



Orchestrating the climate choir: the boundaries of scientists' expertise, the relevance of experiential knowledge, and quality assurance in the public climate debate

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Abstract

Scientific knowledge is at the heart of discussions about climate change. However, it has been proposed that the apparent predominance of climate science in the societal debate should be reconsidered and that a more inclusive approach is warranted. Further, the introduction of new communication technology has made the information environment more fragmented, possibly endangering the quality of societal deliberation on climate change concerns. Using focus group methodology, this paper explores how climate scientists, climate journalists, and citizens perceive scientific experts' mandate when they communicate publicly, the role of experiential knowledge in discussions of climate-related issues, and who the three actors prefer to guard the quality of the climate information exchanged in the public sphere. The findings show that scientific experts are perceived to carry a high degree of legitimacy, but only within their own narrow specialty, while experiential knowledge was seen as more useful in applied domains of science than in arcane research fields. In the new media landscape, journalists are still generally preferred as gatekeepers by all three actor types.

Keywords Climate choir · Scientists' expertise · Experiential knowledge · Public climate debate

Over the past 30 years, climate change has gained an increasingly prominent position on the societal agenda. Until now, science has held a seemingly unrivalled primacy in the public discussion of the subject (Sarewitz 2011, p. 479). However, observers have repeatedly criticized the hegemonic status of science in shaping the understanding of climate change, emphasizing the need to acknowledge the merit of non-scientific knowledge (Engels 2019, p. 2; Klopogge and Sluijs 2006, p. 383; McMichael et al. 2021, p. 10). In line with this, it has been proposed that climate science should abandon its "speaking agenda" in favor of a "listening agenda" and thereby institute a more reciprocal flow of information between the climate scientific community and the broader society (Dudman and de Wit 2021).

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Whereas Dudman and De Wit's advocacy for the implementation of a listening agenda is tied to the Intergovernmental Panel on Climate Change (IPCC), the aim of this paper is to assess the receptivity to alternative forms of knowledge in the public climate debate at large. It does so by turning to three central actors in this respect, namely climate scientists, climate journalists, and citizens, to explore their perceptions of how scientific and experiential knowledge should feature in the societal deliberation of climate-related issues. Recognizing that a restructuring of the knowledge hierarchy in climate communication cannot be externally imposed, this paper aims to offer empirical insights into how the call to reassess the role of scientific and experiential knowledge resonates with three key figures in the public climate debate.

The potential for expanding the cast in the societal conversation on climate scientific affairs is investigated in a media landscape of unprecedented accessibility. It has thus never been easier for non-scientists to participate in scientific discourse. The advent of blogs and social media has paved the way for a proliferating range of actors to contribute directly to the public debate on science-based issues (O'Neill and Boykoff 2010, pp. 241–242). In doing so, this development, referred to as “science communication 2.0” (Bucchi 2017), accentuates what Collins and Evans term “the problem of extension” (Collins and Evans 2002, p. 237, 2017, pp. 13–14). This describes the challenge of distinguishing relevant from irrelevant lay input to avoid watering down the scientific discussion and eroding the concept of expertise (Collins et al. 2023, p. 53). Historically, the task of curating the stream of information in the public sphere has rested with journalists (Van Dalen 2020), but in the age of science communication 2.0, their continued function as gatekeepers has been questioned (Brüggemann et al. 2020, p. 8; Pearce et al. 2019, p. 1). This situation prompts new considerations about how to guarantee the quality of the knowledge introduced in public discussions of science in general (Bucchi and Trench 2014, p. 9; Minol et al. 2007, p. 1132) and, specifically, in the context of climate change (Treen et al. 2020, p. 12). The present paper aims to clarify the puzzle surrounding the assignment of responsibility for certifying knowledge in the public climate debate. In a time when this chore does not self-evidently lie with journalists, the study will shed light on how climate scientists, climate journalists, and citizens perceive this matter.

Hence, this study aims to address the following research questions:

RQ1: How do climate scientists, climate journalists, and citizens negotiate the boundaries of scientific experts and the relevance of citizens' experience-based input in the public discussion of climate-related issues?

RQ2: How do the three actors make sense of the quality assurance of the knowledge claims put forth in the public climate debate?

The research questions will be examined by way of 15 focus groups with Danish climate scientists, climate journalists, and citizens.

1 Background

For a long time, science was the sole avenue to advance the grasp of climate change as the phenomenon was “observed, predicted, studied, analysed and perhaps adapted to because of scientific discoveries” (Wilson 2000, p. 201). Accordingly, scientific sources have been instrumental in the media coverage of the subject. While the reliance on testimony from

climate scientists was more pronounced when climate change first became a mainstay on the news agenda in the late 1980s and early 1990s (Trumbo 1996, p. 278), nowadays, scientific experts continue to play a key role in climate journalism (Comfort et al. 2020; Wang and Downey 2023, p. 12).

Lately, however, academics have voiced apprehensions regarding the dominant role of science in public discourse on climate change, resulting in the neglect of citizens' viewpoints (Areia et al. 2019, p. 298; Nash et al. 2020, p. 65; Schäfer and Painter 2020, p. 12). The focal point is the notion that science provides only a "narrow pathway of understanding and action" (Rice et al. 2015, p. 255), overlooking the vital facet of citizens' experiences (Burke 2020, p. 4). These concerns align with Dudman and De Wit's proposition for a listening agenda in climate science communication, mirroring a broader shift in the literature on science communication. In recent decades, researchers in this field have underscored dialogical approaches to the science-society relationship, discrediting the knowledge-deficit model and its unilateral communication from scientists to a passive public (Bubela et al. 2009; Bucchi and Trench 2014; Reincke et al. 2020; Stilgoe et al. 2014).

The plea for a more inclusive climate debate also corresponds with Funtowicz and Ravetz's idea of "post-normal science" (Funtowicz and Ravetz 1993). This concept is used to describe scientific issues that are characterized by uncertainty, disputed values, high stakes, and urgency (Funtowicz and Ravetz 1993, p. 744), with climate change being hailed as a quintessential example of post-normality (Bray and Storch 1999; Krauss et al. 2012). A central element in Funtowicz and Ravetz' train of thought is the necessity of operating with an extended peer community in relation to post-normal science issues, where "problems lack neat solutions," "phenomena are ambiguous," and "all research techniques are open to methodological criticism" (Funtowicz and Ravetz 1993, p. 752). They argue that "extended facts" from non-scientific stakeholders are a valuable resource in such uncertain circumstances. The experiential knowledge may help in defining the problem at stake and be a resource for critical reflection on the scientific data (Funtowicz and Ravetz 1993, p. 753). Experiential knowledge is commonly defined as "localised or informal knowledge reflecting people's everyday interpretation of a situation" (Raymond et al. 2010, p. 1768).

On the other side of the argument, Collins and Evans contend that opening the discussion to a wider range of participants breeds new dilemmas. Their chief interest is to prevent the "disastrous" scenario where "the distinction between expertise and democracy" is dissolved (Collins and Evans 2002, p. 269). Collins and Evans' focal argument is that relevance is a matter of possessing expertise. Yet, they maintain that this trait is not per definition reserved for scientists, as it is possible to find uncertified experts with relevant experience among the public (Collins et al. 2023, pp. 64–65). The duo further points out that it is essential to discriminate between different types of science as the potential for relevant contributions from citizens hinges on the scientific discipline in question. They posit that the public can readily contribute scientifically relevant insights regarding research in public-use technologies and planning (Collins and Evans 2002, p. 267). However, in their view, debates concerning esoteric scientific questions such as the discovery of gravitational waves or the detection of solar neutrinos cannot derive benefits from non-scientific contributions (Collins and Evans 2002, pp. 242–243, 2019, p. 87). Involvement in such disputes should be reserved for a core group of researchers possessing highly specialized proficiency within that field (Collins and Evans 2002, p. 242).

