



DEMOCRACY OR WAR?

The communication of the climate issue online

by Tomas Moe Skjølsvold, Marianne Ryghaug and Eirik Frøhaug Swensen

For years, technology optimists have hoped that the internet might serve as a vehicle for democratization. Meanwhile, many STS-scholars have called for a democratization of scientific practices through increased transparency and inclusion of lay-persons in scientific knowledge production. Many expect this to result in increased scientific quality and more legitimate knowledge claims. In this article, we explore what happens when science related communication moves online. Do climate scientists and climate 'skeptics' use the internet to engage lay persons in factual deliberations and debate? Does the rise of the internet as a channel of science communication herald a new, democratic scientific era? Our paper suggests that such claims should be made with caution. Instead we identify two ways that the internet is used by climate scientists. First, it is a tool to fight a cold war with climate skeptics, a dynamic which is hidden from public view. Second, it is a site of education, where ready-made packets of facts should be transported to lay-people to mitigate perceived knowledge deficits. This strategy is mimicked by climate skeptics who attempt to make their communication appear more scientific than the scientists.

Keywords: climate communication, climate science, online communication, scientific democratization

Authors: Tomas Moe Skjølsvold, Marianne Ryghaug
Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology
Email: tomas.skjolsvold@ntnu.no, marianne.ryghaug@ntnu.no, eirik.swensen@miljodir.no.

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Introduction

To anyone interested in science, it should be clear that the internet has opened a flood of new opportunities for scientific dialogue and communication. Online channels have catered for new modes of scientific production and communication practices. For instance, it is now common for large international scientific networks to collaborate, strategize, plan and discuss across disciplinary and national borders through participation in e-mail lists (Ryghaug and Skjølsvold 2010). Further, the internet has opened for new ways of communicating scientific results to actors outside science. Research is disseminated via new platforms. Many of these are interactive, allowing for discussions between those who produce scientific knowledge and in principle, any interested lay-person. Social media, blogs, online newspapers and specialized scientific websites are all relevant examples.

This development has coincided with a trend in STS and related fields, where some observers of science have called for the democratizing of scientific practices. Some examples include Funtowicz and Ravetz (1993) call for 'post-normal science', Gibbons et al. (1994) description of a 'Mode 2' production regime for scientific knowledge, and Callon's (1999) observation of a movement towards a scientific model where lay-people and experts co-produce knowledge. Commonly, these ideas assume that the inclusion of non-scientists in scientific deliberation will improve the quality of scientific products, and that knowledge claims might gain legitimacy through the incorporation of locally anchored and contextually contingent lay-knowledge. In the words of some authors, such practices of inclusion will produce 'socially robust knowledge' (Nowotny, Scott, and Gibbons 2001), a concept incorporating the merits of lay people contribution to scientific production, and what is considered an increased demand for public proofs for scientific knowledge claims.

In the 1990s and around the turn of the millennium there was much celebratory optimism concerning the role of the internet as a technological force of democratization (e.g. Dahlgren 2000, Ferdinand 2000). While some aspects of this writing appear naïve in retrospect, so-called web 2.0 technologies are now frequently mobilized with the goal of fostering new modes of public participation and collaboration in e.g. politics (Cogburn and Espinoza-Vasquez 2011) and in business organizations (Pettersen 2014). Similar potential has been noted and described for scientific production, for instance under the header of citizen science (e.g. Haklay 2013). In this paper we are interested in what happens when climate science ventures into the online sphere. Climate science has been criticized for being non-transparent, to lack openness (e.g. Hulme and Ravetz 2009, Krauss, Schafer, and von Storch 2012, McAllister 2012). Thus, moving climate communication online might be one way to broaden the participation in scientific production, and the public deliberation around climate issues. We explore such issues empirically, studying if such participatory initiatives can be identified.

