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Publication metadata

WIREs CLIMATE CHANGE

Article type: **Overview**

Climate change communication: what can we learn from communication theory?

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Abstract

The literature on climate change communication addresses a range of issues relevant to the communication of climate change and climate science to lay audiences or publics. In doing so, it approaches this particular challenge from a variety of different perspectives and theoretical frameworks. Analysing the body of scholarly literature on climate change communication, this article critically reviews how communication is conceptualised in the literature and concludes that the field of climate change communication is characterised by diverging and incompatible understandings of communication as a theoretical construct. In some instances, communication theory seems reduced to an 'ad hoc' toolbox, from which theories are randomly picked to provide studies with a fitting framework. Inspired by the paradigm shift from transmission to interaction within communication theory, potential lessons from the field of communication theory are highlighted and discussed in the context of communicating climate change. Rooted in the interaction paradigm, the article

proposes a meta-theoretical framework that conceptualises communication as a constitutive process of producing and reproducing shared meanings. Rather than operating in separate ontological and epistemological perspectives, a meta-theoretical conceptualisation of communication would ensure a common platform that advances multi-perspective argumentation and discussion of the role of climate change communication in society.

Introduction

Climate change communication is a topical matter. The past decade has seen an immense increase in publications addressing the issue of communicating climate change to lay audiences, who are emphasised as particularly relevant in the context of climate change. This increase has been triggered by the significant contributions to climate change of individual and household emissions[1] and by the ability of individuals to exert political influence.[2]

Previous reviews of climate change communication[2-8] have documented trends, challenges and strategies that all contribute to mapping the field with respect to what is known and what is still to be discovered. Briefly outlined, climate change communication has been labelled a "wicked problem"[9], essentially referring to an issue so complex in nature that it has no obvious solution. Research on climate change communication is predominantly motivated by an aspiration to address the communication challenges or barriers that arise as a result of this particular wickedness, and the communication challenges are many. In the scholarly literature, climate change is described as a complex, pervasive and uncertain phenomenon that people find difficult to understand, conceptualise and relate to.[8] It is an issue characterised by uncertainty, controversy, scepticism and limited engagement by individuals. The lack of engagement and action is often attributed to the fact that climate change is perceived to be distant in time and space, leaving many people to conclude that the changing climate does not pose a conspicuous personal threat worthy of outranking other, more immediate concerns.[10] Thus, in order to address these challenges, recent research argues for a shift in focus from information deficits to issues of communication challenges and driving forces for engagement and learning.[3,4,11,12] As such, the conversation has shifted from informing and educating the ignorant masses to engaging people with the issue of climate change.

As a commentary to the expanding research field, Moser[7] argues that "scholarly work on climate change communication has not grown out of the field of communication studies" (Ref. 7, p. 33), and supporting this notion, Fischhoff[13] emphasises that the science of communication ought to be central to the science of climate change and climate decision-making, adding that "the stakes are too high for ad hoc communication" (Ref. 13, p. 705). In further support of this view, Lindenfeld and co-authors[14] maintain that "we need to understand communication as a science, that, to be done well, demands the same levels of scientific attention and support that other disciplines receive" (Ref. 14, p. 125).

This article conducts a comprehensive review of climate change communication literature and analyses the body of literature from a *communication* perspective. In asking: What can we learn from communication theory? the paper identifies communication approaches in the climate change communication literature and proposes a meta-theoretical framework that conceptualises communication as a constitutive process in which cultural and social contexts are acknowledged as important influential factors.

AIM

This paper discusses how communication theory can contribute to the expanding field of climate change communication by asking three questions:

- What communication approaches inform the scientific literature on climate change communication?

- How can the theoretical trends and perspectives within climate change communication – and the evolution of these trends – be understood in a context of communication theory?

- What lessons can the field of climate change communication learn from the (disperse) field of communication theory?

A fundamental starting point for addressing these questions is to revisit communication theory to illuminate the questions: How is communication defined? What is known about communication? This is followed by a comprehensive review and analysis of the climate change communication literature to identify communication approaches, trends and perspectives as applied in this context. Finally, the results of the literature review are discussed in the context of communication theory, emphasising perspectives that could contribute to a deeper understanding of communicating climate change.

COMMUNICATION THEORY – A META-THEORETICAL APPROACH

Communication science is a scholarly discipline that investigates how people interact in different contexts, e.g. interpersonal, group, organisational and mediated.[15] Where the term communications (with an s) is often used to refer to communications technologies or systems for sending and receiving messages, communication (without an s) has a broader meaning and refers to the connection and exchange of information between individuals. As such, communication scholars study and develop understandings of different forms of human communication, and from a more pragmatic perspective, they develop theory to help increase the effectiveness of applied communication. Interdisciplinary in nature, communication science is rooted in theories and ideas about human behaviour and society,[16,17] and since the dawn of the research field in the early 20th century and up until today, scholars from various and diverse scientific disciplines have influenced and shaped the discipline. Hence, the evolution of communication theory reveals a multifaceted and disparate field marked by a lack of consensus on a general theory or approach.[18] To illustrate this point, communication as a field captures a broad range of subcategories, each drawing on different, yet often interrelated, theoretical frameworks and theories. Examples include mass communication, organisational communication and interpersonal communication. In addition, communication is also widely applied and used in other fields and interdisciplinary endeavours, leading to new, emerging subfields such as health communication, political communication and environmental communication, to name but a few. The broad scope and interdisciplinary nature of communication studies mean that scholars from many different fields with different scientific training and background engage in communication research. This, on the one hand, helps advance and enrich the field of communication and define new, interdisciplinary subfields, but on the other hand, it also represents a challenge for the disciplinary identity and risks diluting the scholarly ethos and rigour of communication research.