Nevertheless, modern communication technology has empowered a multitude of individuals to engage in public discussions on a wide array of climate-related topics, ranging from the causes of climate change to the efficacy of renewable energy solutions, without regard to their academic credentials. When legacy media were the predominant vehicles

for the public sphere, journalists served to differentiate between pertinent and irrelevant lay entries to the societal debate on scientific topics (Trench 2007, p. 134). The advent of science communication 2.0 signified a break with this epoch (Fahy and Nisbet 2011, p. 782). According to Bucchi, this shift has the characteristics of a double-edged sword as, on the one hand, it improves the conditions for increased public participation in deliberations of science, while, on the other, it risks “pushing into the public discussion rushed conclusions and even fraudulent content” (Bucchi 2017, p. 891). The danger of online platforms leading to an unsound discussion has been proposed to be particularly pressing in relation to climate change. Schäfer thus remarks that the “scientific mainstream is inadequately represented in online climate communication” (Schäfer 2012, p. 532). Additionally, web-based deliberations on climate change have been suggested to be highly susceptible to the diffusion of misinformation (Treen et al. 2020, p. 12) and the creation of echo chambers (Pearce et al. 2019, p. 13; Walter et al. 2018).

Acknowledging that a reassessment of the limits of scientific experts and experiential knowledge in the societal climate discussion is justified (RQ1) and that the traditional quality assurance of publicly stated knowledge claims is challenged (RQ2), the present paper will probe how the potential changes resonate with three significant actors in climate science communication by conducting a focus group study with climate scientists, climate journalists, and citizens in Denmark.

2 Methods

2.1 Case selection

The present study was carried out in Denmark, a country with a solid legacy of citizen involvement in questions of science and technology. Largely owing to consensus conferences, public hearings, and scenario workshops organized by the Danish Board of Technology, Denmark, has been regarded as a frontrunner in public participation in science and technology issues (Goven 2003; Mejlgaard 2009, p. 486; Seifert 2006). In a cross-European analysis pertaining to a range of science-in-society dimensions, Denmark was placed in the cluster of countries with a consolidated science communication culture and a formalized tradition of public presence in science and technology decision-making (Mejlgaard and Stares 2012, pp. 745–746). In keeping with this, Denmark has been one of the pioneering countries in establishing a citizen assembly in the climate area (Danish Ministry of Climate Energy and Utilities 2020). Considering the Danish history of strong public inclusion in discussions of scientific topics in general and climate matters in particular, it might be expected that content from lay people should be more treasured in this setting than elsewhere. Denmark therefore approximates a critical case of the most-likely kind in this regard (Flyvbjerg 2006, pp. 229–232).

Another trademark of the Danish context is the comparatively high level of climate anxiety. Nearly half of the Danish population holds the belief that climate change is the most crucial global problem. Consequently, Denmark ranks as the second-most climate-concerned nation within the European Union (Anon 2019, p. 8). This heightened awareness of the threat stemming from climate change could have contradictory implications. It might lead to a preference for authoritative scientific voices, bolstering a traditional approach, or it could foster more openness to the experiential insights of individuals as they might be seen to form an immediate connection to this pressing issue. The Danish case therefore

offers an intriguing opportunity to explore the views on the contribution of scientific expertise and experiential insights to the ongoing climate debate in an environment characterized by pronounced climate concern.

Moreover, the Danish citizenry has a particularly high degree of trust in the conventional media (Newman et al. 2021, p. 19). The Danish circumstances can therefore also tell us something about the perceived need for journalistic filtering of the societal conversation about science-based topics when the media is held in great esteem.

2.2 Research design

This study is based on 15 focus groups composed of different constellations of Danish climate scientists, climate journalists, and citizens (the same data has been used to produce another research article focusing on these actors' role perceptions (Nicolaisen 2022)). This method was chosen as it accords with the study's interest in group-level perceptions. Indeed, a strength of focus groups is their ability to capture processes of group-level negotiations in all their complexity (Bloor et al. 2001, p. 4). Focus groups are therefore useful in explorations of socially constructed phenomena (Cyr 2019, pp. 19–20) such as the ones targeted in the current study. Neither the boundaries of scientific and experiential knowledge in the public climate debate nor the optimal way of ensuring its quality is thus nature-given; rather, they depend on processes of social negotiation. A further argument for employing focus groups is that they can be used to support the triadic perspective of this study because of a research design with both homogeneous (featuring only one actor type) and heterogeneous (featuring all three actor types) focus groups. The homogeneous groups allowed for a probing of the intra-segment consensus on the topics discussed, whereas the heterogeneous groups enabled a direct observation of inter-segment negotiation. Comprising focus groups of participants with highly diverse backgrounds opposes the common wisdom in the focus group literature, which warns against within-group heterogeneity (Barbour 2018, p. 70; Bryman 2004, pp. 508–509). Nevertheless, this concern seems to be more pressing when touching on sensitive subjects where potential power imbalances can affect the group dynamic negatively (Allen 2005; Ayrton 2019). Concerning the present study, the advantages of creating a more multifarious discussion environment outweighed the risk involved in mixing the three segments of actors.

During the fall of 2021, I conducted four homogeneous focus groups with each type of actor as well as three heterogeneous groups where representatives of all three actor types were present. I initially aimed for an equal number of homogeneous and heterogeneous groups. However, during data collection, I added an extra homogeneous group for each actor type because of an incident in a homogeneous citizen group where two participants dominated the discussion. To ensure balance, two more homogeneous groups were organized for the other actor types. Surprisingly, the group that I had somewhat dismissed later revealed valuable data. My initial frustration with losing control over the discussion led me to underestimate the session's worth.

The groups consisted of between four and seven participants each (see Appendix A for group composition). In total, 26 climate scientists, 24 climate journalists, and 26 citizens participated. A semi-structured moderator guide encompassing two sorting exercises was employed to organize the discussions (see Appendix B for moderator guide), which lasted around 90 min and were conducted in Danish. The focus group interviews were audio-recorded and later transcribed with the aid of student assistants.

A climate scientist was defined as a university researcher who studies either the physical basis of climate change or how to mitigate or adapt to it, while a climate journalist was qualified by having produced comprehensive climate-related journalistic content and self-identifying as such. The defining trait of a citizen was an individual over the age of 18.

The sampling of participants was performed with a purposive tactic (Barbour 2018, p. 69) to achieve maximum variation in key characteristics linked to each actor type (Flyvbjerg 2006, p. 230). Regarding the climate scientists, this meant that the participants were affiliated with a range of Danish universities and varied with respect to seniority (i.e., post.doc., assistant professor, associate professor, senior scientist, professor) and academic specialties (e.g., glaciology, carbon capture and storage technologies, policy analysis). The climate journalists represented varied types of media (nationwide media, niche media, freelancers) and levels of experience (long (10+ years), medium (5–10 years), short (<5 years)), while the sample of citizens represented a broad span of the Danish population in terms of age (20–35, 35–50, 50+), educational level, occupation, and climate attitude (climate-concerned, neutral, climate skeptical). Participants with specific educational and occupational backgrounds (e.g., primary school teachers, self-employed) and distinct climate attitudes in either direction were recruited via Facebook groups. The researcher's network was also used to find people with relevant profiles. However, to qualify for participation, persons had to be at two or more removes from the researcher (for details about the recruitment procedure, see Appendix C).

Before the data collection was initiated, the study was granted ethical approval by the Research Ethics Committee at X University (approval number 2021–81).

2.3 Strategy for analysis and coding

The analysis of the focus group interviews was assisted by coding in NVivo and was greatly inspired by Auerbach and Silverstein's principles for coding qualitative data (Auerbach & Silverstein 2003, pp. 34–84). Guided by the research questions, the material was inductively coded in three waves. First, a within-case analysis of each focus group was performed. Here, the 15 transcripts were thoroughly examined to detect units of data where the participants reflected on either climate scientists' function as experts, the applicability of experiential knowledge, or how to assure the quality of the public climate debate. Each unit of relevant text was then provided with a code describing its content. In the second wave of analysis, an across-case approach was used as the codes from the different focus groups were compared to assemble text units with similar content under the same repeated idea. The final phase of analysis was fixated on the identification of themes in the data by grouping the repeated ideas into more inclusive categories. In the latter stages of the analytical process, I paid particular attention to how the themes manifested across the different group compositions. Displays were created to help navigate the different themes (see Appendix D for displays related to the different facets of the research questions).