There are countless websites dedicated to climate issues. Some are hosted by climate scientists, others by so-called climate 'skeptics'. However, it is an open question whether lay-people who cannot be defined as parts of these camps participate in such fora. We set out to do an empirical analysis of how and to what extent online platforms such as blogs, newspaper commentary fields etc. are used by climate scientists and climate skeptics, and the degree to which their communication on such platforms take on a dialogical form, opening up for layperson participation in scientific debate and scientific production. This general interest in climate communication feeds in to three concrete questions that we want to explore further:

- (1) How has the emergence of online communication facilitated new modes of dissemination and communication by climate scientists?
- (2) What are the online communication strategies of so-called climate skeptics?
- (3) To what extent is this communication dialogue based, i.e. consisting of exchanges between the two camps (scientists and skeptics) and openly accessible to third parties such as lay-persons?

In sum, our interest in studying climate communication online has emerged from a curiosity regarding whether or not online communication has served to establish more participatory, inclusive and deliberative scientific practices, and opening climate science to broader audiences. During the 1990s, many STS scholars called for such openness and transparency, under the banner of democratisation of the sciences. It is probably wise here to think about democracy in a broader sense than merely a formal decision making system, but to highlight what is often thought of as cornerstones in liberal democracies. This includes mechanisms to have different voices heard and represented in deliberative processes, as well as ideals concerning the possibility of broad participation in processes of shaping outcomes (see e.g. Bollen 1993).

Of course it is not given that online communication will lead to openness, exchanges and factual deliberation. While analysing climate scientists' communication and dissemination strategies, Sunniva E. Tøsse (2013) pointed out that there has been a long standing heated media situation around climate science, creating a "charged context of reception" (ibid. p. 33). There is little suggesting that online arenas should be any less 'charged' than journalistically mediated outputs. As Callon (1999) has pointed out, opening an arena for deliberation also entails allowing skepticism and distrust to surface. In Tøsse's account, the climate scientists embarked on a balancing act where they weighed ideals about openness and transparency against their own needs to control the modification of fact-claims in what they saw as a hostile environment. An important question for us then is if such strategies change when we



zoom in on the online sphere. The internet is a many-headed beast where countless actors and interests are present. This makes it a potentially attractive arena of scientific deliberation. Whether this serves to consolidate trenches or to open for factual deliberation

with wider audiences will be one of the issues we explore in the following. First, we will have to dig a little deeper into the theoretical assumptions mentioned briefly above and previous research related to the climate issue.

Towards a more democratic climate science?

Some years ago, the internet played a crucial role in the incident that was to become known as 'Climategate'. An archive of around 1,000 e-mails that involved scientists at the Climatic Research Unit (CRU) at the University of East Anglia was unlawfully made public. The -gate suffix suggests that the e-mail authors were involved in a scientific scandal, and that anthropogenic global warming was a hoax. The online sphere and mainstream press exploded in subsequent controversy. As an example, it was described in *The Telegraph* as "The worst scientific scandal of our generation" (Booker 2009). In the following months numerous investigations were conducted, the outcome being that the scientists were found innocent of misrepresenting climate records to exaggerate warming trends.

This does not mean that controversy ended, and much of the following discussions called for more transparent climate scientific practices. This debate was more difficult to dismiss. Some called for active public engagement to provide a realistic image of scientific practice (e.g. Ryghaug and Skjølsvold 2010), others asked about who should have access to scientific data (McAllister 2012). Still others discussed reform in climate scientific policy advisory processes (Grundmann 2013). Increased openness and transparency, it was argued, would increase public understanding of scientific practices (Hulme and Ravetz 2009), and improve scientific reputation (Russell et al. 2010).

In STS, discussions about the science-publics relationships are not new. Numerous schools have called for more open, transparent and inclusive scientific practices. This is considered important in part because certain public expectations about scientific conduct and openness have emerged, but just as importantly, STS has done tremendous work to complicate the relationship between what has traditionally been considered privileged expert knowledge, and laypeople (e.g. Wynne 1991). Scientists have traditionally considered lay people to be knowledge deficient (see e.g. Bauer 2009), the result being communication strategies aimed at increasing scientific literacy. As awareness has grown concerning the importance of informal knowledge production by lay people, many have argued for the inclusion of lay knowledge and lay experience in formalized scientific processes to enrich, improve and make knowledge claims more legitimate in social and political contexts (see Hessels and Van Lente 2008 for a review).

