotwhopper.com/2019/10/do-your-bit-help-with-survey-of-climate.html)
9. **RealClimate**  
[www.RealClimate.org/index.php/archives/2019/10/do-you-want-to-share-your-views-on-climate-change-and-reading-blogs](http://www.RealClimate.org/index.php/archives/2019/10/do-you-want-to-share-your-views-on-climate-change-and-reading-blogs)
10. **Stoat**  
[mustelid.blogspot.com/2019/10/a-survey-of-blog-audiences.html](http://mustelid.blogspot.com/2019/10/a-survey-of-blog-audiences.html)
11. **Under The Banyan**  
[underthebanyan.blog](http://underthebanyan.blog)
12. **3000 Quads**  
[3000quads.com/2019/10/10/a-climate-survey-and-its-not-even-mine](http://3000quads.com/2019/10/10/a-climate-survey-and-its-not-even-mine)

## SUPPLEMENTAL MATERIAL IX

Table overview of entire analysis (continues next page)

SEQ		1		2		3		4		5		6	
1.	ACT	I		I		I		I		I		I	
2.	INTERACT	I R		I		I		I		I		I	
3.	DOUBLE INTERACT	I P	P O	I	I N	I	A	I	P O	I	P O D	I R P	P O D
4.	DOUBLE INTERACT	I P	P O							I P	P O	I R P	I N P O
5.	DOUBLE INTERACT	I P	P O							I	I N		
6.	DOUBLE INTERACT	I P R	P O							I R	P O		
7.	DOUBLE INTERACT									I	A		
8.	DOUBLE INTERACT									I R	P O		
9.	DOUBLE INTERACT									I R	I N		
10.	DOUBLE INTERACT									I R P	P O		
11.	DOUBLE INTERACT									I R P	A		
12.	DOUBLE INTERACT									I P	P O		
13.	DOUBLE INTERACT									I	I N		
14.	DOUBLE INTERACT									I	P O		
15.	DOUBLE INTERACT									I R P	P O R E		
16.	DOUBLE INTERACT									I R P	P O		
17.	DOUBLE INTERACT									I P	P O		
18.	DOUBLE INTERACT									P	P O		
19.	DOUBLE INTERACT									P	P O		
20.	DOUBLE INTERACT									R P	P O		
21.	DOUBLE INTERACT									I R P	P O		
22.	DOUBLE INTERACT									R P	P O		
23.	DOUBLE INTERACT									P	P O A		

[illegible]



## SUPPLEMENTAL MATERIAL X

### Overview of the final selection of blogs

BLOGS	NUMBER OF BLOG POSTS
<a href="http://wattsupwiththat.com">wattsupwiththat.com</a> *	1395
<a href="http://RealClimatescience.com">RealClimatescience.com</a> **	388
<a href="http://notrickszone.com">notrickszone.com</a> *	218
<a href="http://iceagenow.info">iceagenow.info</a> *	185
<a href="http://www.masterresource.org">www.masterresource.org</a> *	118
<a href="http://www.climateconversation.org.nz">www.climateconversation.org.nz</a> *	62
<a href="http://gregladen.com/blog">gregladen.com/blog</a> **	59
<a href="http://www.eco-imperialism.com">www.eco-imperialism.com</a> *	55
<a href="http://www.thegwpf.org">www.thegwpf.org</a> *	31
<a href="http://RealClimate.org">RealClimate.org</a> **	24
<a href="http://www.thinkorswim.ie">www.thinkorswim.ie</a> **	23
<a href="http://carbon-sense.com">carbon-sense.com</a> *	16
<a href="http://climatesciencewatch.org">climatesciencewatch.org</a> **	15
<a href="http://www.brusselsblog.co.uk">www.brusselsblog.co.uk</a> **	13
<a href="http://www.coyoteblog.com">www.coyoteblog.com</a> *	13
<a href="http://jennifermarohasy.com">jennifermarohasy.com</a> **	10
<a href="http://www.climate-lab-book.ac.uk">www.climate-lab-book.ac.uk</a> **	7
<a href="http://greatwhitecon.info">greatwhitecon.info</a> *	1

Note: \* = Climate sceptical blogs; \*\* = Climate mainstream blogs

Table SX

Descriptive statistics, by dataset and outcome variable.