3 Analysis

The first subsection delves into the main themes of the participants' deliberations of climate scientists' expertise, while the following part examines their discussion of the applicability of citizens' experience-based input. Finally, the participants' negotiations of who

should ensure the quality of the societal debate on climate science will be analyzed. All quotations from the focus groups have been translated from Danish by the author.

3.1 Perceptions of scientists’ expertise

During the inductive coding of the focus group material, it became apparent that the deliberation of scientific expertise across the different group compositions could be arranged around two dimensions: scope and certainty (see Fig. 1). The discussions connected to the former pertained to the extent of climate scientists’ area of expertise when they feature in the public debate, while the ones revolving around the latter focused on the certainty that should be attributed to scientific knowledge claims. Below, these two central aspects of the participants’ understandings of scientific expertise will be examined in turn.

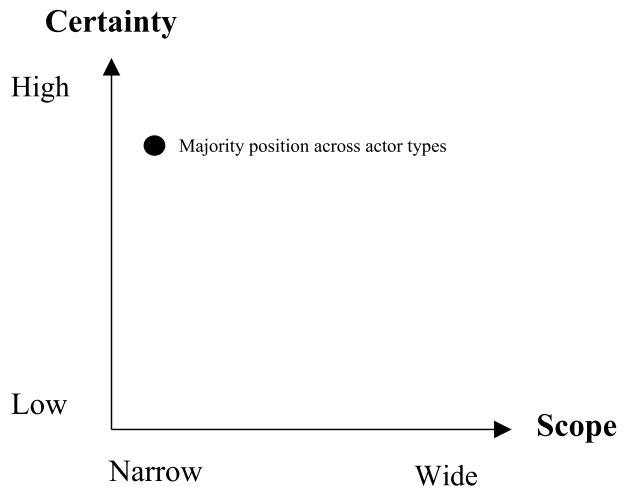
When reflecting on the scope continuum of scientific expertise, participants from all three segments agreed about a narrow delimitation of individual climate scientists’ field of proficiency. On the whole, they therefore wanted climate scientists to remain faithful to their own niche of research when communicating in public. The following examples show how this viewpoint was commonly articulated by climate scientists, climate journalists, and citizens alike:

But a lot of the requests [from the media], as you say, might be a bit on the fringes, and then you have to sometimes say, ‘I don’t know anything about that’, and that is an important part, I think, to kind of say, ‘Here, I will make a statement, here, I don’t really ...’ At least there, I won’t be able to speak as a scientist, there I would just speak as a citizen, but that is not what they are looking for. *Climate scientist (male, senior scientist), Group 15*

I think that the scientists’ biggest obligation in this regard is to communicate exactly what they are knowledgeable about and exactly what their studies show and nothing else. The most dangerous thing, I think, for us journalists are all-round experts [...] *Climate journalist (male, medium experience, niche media), Group 2*

Well, so Option A [referring to a card in a sorting exercise with different fabricated public statements made by a climate scientist (See Appendix B for details

Fig. 1 Illustration of dimensions in the participants’ discussions of climate scientists’ expertise



on the moderator guide)], that is what he studies. Option C is a further conclusion, which he has not studied, so I don't think he should say that. He should only speak about what he has studied. *Citizen, (neutral, female, 20s, product manager), Group 7*

Of the three types of actors, the climate scientists were by far the most vocal in stressing the limited breadth of scientists' realm of expertise. One noted that credibility might be lost if colleagues acted as experts on questions outside their home turf, while another found it to be "one of the biggest problems out there" that climate scientists are making media appearances related to topics "far beyond what they have research-based knowledge on." However, there were also a few exceptions to the rule as some climate scientists perceived it to be legitimate for them to contribute insights on research themes neighboring their own. This is exemplified in the excerpt below from one of the homogeneous groups:

The talk that they want to have for 10 minutes or whatever you get on Deadline [Danish news program] is maybe something that basically relates to papers written by maybe 50 different authors, and I am not the author of all 50, but I am able to recap in round numbers the content of the 50 papers, and here, I don't feel that I am compromising my professionalism. On the contrary, I think that a big part of my professionalism lies in the ability to embrace larger quantities of literature and sort of present the overall implications of it. *Climate scientist (male, professor), Group 4*

A similar attitude was voiced by a climate scientist who argued that you could be the most knowledgeable person in the country on a subject outside your own niche of research. He therefore preferred to say "based on my knowledge" instead of "based on my research" when making statements to the media. None of the climate journalists and citizens backed this interpretation, as they subscribed to a more restricted notion of scientific expertise about climate change.

Regarding the certainty axis, two opposed positions were apparent in the focus groups. One cluster of participants saw scientific expertise as authoritative and as something that deserves to be presented as such in the media. A citizen in a homogenous group articulated this outlook:

I lean on science, what the scientists have found out, and what the UN communicates based on many scientists who agree. So, so, that is what I must stick to. I am not a scientist. I am not even a biologist. I am just a [former] teacher. [...] I think what is important to me is to listen to what they say, the ones who know something about it, and then I try to figure out, what can I, little me, do. [...] *Citizen (climate conscious, female, 60s, pensioner), Group 9*

Some participants also wished that climate scientists would be more unequivocal when communicating their research. This standpoint was displayed in the following dialogue between a citizen and a climate journalist from one of the heterogeneous groups:

I think that most scientists communicate way too ... *Citizen (climate conscious, female, 40s, nature interpreter)*

Conservatively? *Climate journalist (male, niche media, medium experience)*

Too ... well they don't dare to say it pointedly. It becomes something like, 'We think maybe it will be like this', 'There is a high likelihood that ...', instead of just saying ... and it has taken 100 IPCC reports before they kind of said that this is what is going on. *Citizen (climate conscious, female, 40s, nature interpreter), Group 13*

The contrasting view was that scientific knowledge is inherently uncertain and that science-based propositions about the state of the world should therefore always be labelled accordingly. One citizen from a heterogeneous group, a biomedical scientist, was particularly adamant about this critical stance towards science:

I think there is ... and you will hate me in a minute, and that is fair enough. I think that there is a little bit of researcher hubris involved in saying that you can predict how the earth will look in nearly a hundred years. We have *never* ever been able to do that before, and you have no idea whether you can now. *Citizen (climate skeptic, male, 40s, associate professor in biomedicine), Group 13*

He explained how his conception of scientific knowledge as uncertain had been fuelled by his recent engagement with COVID-19 research, where he had experienced scientific prognoses to be wrong on many occasions. However, his opinion was heavily contested by the other participants, primarily a climate scientist and a climate journalist, who both argued that climate science deserves to be presented as reliable based on the high level of consensus in the research community and the fact that climate models dating back to the 1970s have proved to be rather accurate. A parallel mechanism was triggered in a homogeneous group with citizens when a participant questioned the veracity of climate science:

But what if science is mistaken? That, that, that climate change is not man-made? *Citizen (climate skeptic, male, 40s, carpenter)*

Yeah, yeah, what if, and what if? Well, we also need to, well, in my view you also need to say, well, a lot of science is available, which is what you need to argue based on, uh, when there isn't anything else. [...] *Citizen (neutral, female, 40s, clerk), Group 8*

The two instances show how a similar assessment of scientific uncertainty was articulated by climate-skeptic participants with varying proximities to science, with one being an insider (the associate professor of biomedicine) and the other an outsider (the carpenter). In both cases, the other group members were quick to challenge their doubt towards presenting climate science as settled. However, climate skepticism did not translate into a universal dismissal of scientific experts' standing in the public climate debate. In fact, some climate skeptics argued that the societal deliberation of climate change was not sufficiently based on scientific data and that it would therefore benefit from being more influenced by "the right" experts.