With this section, I do not search or argue for a specific communication model or theory that encompasses the scientific diversity of the field of communication, nor do I seek to argue in favour of one model over another. Instead, I attempt to provide an overview and critical discussion of the evolving field of communication theory according to the underlying assumptions that guide the different theoretical and scientific traditions that have influenced and still influence the discipline. What are the underlying trends and patterns that steer our ideological understanding of communication? By no means does this section provide a full comprehensive account of the history of communication theory; instead, focus is on outlining overall perspectives in two widely acknowledged communication paradigms or research traditions that have influenced the field of communication. The lessons from the evolution of communication theory will be used to benchmark and advance the discussion on the scientific literature on climate change communication.

Communication as transmission

In its early days, in the 1930s, communication research was highly influenced by fields of psychoanalysis, behavioural science, sociology and social psychology, giving rise to a research tradition with strong emphasis on studying and measuring the effects of communication activities. [19,20] Lasswell's[21] famous statement, *Who says what in which channel to whom with what effect*, derived from his research on wartime propaganda, illustrates the essence of the dominating communication approach at the time. Given the wartime context, Lasswell's view on propaganda or communication as "the management of collective attitudes by the manipulation of significant symbols" (Ref. 19, p. 213) naturally reflects an understanding of communication as a discipline of information and control. Shannon and Weaver's[22] notion of communication as "all procedures by which one mind may affect another" (Ref 22, p. 3) and their "information theory" add to depicting the communication process as a transmission of a message from a source to a destination and crystallise the strong focus on effects studies[1] (see figure 1).

FIGURE 1

Furthermore, this illustrates the distinctive left-to-right conception of communication that was very characteristic of the period.[19] In line with this thinking, Scramm conceived communication as a process of encoding and decoding messages, which would lead to an appropriate response from the receivers. Consistent with the spirit of the time, he focused on communication as a process leading to attitudinal or behavioural effects as a direct result of message stimuli[23]. Nevertheless, his theories are considered to have fostered the trend towards a paradigm shift, because of his approach to communication as a more dynamic process where communicators simultaneously send and receive. The communication research that emerged in the first half of the 20th century, here exemplified by Lasswell, Shannon and Weaver, and Scramm, has later been coined "the transmission paradigm", because it builds on a linear-effects perspective of stimulus and response. In this view, communication is a tool that is used to transfer ideas or knowledge from one mind to another, focusing on the sender as the active part. This functionalistic stance sees communication as a delimited act with a well-defined beginning and end, both of which can be measured.[15,24]

Communication as interaction

In the 1970s and 1980s, many scholars began to regard the linear transmission-oriented approaches as somewhat naïve simplifications of the interactive context-dependent nature of communication.[15,25] Consequently, the decades saw the emergence of a growing body of research and theories inspired by cultural and linguistic research and focused on subjective message meanings and the cultural and social influences on message interpretations.[16,26] The influence of cultural studies meant that communication became associated with the invention and construction of meaning rather than the discovery of 'truth', acknowledging that the sender can never exert control over the meaning of the message content. Nevertheless, conventional communication and media effects scholars often viewed the focus on individual message interpretations as interfering with the design of their studies.[19]

Hall[27] contributed to the early critique of the transmission paradigm and its in-built behaviour manifestations of communication and argued, "before a message can have an 'effect' (however defined), satisfy a 'need', or be put to a 'use', it must first be appropriate as a meaningful discourse and be meaningfully decoded" (Ref 27, p. 130). The asymmetric nature of message meanings was fundamental to Hall's communication approach, and his theories paved the way for new communication theories and approaches to emerge. With their emphasis on unravelling the complexities of signs and meanings, theories of semiotics played, and still play, a key role in the development of this meaning-oriented approach to communication, and many scholars argue that semiotics, as the science of signs and meaning, can provide a framework and contribute to a deeper understanding of how communication operates.[25,26,28]

The influence of cultural studies and meaning-oriented approaches to communication is said to mark the beginning of a new communication paradigm, often referred to as the interaction paradigm or the ritual or constitutive view of communication.[15,24] Rather than assuming that meaning is immanent to the text, communication is seen as an on-going cycle where focus is on subjective interpretations of messages. Text only contains meaning when interpreted, and the receiver is no longer conceptualised as a blank canvas. In effect, sender(s) and receiver(s) are acknowledged as equally active in the communication process or cycle, which is exemplified by figure 2 where meaning-creation occurs in a relationship between the message (text), participants (producers and readers) and contextual factors.

FIGURE 2

Accordingly, the paradigm shift in communication theory illustrates a shift from a functionalistic transmission-oriented approach to a perspective where all participants – senders and receivers – become co-authors or co-creators of meaning and where cultural and social contexts are recognised as important influential factors.