	Dataset	Negative_emotion	Positive_emotion	Emotion	Anger
N	Blogs	2573	2573	2633	2573
	Twitter	167000	167000	167000	167000
Mean	Blogs	0.00527	0.00292	0.008	6.08E-04
	Twitter	0.00616	0.0027	0.00887	2.63E-04
Median	Blogs	0.00359	0.00191	0.00613	0
	Twitter	0	0	0	0
SD	Blogs	0.0078	0.00499	0.00944	0.00165
	Twitter	0.022	0.0144	0.0274	0.00425
Skewn.	Blogs	9.05	10	6.21	6.06
	Twitter	4.97	7.26	4.25	19.8
SE skewn.	Blogs	0.0483	0.0483	0.0477	0.0483
	Twitter	0.00599	0.00599	0.00599	0.00599
Kurtosis	Blogs	154	187	77.5	55.9
	Twitter	38	78.5	26.3	516
SE kurtosis	Blogs	0.0965	0.0965	0.0954	0.0965
	Twitter	0.012	0.012	0.012	0.012

Disgust	Surprise	Joy	Fear	Sadness
2573	2573	2573	2573	2573
167000	167000	167000	167000	167000
5.85E-04	5.32E-04	2.38E-04	0.00103	0.00182
2.47E-04	2.67E-04	1.40E-04	6.83E-04	0.00104
0	0	0	0	3.63E-04
0	0	0	0	0
0.00524	0.00141	9.81E-04	0.00547	0.00616
0.00435	0.00515	0.00304	0.00723	0.0092
42.5	6.36	10.6	37.2	27
24.2	36	26	15.4	13.6
0.0483	0.0483	0.0483	0.0483	0.0483
0.00599	0.00599	0.00599	0.00599	0.00599
2007	66.8	166	1668	1034
824	2137	886	406	305
0.0965	0.0965	0.0965	0.0965	0.0965
0.012	0.012	0.012	0.012	0.012

Table Welch's t-tests and Mann-Whitney U-tests for blog posts and tweets, per outcome variable

Variable	Test	Statistic	df	p	M <sub>diff</sub>	95%CI	Effect Size
Negative_emotion	Welch's t	-5.48	3243	<.001	-8.93e-4	[-1.21E-3, -5.73e-4]	-0.054
	Mann-Whitney U	8.01E+07		<.001	3.21E-03	[3.14E-3, 3.27E-3]	0.627
Positive_emotion	Welch's t	2.09	3270	0.037	2.18E-04	[1.35E-4, 4.23E-4]	0.0203
	Mann-Whitney U	8.68E+07		<.001	0.00177	[1.73E-3, 1.81E-3]	0.596
Emotion_total	Welch's t	-4.4	3375	<.001	-8.62e-4	[-1.25E-3, -4.78E-4]	-0.0421
	Mann-Whitney U	8.43E+07		<.001	5.26E-03	[5.16E-3, 5.37E-3]	0.617

Note: Effect sizes are displayed in Cohen's d for the Welch's t-tests and as rank biserial correlation for the Mann-Whitney U-tests.