Overall, the focus groups gave the impression that the three types of actors were rather aligned in their appraisal of experts' knowledge as certain but very particular. In instances where climate-skeptic citizens questioned the reliability and predictive power of climate science, more confident group members swiftly countered these views. Conversely, when someone expressed something akin to blind faith in climate science, their beliefs were either positively reinforced or left unchallenged by the other group members. Yet, the participants' insistence that scientific experts should confine themselves to their specific field, a pervasive pattern in the focus groups, attests to their awareness of the limitations to the authority of climate scientists. This finding accords with Collins and Evans' assertion that scientists must function as "specialists" rather than "generalists" when acting as experts in the public domain (Collins and Evans 2002, p. 270).

3.2 Perceptions of citizens' experience-based input

Another major topic in the focus groups was the pertinence of experiential knowledge in the public discussion of climate-related issues.

Most participants from all three segments acknowledged that laypeople could provide valuable insights to supplement science-based knowledge. In many groups, the discussion progressed from focusing on whether experiential knowledge was useful to the public climate debate to how it could be integrated into climate journalism and occur alongside observations from climate science. This leap seemed straightforward as most participants, especially the climate journalists, could easily imagine the incorporation of citizen perspectives into climate stories. Here, citizens could be granted the status of "everyday experts" used to ground an otherwise abstract discussion in the experiential knowledge of the public, accumulated through professional experience (e.g., as farmers) or by engaging in certain lifestyle practices, such as going on climate-friendly vacations.

However, it was reiterated that the experiential knowledge of citizens did not qualify them to contribute to the resolution of scientific questions. Climate journalists in different groups explained how scientific credentials were required to be considered a legitimate participant in discussions of the substance of climate science. While not denying that citizens could potentially deliver relevant insights on scientific matters, the climate journalists argued that it would simply be too difficult to verify their knowledge as nothing akin to the peer review process exists for this kind of information. A citizen in a homogeneous group also expressed concern about using citizens as experts in climate reporting:

[...] But a farmer [...] experiencing that there has been more rain or more erratic weather or whatever. It might just be a single case. It is not very scientific and, well, correct to cite him. [...] Then you get some outlier, and that would be totally wrong in relation to the general picture [...] Well, then you should have conducted an investigation of a thousand farmers or something like that and then kind of see, what is the tendency in Denmark and kind of use the scientific method to do it [...] *Citizen (neutral, male, engineer, 20s), Group 14*

Nonetheless, participants of different types recognized that citizen perspectives and scientific knowledge could still be fruitfully linked through climate journalism. In a homogeneous group with citizens, a participant expressed enthusiasm about this prospect:

I have experience with driving an electric car, I have solar panels on my roof, and I grow vegetables on my roof [...] I have some practical experience, and that can be relevant for science in relation to building a bridge between the climate knowledge that they are responsible for [...] and something that can be carried out in reality, right? *Citizen (climate conscious, female, 60s, pensioner)*

So, your knowledge can actually fertilize the research with new ideas? (*Moderator*)

Yes, I definitely think so. *Citizen (climate conscious, female, 60s, pensioner)*

I would like to hear something concrete about that. What tangible things do you imagine that could be? *Citizen (climate skeptic, male, 50s, high school teacher)*

I have a suggestion for that [...] *Citizen (climate conscious, male, 30s, construction consultant), Group 7*

In the above passage, the high school teacher challenges the pensioner's conviction about the mutual enrichment between experiential and scientific knowledge. The high

school teacher had previously stated that citizens did not possess the competences to generate any valid knowledge pertaining to the climate. Although the question in the example was directed at the pensioner, another participant answered. He thought that researchers in eco-friendly architecture could learn helpful lessons by studying the energy-self-sufficient houses built by his company. A concrete example of how citizens can contribute to the public climate debate was also offered in another group by a climate scientist working in sustainable agriculture, who explained how he had derived new hypotheses based on the experiences of farmers. In relation to this, a climate journalist also described how the experiences of citizens had provided him with impetus for crafting new journalistic ideas.

The rejection of citizens' ability to produce any knowledge useful to the societal discussion related to climate science was found in a fraction of participants. However, this viewpoint seemed to be connected to a narrow understanding of the climate debate as being exclusively about geophysical processes. For example, one climate journalist argued that climate matters were "too technical" for laypeople to be able to deliver valuable input. In a homogeneous group with climate scientists, two participants expressed a similar attitude as they agreed that non-scientists would be incapable of engaging in a discussion about how to, for example, "date an ice core based on isotopes and dust." This assessment was mirrored by a citizen in another group, who did not think she "knew enough" to participate in the debate. According to another citizen, members of the public "should have enough self-insight to realize that they are not smarter than the scientists in the scientists' own area of expertise".

In the aggregate, the experiential knowledge of citizens was seen as an important supplement to scientific knowledge in climate journalism, but it was also evident that it would never qualify citizens to take part in the media's coverage of scientific disputes. This application of the extended facts appears to be in accordance with Funtowicz and Ravetz' conception of the extended peer community, which Ravetz later stressed was never conceived of as a "replacement peer community" (Ravetz 2011, p. 156). The justification for involving other kinds of stakeholders in science is thus exactly that they can contribute other kinds of insights. It was clear that this was also the role the participants intended for the public in climate journalism.

At the same time, the worth of experiential knowledge to public discussions of the climate proved to be caveated as it varied between different branches of research, backing Collins and Evans' recommendation to evaluate the pertinence of lay input based on the type of science considered (Collins and Evans 2002, pp. 265–266). It was apparent that the participants saw the esotericism of the science to be inversely correlated with the potential for relevant engagement of non-scientists. Citizens were seen to be able to contribute experiential knowledge to discussions within more solution-oriented research fields, while their voices had no application in more technical debates around, for example, climate modelling or glaciology.

3.3 Quality-assuring the public debate on climate science

It was evident from the focus group interviews that numerous participants from each segment perceived the quality of public deliberation on climate change to be under threat. Misinformation turned out to be a key concept in their discussions. However, the participants diverged in their perceptions of the causes of false information and the consequent remedies to alleviate it.

Most participants pointed to the unmoderated debate on social media as the primary liability regarding the dissemination of false knowledge claims. A climate journalist saw the increased communicative power of citizens as a potential pitfall for the quality of the information shared:

I would say that social media has changed the role distribution so that people like us and climate scientists, their voices weigh less heavily, right, than they did previously, right? Then the voice of an ordinary, and in some cases ignorant citizen, weighs more heavily, you could say, right? And that can pose a problem in relation to misinformation and fake news and so on, right? *Climate journalist (male, long experience, nationwide media), Group 1*

Several citizens also lamented the standard of discussions about climate change on social media, which one participant described as “mudslinging.” Moreover, another citizen explained how she got nothing but confusion out of engaging in Facebook debates about climate-related subjects:

[...] some of the things that I think is, like, quite annoying is when I have sometimes tried to seek out something, and then I have maybe seen it referred to on Facebook. I know it's not the best source [...] I read something about something. I think it was those floods or something, and suddenly someone wrote that it had something to do with the turn of the Gulf Stream, and then I became totally confused. [...] *Citizen (neutral, female, 30s, caregiver), Group 14*

In line with the above quote, the participants in a homogeneous citizen group agreed that unmediated online climate discussions often feature random facts and that journalistic mediation is therefore necessary. This opinion was also shared by a number of climate scientists. One argued that “old-fashioned classic media” strive to “eliminate the noise to get the signal through,” while social media “self-reinforce the noise” in discussions of scientific topics.

Among the climate journalists, there was a broad recognition that the value of the public discussion of climate change hinged on journalistic moderation. In a heterogeneous group, a climate journalist warned the participating climate scientists about the possible consequences of bypassing the “old media” when communicating publicly:

But, well, we have accumulated credibility over a long period, which we safeguard ferociously. The new media haven't, and so the risk that they don't comment on content and don't sort it emerges. What might happen is that you go out on a platform as a scientist, and then the debate runs amok. *Climate journalist (male, long experience, nationwide media), Group 11*

He warned that without a journalistic filter in the discussion, trust in science may drop as it has done in the United States. In another group, a climate journalist asserted that “any debate not controlled in some way becomes bad.” Generally, the perceived need for journalistic intervention occurs in situations where citizens venture into domains usually reserved for scientists, not in instances where they share their experience-based knowledge.