Towards a meta perspective of communication

Despite scholarly consensus on the paradigmatic developments within communication theory, the field is a melting pot of diverse theories. In his seminal article, Craig[25] outlines seven traditions of communication theory that have contributed to the present field of communication. According to Craig's argument, the different traditions co-exist; however, embracing the diversity of the

communication field, he argues for the application of a conceptual meta model of communication, the constitutive model, that defines and guides the overall ideological approach and understanding of communication. This approach is rooted in the interaction paradigm and conceptualises communication as "a constitutive process that produces and reproduces shared meanings" (Ref. 25, p. 125). Craig[25,29] advocates using the constitutive model as "a meta model that opens up a conceptual space in which many different theoretical models of communication can interact" (Ref. 25, p. 126). The vision of a unified and coherent field of communication theory is shared and backed by many scholars within the field.[24,30,31] As such, the multiplicity of communication science and theory is considered an asset as long as different theories and methods build on an understanding of communication as a process of meaning creation and social construction. The days of the "magic bullet" are over, and communication is by and large defined as a complex social and cultural phenomenon that acknowledges meaning as a principal element.

How does the conversation of communication as a disciplinary field of scholarship serve to advance the nascent field of climate change communication? It is important and relevant to include a conceptual meta model in the scholarly conversation, as it helps define a common theoretical stance and, linked to that, terminology that provide direction for and consensus on what is being studied. Without this, it is difficult to find common ground and agree on what is being studied and how to approach and conceptualise such studies. Relating to this discussion, Cox[32] reflects on the mission and self-understanding of the related subfield of environmental communication and discusses constitutive and normative orientations in the field. Defining environmental communication as a crisis discipline, he argues that it is difficult to escape the pragmatic dogmas that often lead to an instrumental approach to communication, because the objective of "solving the crisis" is implicit in most of the scholarship. This pragmatic orientation often results in a transmission-oriented perspective that conceptualises communication as a means to convey compelling messages to a broad audience.[33] However, the strategic and theoretical stances do not have to be separate and mutually exclusive, but we need to acknowledge both aspects in the scholarly conversation. Although the constitutive approach to communication dismisses the linear and transmission-oriented approaches to communication, it still allows for normative or strategic objectives to guide scientific undertakings, as long as these are founded on theoretical understandings generally accepted by the communication scholarship.

METHODS AND MATERIALS

To identify patterns in the communication approaches of the climate change communication literature, I conducted an article search in the SCOPUS and the Thompson Reuters Web of Science databases, searching for scientific literature published before the end of 2014. Only scientific literature was included in the search, excluding books and grey literature. This could of course be seen as a limitation to the study; however, with the objective of documenting theoretical strands within climate change communication, I considered an overview of scientific literature more appropriate and sufficient. The search included the following search terms in titles, abstracts and keywords: ("climate change" NEAR/2 "communicat*") *OR* ("global warming" NEAR/2 "communicat*") *OR* ("climate communicat*") *AND* (Public OR "lay people" OR "lay audience"). Duplicates of the searches in the two databases were removed, resulting in a total of 299 articles. I conducted the search to identify articles with an explicit focus on climate change communication, but communication turned out to be a term with multiple meanings, applied in many different

contexts. Therefore, I read the abstracts to ensure that the articles has a focus on climate change communication in the sense that they contributed with an understanding of communication of climate change and climate science to lay audiences. In this paper, the term 'lay audiences' is applied broadly to refer to a non-scientific audience that also encompasses, for instance, the general public or case-specific target audiences. I omitted abstracts where communication was only mentioned in a passing remark or where it did not refer to a (theoretical) field or practice. The initial screening resulted in a list of 196 articles, which were read and mapped in a table according to time of publication on the y-axis. The x-axis encompassed different categories of communication approaches, including the aim of the article, key findings and recommendations, communication approach, climate change communication challenges and methods, as illustrated in table 1.

TABLE 1

I defined 'communication approach' broadly and used the term to account for explicit as well as underlying theoretical assumptions regarding communication. This included, for instance, the application of a specific theoretical framework or model, theories informing the design of the study or assumptions about the sender, message and target audience expressed throughout the article. The chronological structure was employed to provide an overview of the evolution over time (if any) of approaches to climate change communication. To survey the literature in a systematic manner, I used the mapping of the climate change communication literature to identify patterns and trends in the understanding of communication as evident through the study design, methodology, terminology and theoretical framework applied in the literature.

For the purpose of analysis, I conducted an initial coding of the reviewed material with respect to research aim. This was done to create a point of comparison, as publications within climate change communication serve different research aims, which in turn influences the theoretical perspectives applied. Hence, the thematic coding allowed for a comparison and overview of the communication approaches of articles with similar research objectives. To provide an overview of the most prevalent types of articles, I conducted a frequency analysis of articles belonging to each category.

RESULTS: CLIMATE CHANGE COMMUNICATION – A THEORETICAL PERSPECTIVE

Reviewing the articles on climate change communication disclosed a field with a broad application and understanding of communication as a theoretical field and as a practice. The research within climate change communication clusters around five main perspectives as defined by the stated aim of the articles: public understanding of climate change, mass media, strategic communication and communication effects (table 2). The last category comprises literature reviews and methodological and conceptual contributions of a more theoretical character. Some articles could be argued to belong to two or more categories given their research aim. This could, for instance, be an article investigating the link between media coverage and public understanding of climate change. In these cases, the article was placed in the category deemed to be the primary in relation to research focus; however, this naturally represents a bias with respect to the frequency count. The articles within each of the five categories share similar research objectives and rationales for conducting the research, but, examining the communication views that inform the different studies, great epistemological, ontological and methodological diversity is unveiled.