Blog dataset: Wilcoxon signed-rank tests for individual emotion categories

Variable		Z	p	M <sub>diff</sub>	95%CI	Effect Size
Anger	Disgust	126290	<.001	5.81E-04	[4.48E-4, 7.45E-4]	0.329
	Surprise	255487	0.156	1.05E-04	[-4.70e-5, 2.53E-4]	0.0522
	Joy	262730	<.001	9.98E-04	[8.97E-4, 1.14E-3]	0.498
	Fear	171377	<.001	-7.34e-4	[-8.59e-4, -5.40e-4]	-0.306
	Sadness	109243	<.001	-0.00178	[-1.94E-3, -1.65E-3]	-0.719
Disgust	Surprise	172281	<.001	-2.58e-4	[-4.53e-4, -1.21e-4]	-0.137
	Joy	172712	<.001	6.93E-04	5.32E-4, 8.57E-4	0.350
	Fear	77627	<.001	-0.0012	[-1.31E-3, -1.07E-3]	-0.580
	Sadness	41276	<.001	-0.00205	[-2.21E-3, -1.96E-3]	-0.881
Surprise	Joy	253449	<.001	9.08E-04	[7.68E-4, 1.01E-3]	0.470
	Fear	229015	<.001	-7.02e-4	[-8.55e-4, -5.10e-4]	-0.286
	Sadness	180165	<.001	-0.00173	[-1.87E-3, -1.57E-3]	-0.631
Joy	Fear	58695	<.001	-0.00149	[-1.6E-3, -1.4E-3]	-0.731
	Sadness	36845	<.001	-0.0023	[-2.44E-3, -2.16E-3]	-0.907
Fear	Sadness	147200	<.001	-0.00139	[-1.52E-3, -1.31E-3]	-0.584

Note: Effect size is displayed as rank biserial correlation.



Twitter dataset: Wilcoxon signed-rank tests for individual emotion categories

Variable		Z	p	M <sub>diff</sub>	95%CI	Effect Size
Anger	Disgust	87258	0.009	0.00236	[1.41E-6, 4.37E-3]	0.127
	Surprise	475501	0.520	6.95E-05	[-1.05E-3, 1.49E-3]	0.0201
	Joy	376319	<.001	0.01063	[6.29E-3, 1.88E-2]	0.311
	Fear	375834	<.001	-0.04953	[-0.051, -0.049]	-0.585
	Sadness	253558	<.001	-0.05411	[-0.055, -0.054]	-0.830
Disgust	Surprise	410902	0.353	-1.91e-5	[-1.71E-3, 8.23E-6]	-0.0297
	Joy	333171	<.001	0.00694	[4.02E-3, 0.012]	0.255
	Fear	310017	<.001	-0.05116	[-0.052, -0.050]	-0.634
	Sadness	153702	<.001	-0.05509	[-0.056, -0.054]	-0.889
Surprise	Joy	315465	<.001	0.00951	[5.98E-3, 0.017]	0.294
	Fear	756648	<.001	-0.04712	[-0.048, -0.046]	-0.470
	Sadness	1.04E+06	<.001	-0.05124	[-0.052, -0.050]	-0.617
Joy	Fear	209114	<.001	-0.05327	[-0.054, -0.053]	-0.759
	Sadness	218414	<.001	-0.05558	[-0.056, -0.054]	-0.875
Fear	Sadness	1.76E+06	<.001	-0.00945	[-0.013, -6.97E-3]	-0.295

Note: Effect size is displayed as rank biserial correlation.

Welch's t-tests and Mann-Whitney U-tests for climate mainstream and climate sceptical blog posts, per outcome variable

Variable		Statistic	df	p	M <sub>diff</sub>	95%CI	Effect Size
Negative_emotion	Welch's t	3.039	606	0.002	0.00165	[5.83E-4, 2.71E-3]	0.1712
	Mann-Whitney U	496617		<.001	-7.54e-4	[-1.24E-3, -2.91E-5]	0.12
Positive_emotion	Welch's t	0.814	581	0.416	3.09E-04	[-4.37E-4, 1.05E-3]	0.0471
	Mann-Whitney U	428113		<.001	-8.24e-4	[-1.11E-3, -4.39E-4]	0.2414
Emotion_total	Welch's t	2.913	600	0.004	0.00196	[6.37E-4, 3.27E-3]	0.1652
	Mann-Whitney U	513351		0.001	-9.66e-4	[-1.70E-3, -1.31E-4]	0.0903

Note: Effect sizes are displayed in Cohen's d for the Welch's t-tests and as rank biserial correlation for the Mann-Whitney U-tests.

## COLOPHON

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