However, a cluster of citizens with a climate-skeptic sentiment perceived legacy media to be the primary source of misinformation. Indeed, the critical attitude towards the established media was the most significant common denominator among the climate-skeptic participants. In a homogeneous citizen group, a climate skeptic maintained that almost all Danish climate journalism consisted of misinformation and that he only knew of one newspaper that treats the climate issue in a “serious manner,” namely *Stavanger Aftenblad*,

a Norwegian media outlet. Additionally, a climate skeptic in a heterogeneous group contended that “journalism has already taken sides” and that this was evident in the reporting. This claim was strongly opposed by the attendant climate journalists, who said that the media were merely “listening to science.” A notion of an unmistakable bias in climate journalism was also held by a climate-skeptic citizen in a homogeneous group, who explained how his realization of the skewedness of the media had made him take responsibility for seeking supplementary information elsewhere:

When I first got a look at the other side of the coin, I felt like what I experience in the mainstream media [...] becomes incredibly one-sided and focuses a lot on this doomsday narrative [...] Then I began searching for alternative ways to get informed, and one of the things that you have heard very frequently is that the science is settled, right? There is total agreement on the science. As soon as you begin to go that way, some alarm bells should, per definition, start ringing. [...] *Citizen (climate skeptic, male, 50s, chief revenue officer), Group 9*

A small minority ascribed climate scientists a role in combating the spread of misinformation. On two separate occasions, a climate scientist and a citizen argued that climate scientists should interfere when they come across unwarranted knowledge claims in the public debate.

However, in the grand scheme, the focus groups demonstrated that the three parties concur that upholding the quality of public discourse on climate matters is most effectively achieved when the traditional media take the lead. The evidence from this study therefore corroborates Vos’ claim that journalistic “gatekeeping is not declining, dying, or dead” (Vos 2020, p. 90) and indicates that the “crisis of mediators” (Bucchi and Trench 2014, p. 9) in science communication is not as pressing as it might seem. In contrast, the data presented here indicates that journalistic gatekeeping is requested in even more contexts than just the traditional media outlets.

4 Discussion

The outcome of this study offers important background to Dudman and de Wit’s request for invoking a listening agenda in climate science communication. It corroborates that the contributory potential of the public is widely recognized among climate scientists, climate journalists, and citizens. However, it was also apparent from the focus groups that the relevance of the experiential knowledge of citizens is to a large degree predicated on the topic in question. This is in line with the research of Garcia-del-Amo et al. as they show that Spanish climate scientists saw a higher potential for the inclusion of local knowledge into climate research connected to the biological and socioeconomic systems than to the climatic and physical systems (García-del-Amo et al. 2020, p. 80). These findings from Denmark and Spain resonate with Collins and Evans’ contention that esoteric sciences will not gain from the experiential knowledge of citizens. This could be seen as a natural consequence of the abstract nature of several facets of the climate challenge. Relatedly, Beck describes the new types of risks facing modern societies such as climate change as “second-hand non-experiences” (Beck 1992, pp. 71–72). Beck’s point is exactly that many aspects of such risks are “by nature beyond human perception” (Beck 1992, p. 72). This underlines the difficulty of implementing a universal “listening agenda” in climate communication as some elements of climate change can only be comprehended by scientific

means. However, the focus groups also revealed that citizens felt geared to contribute to more applied types of climate science, and their potential to supplement the scientific knowledge in these areas was also recognized by climate scientists.

The fact that some citizens in the focus groups expressed an aversion towards participation in discussions of climate science is a testament that one should be wary when taking the public desire for involvement for granted. One participant found it to be outright “provocative” for citizens like him to enter the discussion of climate-scientific issues. This sentiment accords with the findings of another recent study on climate journalism. Through a survey with a representative sample of the Danish population, Willig et al. display a general satisfaction with the level of expert appearances in the media’s climate coverage. Almost a fourth of their respondents think that scientific experts feature “too little” (Willig et al. 2022, p. 533). Likewise, Suldovsky and Taylor-Rodriguez show that some segments of the population actually prefer climate communication in the mold of the deficit model as they rely more on expert knowledge than their own personal experience (Suldovsky and Taylor-Rodríguez 2021, p. 11). Their study serves to illustrate that the valuation of scientific and experiential knowledge is a zero-sum game, where high appreciation of the former leads to a depreciation of the latter and vice versa, and, further, that these different stances on the merit of the knowledge types translate into separate science communication preferences. Indeed, the skepticism towards public participation is not reserved for climate science. In fact, a similar reluctance to engage with science has been found regarding genomics (Dijkstra and Gutteling 2012) and nuclear technology (Turcanu et al. 2014). According to Dijkstra and Gutteling, “contrary to the often assumed expectation that people will participate at large – engagement of the public is not always possible or necessary” (Dijkstra and Gutteling 2012, p. 386).

In a study of experts’ conceptualizations of lay knowledge in environmental decision-making, Petts and Brooks argue for the need to know how experts perceive lay input as they could potentially pose a barrier to the incorporation of citizen contributions to the deliberative process (Petts and Brooks 2006, p. 1048). The research design employed in the present study is underpinned by a similar philosophy, acknowledging the dependency structures among the investigated actors in climate science communication. For example, if climate science and climate journalism are not ready to listen, contributions from the public will have less impact. However, whereas Petts and Brooks operate with a unidirectional, one-dimensional outlook, the present study has a reciprocal and three-dimensional perspective on the use of different types of knowledge in the public debate on climate-related issues. This research makes a significant contribution by highlighting the alignment between the viewpoints of the actors regarding the boundaries to the contributions of scientific experts and lay people, as well as their shared sense of responsibility for ensuring the quality of discussions. The findings reveal a substantial consensus among all three actor groups on these matters. This widespread concord was testified to by the low level of conflict in the heterogeneous focus groups. While the homogeneous groups with climate scientists and climate journalists were also relatively harmonious, the groups consisting exclusively of citizens tended to be more prone to disagreement when the participants deliberated the relevance of lay input and the credibility of journalists as gatekeepers.

A major priority of this study has been to investigate how the quality of the public climate debate ought to be secured. While the definition of what constitutes quality in the public debate could potentially be construed in a variety of ways, the participants in the focus groups were quite univocal in emphasizing that avoiding unsubstantiated knowledge claims was a central concern in securing a decent public discussion. According to the participants, the diffusion of sub-standard knowledge claims could be the result of either ignorant or

ill-intended people interfering in the discussion of scientific facts. In this regard, it is relevant to consider Treen et al.'s (2020) discrimination between misinformation and disinformation, which proposes a distinction based on the intention of the sender. Misinformation pertains to "misleading information that is created and spread, regardless of whether the intent is to deceive," while disinformation is transmitted with the intent of deceiving the receiver (Treen et al. 2020, p. 2). This differentiation helps gain a more nuanced appreciation of the participants' preference for keeping the gatekeeper function within the ranks of journalists. Some participants endorsed journalists as gatekeepers because their perceived scientific proficiency was assumed to make them better equipped to curate knowledge claims. Others trusted journalists to be more likely to engage with knowledge in an unbiased way because of the professional norms guiding journalistic practice. However, recent scholarship challenges this optimistic view. Climate journalists in diverse settings have thus been found to encounter difficulties in coping with the abundance of technicalities connected to the beat (Ejaz et al. 2022; Robbins and Wheatley 2021). In a similar vein, Wirz and Brossard point to journalistic errors following increasingly precarious working conditions in modern newsrooms as a main source of misinformation in environmental reporting (Wirz and Brossard 2022, p. 287).

A notable limitation of the present study is that it overlooks the policy aspect because of the absence of politicians and civil servants in the cast of participants. It could undoubtedly have been stimulating to include these actors to explore the role of scientific and experiential knowledge in policy development and, thereby, supplement the extant literature on these themes (Brewsters Soyapi et al. 2023; Lemos et al. 2012). However, broadening the actor ensemble and the scope of the study would be practically insurmountable given the research design with homogeneous and heterogeneous groups and an already packed moderator guide. To maintain symmetry, adding another actor type would hence have required conducting an additional four focus groups, while each session should have been extended to a point where the participants' attention span would have been seriously tested if more ground had to be covered.