TABLE 2

Public understanding of climate change

Studies focusing on public understanding of climate change typically seek to map public perceptions of climate change and associated risks in certain geographical contexts[8,34-36] or measure laypeople's level of knowledge, awareness or attitudes towards climate change.[37-40] In addition, this category also comprises studies aiming to identify factors that influence how the public behaves towards and perceives climate change, such as ideology, personal values, political affiliation and cultural worldviews.[4,41-44] Although these types of articles do not have a strong communication focus, insights into how different publics perceive climate change and how these perceptions are coupled with, for instance, attitudes and behaviour are necessary in addressing the challenge of communicating climate change messages to different audiences. [3] As such, the literature on public understanding of climate change is not surprisingly dominated by a strong focus on audience as the key element. A common denominator of this category of articles is that they place their findings in the broader context of climate change communication, and they often argue for the application of knowledge about public awareness, concerns, attitudes, perceptions and behaviours as means to strategically develop efficient message strategies with the aim of closing a knowledge gap, changing an audience's attitude or behaviour, or encouraging engagement with the issue of climate change.

The mapping of the communication approaches informing this type of studies reveals fundamentally different conceptions about communication. Some articles bear resemblance to views associated with the transmission paradigm in that they, for example, assume a more or less causal correlation between perception, attitude and behaviour, among others, or overestimate the direct effects of dissemination of information.[45-48] Examples of such studies include those applying behavioural economics in a study of homeowners' risk appraisal[43] or quantitatively examining the relationship between public knowledge, level of concern and personal efficacy, arguing that "the dissemination of appropriate information can create greater awareness and concern".[48] Other publications take a different view of communication and, embracing a perspective inspired by cultural and social constructivist theories, acknowledge the vast complexity of attitude formation and behaviour change.[42,49,50] Examples of such publications include a study[49] that discusses challenges in communicating science to lay audiences and advocates a stronger focus on examining how relevant audiences interpret messages, an examination of people's interpretations of cold weather events as evidence for or against climate change[51] and a study[42] that applies cultural theory to explore the influence of personal values on people's perceptions of climate change. Similar to these types of examples is an understanding of communication as a social construction, where people's interpretations play a central role.

To summarise, despite having common research intentions with respect to objectives and contribution, these differing approaches to public understanding of climate change demonstrate contrasting theoretical views of communication. The linear conception of causality between information, attitude and behaviour bears strong resemblance to the transmission paradigm, where cultural and constructivist approaches seem more in line with the constitutive view of communication. Consequently, research on public understanding of climate change operates in separate communication domains, which complicates comparison of results, as these are potentially based on diverging assumptions about reality and the role of communication in constituting that reality.

Mass media

A majority of the publications on mass media and climate change communication centre on media coverage of climate change, and characteristically, studies are focused on content in select media over a select period of time. There seems to be strong consensus within this subject field with respect to choice of methods and theoretical framework. Most studies on media coverage conduct content analyses by means of discourse analysis,[52,53] framing theory [54-56] social representations theory[57,58] or a combination of these theoretical frameworks. As a result, there is a strong focus on text and message in these types of studies, with the primary mode of analysis focusing on textual structures or content frequency. Media studies within this context are often used to contextualise strategies for climate change communication by documenting patterns and changes in how media cover issues related to climate change. Except for a few exceptions, which examine how media content is actually received by an audience,[59,60] most studies focus on the text separately from sender and audience influence or assume a link between media representations and public perception of climate change, as also noted by Shresta and co-authors: "much of the literature, however, speculates about the effects of particular constructions of climate change on public understanding but restricts analysis to media texts" (Ref. 59, p. 4). Nevertheless, in these studies, there is a high degree of consensus about methodological and theoretical frameworks, which could be a reflection of close ties to the disciplinary traditions of media studies.

With respect to communication approaches, this subfield can be characterised as an enclave within the academic literature on climate change communication, offering commentaries about the state of the media landscape. This is done through theories reflecting a subjective ontology, acknowledging communication as a process of meaning-making that constitutes social and cultural reality, but only few studies take the step further to actually examine lay audiences' constructions of climate change as mediated through mass media.

Strategic communication

The largest cluster of articles in the review undertakes a strategic perspective to communication and concentrates on "how to communicate climate change". As delineated in table 2, studies of this nature typically examine how to facilitate change in the public opinion or behaviour through communication or campaign planning,[5,61,62] audience segmentation[63-65] as well as effective message/framing and communication strategies.[66-68] With the aim of spurring public change, however defined, these elements of communication planning are typically discussed as means to overcoming communication barriers or challenges specific to climate change communication.[10,12,69]. The "how to" approach permeating this category often results in a normative focus, where the goal of overcoming the communication barriers becomes the guiding star.

While the articles are similar in terms of research aim and definition of communication challenges, the category epitomises a vast array of research methodologies, theories and assumptions about communication that informs and shapes the various studies. At the one end of the spectrum, articles tend to emphasise the sender as the active part, conceptualising communication as a secluded process of simply conveying a message to an audience.[63,70-72] In this type of article, the communication assumptions seem inspired by simple behavioural theory where information is seen as a driver of behavioural change. Articles representing this view tend to frame communication as an act of, for example, "conveying information",[64] "reducing ignorance"[71] and as "dissemination of

climate change information",[73] focusing on how communication (from the sender's perspective) can change people's behaviours or perceptions of climate change. The other end of the spectrum of communication approaches encompasses articles with a strong focus on audience and audience interpretation that argue for a perspective recognising the audience as active players in communication processes.[6,74-76] Such an approach can be exemplified by a study on visual images and public engagement with climate change, which is based on the ontological assumption that interpretations of images are socially constructed rather than determined by the sender.[6] This end of the continuum also includes contributions of a more theoretical nature that advocate a communication approach in alignment with the constitutive view of communication.[77,78] Here, communication is seen as a much more complex undertaking that focuses attention on message interpretations and how these interpretations are influenced by ideological, cultural and social worldviews.

In summary, this category of articles encompasses studies on climate change communication rooted in different and sometimes conflicting assumptions about communication. The strategic approach to climate change communication tends to infer an instrumental perspective that focuses on how to achieve a certain effect or change through a process of planned communication, which often leads to a sender-oriented focus. Although the limitations of the transmission paradigm are well-documented, the analysis reveals that there are still studies that, to a greater or lesser degree, assume a rather functionalistic stimulus-response approach to communication.

Communication effects

The fourth main perspective on climate change communication is connected to the strategic perspective on communication, but is concerned with measuring communication effects. Publications with this aim share the ambition of documenting the effects of climate change communication; however, effects turn out to be defined and approached in different ways. Some articles zero in on text or message analysis to document and analyse existing communication practices and discuss the potential strengths and shortcomings of a certain message strategy.[79-82] This is typically done through discourse, linguistic or rhetorical analyses. Other articles examine the communication impacts on public awareness, perceptions, attitude, engagement and behaviour with an emphasis on detecting change.[83-86] These types of studies predominantly apply a quantitative approach through, for instance, a survey design where public attitude or knowledge levels are measured before and after a message exposure. A third grouping of articles concentrates on audience reception of communication messages, thus seeking insights into audience interpretations.[87-91] These undertakings are often qualitative in nature and apply research methods such as in-depth or focus group interviews.

Reviewing articles in this category underlines that the approach to communicative effects varies across the literature. The analysis reveals a division between studies oriented towards traditional effects research with a focus on detecting a change in, e.g., behaviour, and studies acknowledging meaning and interpretation as key facets of communication. Again, this division draws parallels to the paradigmatic shift within communication theory from a tradition influenced by positivist and behavioural approaches to a tradition swayed by post-structural lines of thinking. Interestingly, though, the review demonstrates that studies focusing on message interpretations are

underrepresented in the literature and that a large body of research remains situated within a research tradition that seems inspired by the paradigm of transmission.

Conceptual articles

The fifth category encompasses articles of a more theoretical character. These include literature reviews,[2,3,92] articles documenting historical aspects of climate change communication[93,94] and articles aiming to advance conceptual models or frameworks for the field of climate change communication.[11,95,96] A common feature of these articles is that they propose theoretical advancements that are manifested through a recurrent focus on audience interpretations, the audience conceptualised as co-creators of meaning, the communicative context and the social construction of meaning. Interestingly, within this category, there seems to be consent to leave behind ideas and models advanced in the transmission paradigm and accept and take into account the complexity of communication processes. For example, it is argued that although linear and information-centric models that assume "that the public are 'empty vessels' waiting to be filled with information which will propel them into rational action" (Ref. 2, p. 59) have influenced much public policy, these approaches are criticized for being inappropriate and ineffective, as they underestimate the complexity of learning and behavior change. In addition, communicators are urged to move from one-way communication, presuming that information will lead to rational action, towards perspectives of dialogue and reflexive engagement and accept the point that information is not synonymous with knowledge, and that "sending messages" and "educating people" are limited approaches in utility and impact.[97]

Communication approaches in climate change communication

The review of the climate change communication literature reveals a swiftly growing research field influenced by numerous disciplines and traditions. The analysis has sought to outline the communication approaches that contribute to the scientific literature on climate change communication, and the short answer is that the field in many ways appears fragmented with respect to how communication is conceptualised.

When considering communication about climate change at a micro-theoretical level, authors more or less agree to dismissing the information deficit model of science communication. As such, the chronology does show a trend of moving away from the deficit model of science communication in favour of public engagement processes that carry more dialogue-oriented approaches to communication, as also demonstrated by Wibeck.[3] Nevertheless, at a meta-theoretical level, which is the focus of this paper, there seems to be no agreement on what communication means, how it is defined or how it should be used – and many authors do not consider these aspects of communication at all. Accordingly, the analysis does not show a chronological move from a transmission-oriented perspective of communication towards a constitutive view, which could be explained by the relatively nascent and interdisciplinary nature of climate change communication research. Nonetheless, a higher degree of consensus does seem to have been established about the dismissal of the deficit model of science communication that builds on thoughts and ideas from the transmission paradigm (hypodermic needle). Yet, paradoxically, the dismissal of the deficit model does not appear to have led to a rejection of simplistic, linear conceptions of communication, as these intuitively appealing approaches to communication still influence choice of methods and

theoretical models, research design and basic conceptualisation and discourse about communication in numerous publications.