This paper presents insights from a comprehensive focus group study in Denmark addressing three key discussions in climate communication literature. These include (1) defining the role of climate scientists in the public sphere, (2) exploring the potential for dialogical climate science communication involving public experience-based knowledge, and (3) examining the quality assurance of knowledge claims in the science communication 2.0 era. The paper contributes to the expanding literature on the responsibility of climate scientists in the public domain (Cologna et al. 2021; Getson et al. 2020; Oreskes 2020). By taking a normative stance, it offers valuable insights into this ongoing discourse, spotlighting the limited scope of climate scientists' authority when engaging in societal discussions about climate change. Moreover, the study has shown that experience-based input is welcomed in the public discussion of the climate challenge, with two important caveats: it cannot replace but must rather serve as a supplement to scientific knowledge, and its relevance is largely restricted to applied research fields. By shedding light on how citizens can participate in the public deliberation of climate-related issues, this study has engaged with an alleged weakness of post-normal science, namely the vagueness concerning the function of the extended peer community (Yearley 2000, p. 110). Further, it has revealed that journalists are still favored as gatekeepers in a time when alternative communication channels are mounting. This finding contests a prevailing notion in contemporary research that suggests a decline in the role of climate journalists as gatekeepers (Brüggemann 2017, p. 6; Pearce et al. 2019, p. 1). Yet, when reflecting on the participants' inclination to keep journalists at the helm of the public climate discussion, it is essential to be mindful of the context in

which the study was conducted. Because of the high level of trust in the media in Denmark, the approval of placing the gatekeeping responsibility with journalists is therefore not surprising. If the study was to be repeated under more media-skeptical circumstances, such as those found in the United States (Newman et al. 2021, p. 19), it is plausible that the picture would diverge markedly.

It is also possible to draw up a range of practical implications based on the results presented here. For instance, the focus group data supports climate scientists' right to reject commenting on subjects outside their specialties in the media as both the public and their peers expect them to be selective in this respect. Furthermore, the evidence of this study could have a bearing on the ideation of initiatives to strengthen public involvement in the societal discussion of climate change. The paper highlighted the high value of experiential knowledge in the solution-oriented aspect of the climate debate. However, several citizens mentioned that they lacked an outlet to share their insights. Considering this, it seems reasonable to create formal channels for citizens to share their experience-based knowledge with stakeholders. Finally, the acknowledged need for the services of trained climate journalists is noteworthy, especially in a time when audiences' willingness to pay for journalistic products is limited (Goyanes 2014; Groot Kormelink 2023, p. 2214). This discrepancy lends credence to a model such as the Danish with wholly and partly state-subsidized media (Olesen 2020, p. 418).

Appendix A: Overview of focus group composition

	Females	Males
Homogeneous groups with climate journalists		
<i>Group 1 (5 participants)</i>	Freelancer, short experience Nationwide media, short experience	Niche media, long experience Niche media, medium experience Nationwide media, long experience
<i>Group 2 (5 participants)</i>	Niche media, long experience	Freelancer, long experience Niche media, medium experience Nationwide media, long experience Niche media, medium experience
<i>Group 3 (5 participants)</i>	Freelancer, long experience Nationwide media, long experience	Freelancer, short experience Niche media, medium experience Nationwide media, long experience
<i>Group 10 (4 participants)</i>	Nationwide media, long experience	Nationwide media, short experience Niche media, short experience Niche media, short experience
Homogeneous groups with climate scientists		
<i>Group 4 (5 participants)</i>	Professor Postdoc	Professor Associate professor Associate professor
<i>Group 5 (5 participants)</i>	Assistant professor	Professor Professor Associate professor Assistant professor

	Females	Males
<i>Group 6 (7 participants)</i>	Professor	Professor Professor Professor Associate professor Associate professor Senior scientist
<i>Group 15 (4 participants)</i>	Senior scientist Associate professor	Senior scientist Associate professor
Homogeneous groups with citizens		
<i>Group 7 (6 participants)</i>	Climate conscious, pensioner, 60s Neutral, product manager, 20s Climate sceptic, student, 20s	Climate conscious, construction consultant, 30s Climate sceptic, high school teacher, 50s Neutral, farmer, 40s
<i>Group 8 (4 participants)</i>	Neutral, pedagogue, 60s Neutral, clerk, 40s	Climate sceptic, geological consultant, 60s Climate sceptic, carpenter, 30s
<i>Group 9 (4 participants)</i>	Climate conscious, pensioner, 60s	Neutral, student, 20s Neutral, priest, 60s Climate sceptic, chief revenue officer, 50s
<i>Group 14 (6 participants)</i>	Neutral, unemployed, 50s Neutral, caregiver, 30s Climate conscious, outdoor consultant, 50s Climate conscious, architect, 50s	Neutral, engineer, 20s Neutral, student, 20s
Heterogenous groups		
<i>Group 11 (4 participants)</i>	Neutral, early retiree, 60s	Professor Professor Journalist from nationwide media, long experience
<i>Group 12 (6 participants)</i>	Professor Neutral, student, 20s Neutral, primary school teacher, 50s	Journalist from nationwide media, short experience Journalist from niche media, long experience Associate professor
<i>Group 13 (6 participants)</i>	Climate conscious, nature inter- preter, 40s	Journalist from niche media, medium experience Journalist from niche media, long experience Professor Neutral, truck driver, 60s Climate sceptic, associate professor in biomedicine, 40s

Appendix B: Moderator guide (*Translated from Danish*)

Informed consent form (2 minutes)

If any of you have not yet signed an informed consent form, you can do it now.

Introduction (5 minutes)

I would like to thank you for coming today.

This focus group is part of a PhD project examining climate science communication. Specifically, I am interested in the relation between climate scientists, climate journalists, and citizens. I have therefore set up fifteen focus groups with these three types of actors. The focus groups are meant to produce knowledge on how the actors see their own and each other's roles. Focus will therefore not be on the current situation but, rather, on how it ought to be according to you.

I have invited you because you represent a diversity of backgrounds. Today's discussion will depart from questions and exercises provided by me, but it is not me who should be centre stage today. Instead, I hope that you will discuss with each other. It is perfectly fine if it turns out that you disagree, and there are no right or wrong answers.

It is also important to emphasize that everything that is said in the focus group is confidential. I will therefore ask you not to reveal the content of today's discussion to outsiders.

Today's session will last one and a half hours. We will cover three different themes. First, you will discuss the role of citizens in climate science communication, then, the role of the journalists and, last, the role of the scientists. I will ask you a range of questions and present two exercises to you.

The interview will be recorded because I need to have a precise account of your discussion for when I analyse the data. The interview transcripts will be pseudonymised and treated according to the GDPR legislation, the European Union's data protection law.

Before we get started, I will ask you to briefly introduce yourself with your name, age, and occupation (citizens), years of experience, the media you represent (climate journalists), your position, and the university you are affiliated with (climate scientists).

Warm-up questions (5 minutes)

Homogeneous groups with citizens

Question 1: Climate change has been a major public issue for a long time. *Do you do something to follow or even contribute to the public climate discussion?*

Homogeneous groups with climate journalists

Question 1: *What is your motivation for covering the climate topic?*

Probe: *Why is it interesting?*

Homogeneous groups with climate scientists

Question 1: *It differs how much climate scientists communicate their research in public. What is your experience in doing it?*

Probe: *Do you use social media to communicate professional messages?*

Theme A: The role of citizens (20 minutes)

Question 1: *Ought the individual citizen try to keep updated on the climate situation? Why? Why not?*

Stimulus

In case this part of the discussion needed stimulation, the participants were presented with an engagement scale produced by the research. This scale served to illustrate different levels of engagement ranging from 'Totally disengaged' to 'Hyper engaged'. Each point of the scale was associated with specific behaviours, so the totally disengaged were not doing anything to seek information about the climate, while the moderately engaged learned

about the climate situation through the media and the hyper engaged were reading scientific papers and reports about the climate. The participants were then asked to consider the scale when discussing how citizens should engage with climate science information.