The literature review illustrates that three of the five categories, as displayed in table 2, can be characterised by heterogeneous approaches to communication. Articles focusing on public understanding of science, strategic communication and communication effects appear fragmented with respect to communication approaches and can be seen as a melting pot of diverse, often incompatible theories and models with conflicting assumptions about the nature of communication. The analysis paints the clear picture that, in many instances, communication is taken for a pragmatic tool for conveying messages, rather than a disciplinary field of scholarship.

DISCUSSION: WHAT CAN WE LEARN FROM COMMUNICATION THEORY?

This paper asks what we can learn from communication theory. Figure 3 depicts the paradigmatic evolution within communication research and climate change communication research, respectively. As illustrated, both fields have been characterised by periods of fragmentation where diverging approaches have dominated the research. The difference is that where communication scholarship now largely appreciates views of communication as a constitutive practice, climate change communication research appears to be detached from the communication scholarship and has not attained the same level of consensus just yet.
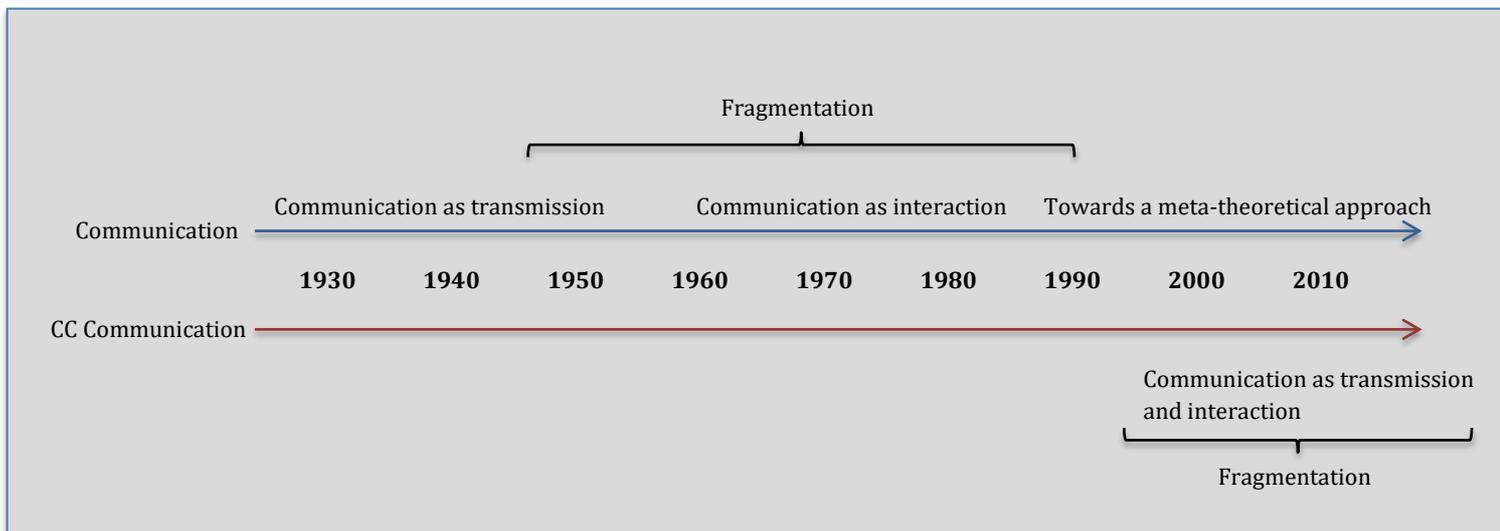

Figure 3: Chronological development within the field of climate change communication as compared to the field of communication

One could argue that a diverse field of research is not necessarily problematic. In fact, one could contend that theoretical diversity and richness are productive and knowledge-expanding features of a research field. And to a certain extent, they are. Yet, fundamentally different conceptions about communication offer distinct and dissonant ways of conducting communication research because they are based on different ontological assumptions.

The scholarly consensus within the field of communication theory to leave behind ideas supporting the transmission paradigm has not reached all corners of the climate change communication literature, where talks about "disseminating information to the public" and assumptions of more or less causal correlations between awareness, attitudes and behaviour still exist. In the climate change communication literature, you sometimes get the impression that researchers more or less uncritically 'pick and mix' communication theories and models to provide "insights" on a certain aspect of climate change communication. For instance, while it might seem logical or intuitively appealing to apply linear models of cause and effect to the context of climate change communication, such approaches bear certain limitations. Although appealing in their simplicity, the nature of communication is much more complex than these transmission perspectives convey. Therefore, when applying a simplistic functionalistic perspective to climate change communication, communication risks being reduced to a toolbox, from which models are randomly picked to solve a problem. Seen in this light, climate change communication can be characterised as an eclectic field suffering from conceptual confusion – or occasionally even conceptual disinterest as a result of varying degrees of theoretical rigour.

To address the question of what can be learned from communication theory, this paper argues for the adoption of a meta-theoretical approach; a common platform that allows for an appreciation of the complexity of communication studies and practices. Developed from the thoughts advanced under the interaction paradigm, the constitutive view of communication is defined as a process of producing and reproducing shared meanings.[25] In support of this, Carey[24] defines communication as a "symbolic process whereby reality is produced, maintained, repaired, and transformed" (Ref. 24, p. 19) and further argues that the study of communication is the study of social processes wherein symbolic forms are created, apprehended and used. Climate change is repeatedly referred to as a 'wicked problem', which makes communication particularly challenging in this context. This conceptualisation essentially means that the issue is characterised by being so complex in nature that it has no obvious solution.[9] The wickedness of climate change can be explained by the interdependencies of systems – be they physical, political, economic or cultural – affecting and affected by climate change. The interdependencies of these systems result in a web of very complex solutions, implying that there is not *one* solution to the problem – the solution depends on the perspective from which the problem is approached. This also means that the communication context of climate change is multifaceted, as is the role of communication in society, which should be reflected in the research and practical endeavours in the field.