Question 2: How do you perceive the importance of keeping up to date with climate change compared to other subjects such as the economic situation or global politics?

Question 3: How should citizens be involved in climate journalism?

Question 4: How do you perceive the possibility of citizens being experts?

Question 5: Modern technology has enabled more people to participate in the public debate on scientific topics such as climate change. What is the significance of scientific knowledge for participation in the societal discussion of climate-related issues?

Probe: Who should participate in this discussion?

Theme B: The role of climate journalists (20 minutes)

Question 1: The climate has a prominent position on the media agenda. What is good climate journalism in your view?

Probe: What characterizes bad climate journalism?

Stimulus

If the participants were unresponsive to the question, I showed them three pictures meant to illustrate different kinds of climate journalism. One picture showed the hockey stick graph, another showed a crossed-over beef, while the last picture showed a starving polar bear.

Sorting exercise

A variety of normative statements about climate journalism was written on cards. On the table, there was a label saying 'Agree' and a label saying 'Disagree'. The participants in turn received a card that they were told to read aloud, and afterwards, they were told to state whether they agreed or disagreed with the statement on it.

'Journalism should not only describe climate change. It should fight it'.

'We are not here to tell the public how to behave. We are here to tell them what is happening'.

'I think that the best climate coverage is local and shows how people are being affected by climate change'.

'It is not my task to be an expert. If I do that, I am committing a journalistic sin'.

'It is important to remain open towards climate denialists, although an overwhelming majority of the scientific evidence does not corroborate their claim'.

'It is an important task for journalists to facilitate interaction between climate scientists and citizens'.

'I should be asking good questions, marshalling good facts, and letting readers draw their own conclusions. Journalists work in the fact industry'.

'As a journalist I have never thought about how to make stories engaging and relevant to a particular audience. It's not really our job to do that. I think it is our job to help people make sense of the world'.

'The media should play down their headlines and write about facts and expertise. They should present things at a higher level and not make use of scare campaigns'.

Probes: Which statements do you agree and disagree with the most? Are there any aspects of the journalists' role that you think are missing among the cards?

Break (8 minutes)

Theme C: The role of climate scientists (20 minutes)

Question 1: Traditionally, the task of scientists has been to do research and teach. How do you perceive climate scientists' responsibility to communicate their research to the public?

Probe: How should climate scientists communicate their research?

Sorting exercise

The participants were presented with a scenario where a climate scientist publishes a study. Two labels were placed on the table. One read 'Appropriate' and the other 'Inappropriate'. The participants were then collectively asked to place four hypothetical public statements made by the concerned climate scientists according to whether they were appropriate or inappropriate.

A climate scientist publishes a study that shows that the water level will rise 2.5 meters in 2100 if we continue to emit as much CO₂ worldwide as hitherto. That prediction exceeds what the UN's climate panel perceives to be the most likely scenario by 50 centimetres. What is the scientist allowed to say based on the result?

A: 'My research shows that the water level will rise 2.5 meters in 2100'.

B: 'My research indicates that we need to do more to limit the emission of CO₂'.

C: 'Based on my research, I assert that it will be a good idea to tax air travel and meat consumption further'.

D: 'My results make me worried on behalf of my grandchildren'.

Probe: What defines whether a statement is acceptable or unacceptable?

Rounding off (10 minutes)

Taking departure in this triangle, I want you to put some labels on the roles of the different actors.

How would you describe the role of climate scientists in the communication of climate science?

If you should do the same for the climate journalists, how would that sound?

What about the citizens?

I want to end the session by thanking you for participating. If any of you have any comments, we can discuss them afterwards. You are also welcome to write or call me. My mail address and phone number are on the blackboard.

Note:

The ordering of the themes differed according to the group composition.

In the homogenous groups with climate scientists, the ordering was as follows: Theme C, Theme A, Theme B.

In the homogenous groups with climate journalists, the ordering was as follows: Theme B, Theme A, Theme C.

In the homogenous groups with citizens, the ordering was as follows: Theme A, Theme B, Theme C.

In the heterogenous groups, the ordering was as follows: Theme B, Theme A, Theme C. Further, the participants in these groups were not exposed to any warm-up questions.

Appendix C: Recruitment procedure

Recruitment of climate scientists

The identification of relevant researchers was initiated by web searches to locate climate scientists at each relevant university. The publication lists of researchers were used to decide if someone could be classified as a climate scientist. This effort resulted in a list of potential participants with varying seniority, research interests, and gender. The researchers were then contacted by phone. Here, they were introduced to the study and asked whether they agreed that their research is climate-related to a large extent. If they confirmed this, they were asked if they wanted to participate in the study and, thus, receive a written invitation at a later point. The researchers were also asked if they knew of colleagues who they thought could be relevant. This was done to identify potentially relevant researchers who were not detected by the web searches.

Recruitment of climate journalists

The identification of the relevant journalists began by approaching the chairmen of Danish Science Journalists (Danske Videnskabsjournalister) and The Association of Energy and Environmental Journalists (Foreningen af Energi- og Miljøjournalister). These inquiries resulted in a list of Danish journalists who covered climate-related subjects. The journalists were then contacted by phone. Here, they were introduced to the study and asked whether they agreed that their journalistic work focused on climate-related subjects to a large extent. If they confirmed this, they were asked if they wanted to participate in the study and, thus, receive a written invitation at a later point. The journalists were also asked if they knew of colleagues who they thought could be relevant. This was done to identify potentially relevant journalists who were not part of the associations. In the end, an exhaustive list of climate journalists with varying media affiliations, format specializations, and experience levels ensued.

Recruitment of citizens

The recruitment of citizens followed a targeted strategy, and a variety of channels were utilized. Facebook groups of social movements were used to identify citizens with strong either pro- or anti-environmental sentiments. The pro-environmental segment was targeted through Facebook groups connected to, for example, The Climate Movement (Klimabevægelsen) or The Grandparents' Climate Action (Bedsteforældrenes Klimaaktion), while the group belonging to The Climate Realists (Klimarealisterne) was used to get in touch with the group of citizens with an anti-environmental sentiment. Facebook groups for people with different professions (e.g., primary school teachers, high school teachers, entrepreneurs) were also used to locate potential participants with a neutral attitude towards the climate. Further, the network of the researcher was utilized to recruit participants of this type. Here, potential participants were required to be at two or more removes from the researcher. The citizens were contacted by phone. Here, they were introduced to the study. If they were interested in participating, they were promised a written invitation at a later point.

Appendix D: Displays

The role of scientific experts

Scope

Climate scientists

First and foremost, I must speak about facts, well, I have to speak about the results that I have produced myself. *Climate scientist (female, postdoc) Group 4*

But who should then provide the answers to how to solve this problem if it is not the ones who ... if it is not the climate scientists? *Citizen (neutral, female, early retiree, 60s)*

Yes, but it is another climate scientist. It is a bit like when you go up to the doctor and say you have knee pain, and you need to have surgery. Then it isn't the doctor who looked at your knee, it is another doctor, and that is where things often go wrong. *Climate scientist (male, professor) Group 11*

Certainty

Climate scientists

[...] Well, it [climate scepticism] is like when people come and say that the world is flat or that the earth is flat. Well to me that is a claim that is not tenable. We have enough evidence that, ehm, and there is a certain ... well to me it is also ... well we can continue to discuss these things and well as you said it is 5000 to 2. *Climate scientist (male, professor) Group 13*

Climate journalists

Well, for my part it unfortunately becomes a bit of, you know, a trite point, well to me it is really all about whether you are talking about something that is within your specialty. *Climate journalist (male, niche media, medium experience) Group 2*

Well, a good example here in the interview is actually that in relation to IPCC I interviewed someone about methane, who knows something about methane and ice and all that, right? But then she shouldn't comment on agriculture and methane emissions from cows and all such things, because it isn't, it isn't something that she knows anything about. *Climate journalist (male, niche media, long experience)*