Making a meta model of communication in line with the constitutive perspective gain traction in research on climate change communication is by no means an easy task. As outlined, climate change communication researchers can hardly be characterised as a cohesive epistemic community. Adhering to a constitutive view of communication necessitates embracing the ontological perspective that climate change is not only a physical phenomenon, but indeed also an ideological, cultural and symbolic issue that takes on different meanings dependent on different people and places.[9] This, in turn, affects the epistemological perspectives and methodological designs of research studies. Considering the interdisciplinary nature of climate change communication research, this could prove difficult, as ontological and epistemological stances are often deeply embedded in different research traditions and therefore hard to alter. This is problematic because, as argued earlier, for a discipline or field to thrive, researchers must share a set of assumptions

about what is being studied. Adhering to older and outdated theoretical understandings of communication simply challenges our ability to work together.

The adoption of a meta-theoretical platform would be a first step towards defining a set of theoretical assumptions about communication that could enable argumentation across perspectives. For example, a meta approach could lead to an advanced discussion and understanding of challenges and barriers within climate change communication and, importantly, address the question of what can actually be characterised as "communication challenges". This is uncharted territory in the literature, but it deserves attention, as the ontological understanding of communication indeed affects the definition, identification and discussion of communication challenges. For instance, the metaphorical use of the term 'communication barrier' in the climate communication literature connotes an obstacle or a hurdle that has to and can be overcome by communication efforts. From a functionalistic stance, it is often considered to be a question of knowing and defining the barriers and subsequently using this knowledge strategically to reach a target audience. This conceptualisation is problematic because it signifies and assumes a simplified perspective of communication, presumes a top-down asymmetric relationship between sender and receiver and disregards the contingent nature of communication by assuming a generic approach to the concept of barriers. On a pragmatic level, the fact of the matter is that not all problems are communication problems. A communication challenge relates to a communication problem in a social context (society) – an issue that can potentially be solved with communication. For that reason, rather than discussing barriers and challenges from a 'sender' perspective, it would be worthwhile considering the reality of climate change from the perspectives of different audiences and thereby gain insights into the driving forces (or lack thereof) behind climate change engagement. For example, instead of seeing advances in communications technology as a means to service a top-down-driven approach to communication, these advances could instead be seen as "opportunities to expand people's powers to learn and exchange ideas and experience" (Ref. 24, p. 27).

The scholarly literature on science communication has seen a development from a strong 'science literacy' perspective over 'public understanding of science' to an emphasis on 'science and society' that highlights public participation, dialogue and engagement with science as a way to democratise science. [98] The constitutive approach to communication offers a frame of understanding that corresponds with the 'science and society' perspective. Embracing communication as a constitutive practice that produces and reproduces meaning in social and cultural contexts means that the study of communication could be defined as the study of social reality as perceived by participants of that particular reality. Receiver and producer of communication are thus seen as equally active participants in (re)producing reality in a process that revolves around interpretations of symbols, i.e. text or visuals (see figure 2). Although the public engagement approach to science communication underlines the validity of different knowledge spheres in scientific and political contexts, many initiatives within climate change communication are still driven by an objective of addressing a public information deficit. [3] This suggests that the power dynamics within climate change are still asymmetrical and that there is a tendency to conceptualise lay audiences as mere receivers of climate information from political or scientific expert sources. Public engagement in the context of 'science and society' refers to an active public or audience involved in discussing, learning about, prioritising and acting on climate change, which is well-aligned with the thoughts advanced by the interaction paradigm of communication that conceptualise sender and receiver as active participants

in a process of co-creating meaning. According to this perspective, the way forward for climate change communication research could be (a continuous) exploration of how people constitute the reality of climate change. What does climate change mean to different audiences and why? What causes people to engage or disengage with climate change? How do climate change discourses contribute to the reproduction, maintenance or transformation of the perceived reality of climate change? And how do advances within, e.g., communications technologies affect what we can create and comprehend, and how do they function as facilitating tools for engagement? Fleming and co-authors[99] support this reflection and encourage examinations of discourse in social settings as a means to understand behaviour as opposed to a methodology simply measuring attitudes, perceptions and opinions. In line with this, other authors within the field of climate change communication call for similar ontological and epistemological scopes and argue for a stronger focus on sensemaking processes.[40,49]

Such a focus does not necessarily disregard strategic communication such as information campaigns. It merely contends that communication cannot be understood correctly unless acknowledged as a constitutive process. Nevertheless, in 'traditional' communication planning efforts, communication is often approached through the lens of strategy, which means that communication ideally becomes a coordinated effort with a strategic aim, clear objectives, coordinated messages and media tactics, well-defined audiences, carefully considered time and resource management. Applying the basic elements of communication planning – sender, message, media, audience, effect – to the communication of climate change science immediately introduces challenges of a conceptual nature. Who is the sender of climate change communication? What is the overall strategy – and who gets to decide this strategy? What is the 'solution' to the 'problem'? Who is the audience(s)? And what is the message? The short answer to a potentially convoluted question is that climate change communication simply does not fit into this traditional planning framework.