But that can ... I actually think that it happens more and more often, well that someone like Mernild [Danish climate scientist] speaks about something that he basically does not know anything about. Well, where you ... and that I think is actually a bit of a problem. *Climate journalist (female, nationwide media, short experience) Group 1*

Climate journalists

I remember that I was a little bit climate sceptical the first year [...] But then I was very quickly pretty convinced by reading different reports and speaking to different scientists that we bear the primary guilt for this, right, and then it has occurred to me, well, the magnitude is enormous regarding what climate change does and we are to blame for it and ... I have developed a very, very strong impression bordering on evidence that we are 100 percent responsible for the climate changes that are ongoing right now [...] *Climate journalist (male, nationwide media, long experience) Group 1*

Citizens

Is it a kind of humility towards their own ... ? (*Moderator*)
It must be something with knowing your own limits, right? *Citizen (climate conscious, female, 40s, sustainability consultant) Group 13*

[...] So that is problematic, I think. Then another scientist is needed [...] So in that way I don't think that he should conclude something about anything he has not studied. *Citizen (neutral, male, 20s, engineer) Group 14*

Well, I think that he [a fictive climate scientist in a sorting exercise] should provide the conclusion to what he has studied and then he should not start to connect it to everything else, then he must just let it stand alone [...] *Citizen (climate sceptic, female, 20s, student) Group 7*

Citizens

Science must seek the truth. *Citizen (climate sceptic, male, 60s, geological consultant)*
Yes! *Citizen (neutral, female, 40s, clerk) Group 8*

Well, the prime minister has an opinion about something. Nobody has an opinion about that curve. How much CO₂ or how much the temperature will increase. *Citizen (climate conscious, female, 40s, nature interpreter)*

[...] There is not widespread about it. That is rubbish. *Climate scientist (male, professor)*
No. There really isn't. There isn't. *Citizen (climate conscious, female, 40s, nature interpreter) Group 13*

The role of citizens' experience-based input

Climate scientists

That is what citizens can do. They can maybe say something about how it is experienced out there in some way, and that is also relevant [...] *Climate scientist (female, senior scientist) Group 15*

Well, it depends, it depends a bit on the subject. If the subject is the scientific facts, then it is pretty important that you have a decent idea about how science works, ehm. If the subject is which personal choices you can make in this regard and how you can contribute to solve the climate then, then, then, ehm, then I would maybe think that you would be better able to say that everybody can participate. So, I will say that it really depends on the subject. *Climate scientist (male, associate professor) Group 11*

But I think that it is a big problem if people start to speak about something that they don't know anything about. That pertains both to citizens and to us. So, if you start to come with absolute statements, ehm, with quantitative statements, ehm, then it is a problem, whether it regards the climate or, or what should you say, the natural scientific aspect of the climate or the societal. *Climate scientist (male, associate professor) Group 15*

So, should we really expect ... is it reasonable to expect that citizens are competent in terms of scientific questions? (*Moderator*)

I think that the most important cue is that they must appreciate the importance of the research. *Climate scientist (male, professor) Group 6*

Climate journalists

I want the word consequence experts. *Climate journalist (male, nationwide media, long experience)*

Yes. (*Moderator*)

[Explains the concept of consequence expert] How does it affect my every day? It may very well be that you are not educated to be an expert, but you are an expert in the consequences that it presents you with. *Climate journalist (male, nationwide media, long experience) Group 11*

No but well I am probably in agreement with what has been said already. Well, I think that you should use the citizens if the citizens can be used to put a face on some topics. Use their stories to illustrate what is going on. *Climate journalist (male, freelancer, short experience)*

Yes, simply as cases. *Climate journalist (female, nationwide media, long experience)*

Simply as cases, yes. *Climate journalist (male, freelancer, short experience) Group 3*

But I am a bit like ... I don't know ... Were you asking whether there should be an exchange between the citizen and the scientists?

Because then I anyway doubt that some research project about the climate, ehm ... At least if you are speaking about the development of climate models and that sort and examinations and treatment of data and so on, then I don't think that a major ... *Climate journalist (male, freelancer, long experience) Group 2*

Citizens

Well, can you use a citizen as expert?

Let's say that an engineer or someone who is not a scientist, but who has read all the climate reports and has built an extensive knowledge about the climate. Can you use him as an expert? (*Moderator*)

No, no. Unfortunately. *Climate journalist (male, nationwide media, long experience)*

A citizen is an expert in being a citizen. *Citizen (neutral, female, 60s, early retiree) Group 11*

Yes, you can ask the citizens: What is your experience? Well, that is a whole other thing than that you are generally supposed to have an opinion about everything. *Citizen (climate conscious, female, 50s, outdoor consultant) Group 14*

Well, but with regard to a field of research ... Well, yes, well, it is not just for fun that you study for five years to learn something and then it is a bit too much if a citizen or a politician comes up and thinks he is much smarter. I think that is too provocative. *Citizen (climate sceptic, male, 60s, geological consultant) Group 8*

Well, I think that I have read about ice core, ehm, drillings and have watched films and think that ... But I would never start to call myself anything approaching an expert. You need to be careful with such things. *Citizen (neutral, female, 50s, primary school teacher) Group 12*

Quality-assuring knowledge claims

*The traditional media as gatekeepers***Climate scientists**

We have good journalists in Denmark, who work with the climate professionally and who are not climate science experts, but who still know very much about the area, and they can, they can call a bluff. When somebody says something stupid, then they are able to pose some good counter-questions. *Climate scientist (male, associate professor) Group 4*

So, journalists, they are interpreters. Have you also said mediators? (*Moderator*)

They can also be critics. They can perform a kind of criticism and play us out against each other to a certain extent. Get more angles on the same thing. *Climate scientist (male, associate professor) Group 5*

*Alternative gatekeepers***Climate scientists**

And then again on the researcher side it will sometimes be appropriate that you should respond and do a fact check. *Climate scientist (male, professor) Group 11*

Climate journalists

What about something like curator, well? There is a lot of information that we discard. *Climate journalist (male, niche media, short experience)*

[...]

Yes, yes. I also feel like saying something with navigating or something like that. *Climate journalist (male, niche media, short experience)*

Yeah, yeah. *Climate journalist (female, nationwide media, long experience)*

But, ehm, I can't exactly ... I think curator is the best word really. *Climate journalist (male, niche media, short experience) Group 10*

Must they [climate journalists] be experts? (*Moderator*)

No! *Climate scientist (male, professor)*

But they can be fact-checkers, as was mentioned earlier. We are actually supposed to be that. *Climate journalist (male, nationwide media, long experience) Group 11*

Climate journalists**Citizens**

[...] I think that we are dependent on, well, we can't all go out and investigate and verify all the knowledge we are presented with. In that regard we need to trust that the people who are working *professionally* with these things and are really committed, together are able to create a picture that is so realistic that we can relate to it, because we don't have the ability to do that. *Citizen (neutral, male, 60s, priest) Group 9*

But I will say the whole technology surrounding it, it has made it easier to write. It was far more cumbersome back in the day to write an opinion piece to a newspaper or something. Well, you, you ... But that also means that people are much more inclined to do something without having any prior considerations. And there I think you have a great problem. *Citizen (neutral, female, 50s, primary school teacher) Group 12*

Citizens

And, and, and our newspapers ... as I understood it, was also part of the topic, well the media. They don't inform about it. They don't inform about data. They can show nice curves about stock prices and the oil price which rises, but to show data about how the climate has varied even just during the last 50,000 years or 800,000 years or half a billion years, that, that they cannot figure out and they don't want to. It is not because we are not able to. *Citizen (climate sceptic, male, 60s, geological consultant) Group 8*

If a scientist is sitting privately and reading something which is nonsense in some newspaper, then he should contact the journalists and say that it is not right. Well, so in principle it should be the experts who do it, because the citizens do not know, do not have any foundation to, ehm, correct it. *Citizen (neutral, male, 20s, engineer) Group 14*

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Data availability The focus group data analyzed in the current study is not publicly available to safeguard the identities of the participants. Participants were thus assured of confidentiality when signing up for participation.

Declarations

Competing interests The author declares no competing interests.

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