A similar discussion has unfolded in the contexts of environmental communication. Lindenfeld and co-authors[100] argue for more sophisticated understandings of communication and for environmental communication scholarship to integrate and build on "rich lines of inquiry, methodological insight and theoretical frameworks that communication scholars have developed" (Ref. 100, p. 25). With the launch of the International Environmental Communication Association, the Conference on Communication and Environment and the journal Environmental Communication: A journal of Nature and Culture, communication is recognised as a scholarly discipline and a core element of the environmental communication field.[32,100]

This paper invites further critical reflection on the theoretical concept of communication. The fragmented nature of the field of climate change communication is problematic because it erodes the opportunity to create a common ground for discussing theories with respect to their practical, methodological and epistemological implications. Greater awareness of communication theory and the implications of theory choice could make the field of communication come into its own as a scientific discipline as opposed to merely a toolbox for ad hoc applications. As outlined, the constitutive view of communication defines communication as a social process that constitutes reality for the participants of that process. Adopting this ontological stance would serve to strengthen the field of climate change communication, ensuring that by *communication* we refer to a set of shared assumptions about what this term comprises and how the assumptions affect

epistemological and methodological aspects of research design as well as the role of climate change communication in society.

Conclusion

Inspired by the evolution of the field of communication theory, this overview article has outlined that different and diverging theoretical outlooks frame the literature on climate change communication. The review analysis drew a picture of an eclectic field with respect to how communication is understood and applied. Communication perspectives usually associated with the transmission paradigm of communication are still applied in the context of climate change communication, where several articles assume a linear and top-down-oriented approach to communication. Other articles adopt a communication perspective inspired by the interaction paradigm and acknowledge communication as a complex construct that holds people's interpretations as the central element. Although theoretical diversity can indeed be an attribute for an evolving research field, the ontological and epistemological diversity of climate change communication literature poses certain challenges, such as conflicting assumptions about the nature and role of communication, varying degrees of theoretical rigour and awareness and an 'ad hoc' approach to the communication aspect of climate change communication.

Inspired by the constitutive view of communication, this article adds to previous literature by arguing for a meta-theoretical approach to communication that can serve as a common platform for climate change communication research and practices. Defining communication as a social and cultural process that constitutes reality could lead to exploring 'meanings' of climate change as an ideological, cultural and sociological phenomenon. Key in this perspective is a conceptualisation of communication participants, senders and receivers, as co-creators of meaning. In addition, this perspective could advance the debate on challenges and barriers and, in particular, discuss what challenges are actually communication challenges in the context of climate change. Furthermore, it could change the focus from an asymmetrical sender-oriented perspective to focusing, for instance, on how communication can facilitate reflection, engagement and learning. Instead of operating in different ontological and epistemological domains, the proposed meta-theoretical platform could function as a device for thinking about communication and appreciating its complexity and thus help redefine the narrative of the role of climate change communication in society.

Climate change communication is for the most part a research field driven by normative concerns. Nevertheless, communication should not be reduced to a toolbox for conveying scientific messages to various audiences. The constitutive approach to communication provides a more nuanced understanding of communication, but what does the constitutive power of communication mean for the field of climate change communication? I recommend scholars within the field of climate change communication to acknowledge communication as a discipline and to draw on insights from communication research in addressing issues of climate change communication. We need to be reflexive about assertions regarding communication rather than simply viewing it as a tool for conveying messages. Emphasising conversational interaction, the constitutive powers of communication forward co-construction as a core element. This, in turn, calls for participatory research, where problems, issues and solutions are explored from different perspectives, including the perspective of audiences.

Acknowledgements

Notes

[1] From the beginning, Shannon claimed that the model did not apply to human communication, but it has often been used to exemplify the transmission paradigm of communication focusing on left-to-right conception of communication

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Figure captions

Figure 1: Linear transmission view of communication. Inspired by Shannon & Weaver's model of information theory (1949)[20]

Figure 2: Communication as meaning. Adapted from Fiske (2011)[26]

Figure 3: Chronological development within the field of climate change communication as compared to the field of communication

Tables

Table 1

	Aim	Communication challenges	Key findings	Communication approach	Method
Author (2007) Title					
Author (2008) Title					

Table 1: Table for analysis

Table 2

Public	Mass media	Strategic	Communication	Conceptual articles

understanding		communication	effects	
Public perception; knowledge; attitude, awareness, concern. Factors influencing behaviour and perception – e.g., ideology, personal values, political affiliation, worldview.	Media framings and discourses. Reception of media messages. The role of news media in relation to public understanding of climate change.	Communication and campaign planning. Process view. How to facilitate change. Audience segmentation and barriers to communication. Message strategies and communication strategies.	Text analysis (message analysis). Communication impacts on public perceptions, attitudes, awareness, engagement and behaviour. Focus on change. Audience reception and interpretation of communication messages.	Climate change communication as a micro field. Conceptual and theoretical models and frameworks. Historic overviews of climate change communication.
19.4%	13.8%	31.1%	28.0%	7.7%

Table 2: Main perspectives in the climate change communication literature. The numbers indicate the frequency of articles with the different perspectives in the body of literature included in the review (n=196)