Such ideas have been concretized through scholarship on 'Mode 2'-science, post-normal science and similar concepts. The assessment is usually that more actors should have a say in scientific production.

Practically this inclusion could be conducted in many different ways, such as consensus conferences or focus groups (Callon 1999), or potentially, through the types of online arenas that interest us here. Gibbons et al. (1994) have proposed that such activities might lead to what they dub socially robust knowledge. Typically, advocates tend to argue that social robustness entails scientific transparency and public involvement. Such ideals have also been picked up in European science policy, where public engagement, dialogue and deliberation have become central key words. Generally, there seems to be a growing belief amongst policy makers that they can mitigate declining public confidence in science through public engagement activities (e.g. Stilgoe, Irwin, and Jones 2006, Tøsse 2013).

Scholars who promote the idea of social robustness call for an expansion of science-public relationships, and enlarging the science production community beyond peers in a narrow, scholarly sense (Nowotny 2003). To meet the expectations of dialogue between science and society, some scholars have called for the establishment of an arena to host the deliberations. Nowotny et al. (2001) used the metaphor of Athen's *Agora* to describe potential situated encounters between science and the public. This metaphor highlighted the complexities involved in the new scientific reality. The idea of the scientific *agora* was an attempt to capture the complexities of science co-produced by scientists and laypeople. The *agora* would be populated by competing experts, scientific organizations and institutions, but also by 'nagging publics', by politicians, commercial interests etc. The *agora*, then, would be a way to contextualize, situate and include new groups in scientific knowledge production. Through this, it would increase insight about the methods and processes of science, catering for more deliberative practices between actors and interests. The result, claims its proponents: socially robust knowledge.

We ask if the emergence of the internet with its many online arenas has created conditions similar to such an arena – a new *agora*? Perhaps the online sphere has enabled increased interaction between science and so-called laypeople, opening up for new modes of deliberative scientific practices. Does it facilitate communication between experts and laypeople? Has the rise of the blogosphere and online newspaper commentary fields given climate scientists new tools to engage and involve wider publics?

Two elements complicate climate science and its deliberation when compared to ideals about strategies of openness: First, the presence of a particular type of public who often engages climate science through dedicated and active opposition, the so-called



'skeptics'. Many ideas about transparency presuppose that the source of public distrust towards science is anchored in alienation from scientific practices. For instance, Callon (1999) highlights how this has been important when concerned actors such as organized patient groups have been enrolled in medical scientific production. So-called climate skeptics may be a different breed of concerned group; they are not necessarily alienated individuals. Several studies show that they often have vested interests, either in carbon capitalism (e.g. Demeritt 2006, Oreskes and Conway 2010) or in traditional power relations between science and society, wishing to stem the tide of changes in the science-policy relationship (Lahsen 2008).

Second, studies of scientists' discursive strategies in controversies (Gilbert 1984) indicate that scientists tend to close up instead of opening up when controversies rage, and that they use demarcation strategies to discredit critics and resolve controversies (e.g. Burchell 2007, Michael and Birke 1994). This is an obvious challenge

if the goal is socially robust knowledge, because trench-style warfare differs in character from deliberative communication.

Mobilizing Sunniva Tøsse's vocabulary of openness and control (2013) these insights could suggest that scientists prefer strategies of control when controversies heat up, and that climate scientists are more interested in achieving 'politically robust' communication. This concept was introduced by Tøsse precisely to address some of the problematic issues with respect to the exercise of control over the reception of scientific information in controversial situations. We want to discuss what happens with the strategies of climate scientists and skeptics when the controversy is played out online. Do we find signs of *agora*-style democratic deliberation that caters for open scientific debates and the production of more socially robust knowledge, or do we rather find that climate scientists and skeptics seek to maintain control over the production and dissemination of factual arguments and withdraw to their own spheres in pursuit of managing the situation?

What do we know about how climate change is debated online?

Some literature already exists that might illuminate our discussion. Mike Schäfer (2012) has reviewed more than 100 papers that deal with online climate communication from multiple disciplinary perspectives. A key insight from this study was that climate scientists are actually not the main players in online climate communication. However, some scientists do use the internet, and they do so primarily in order to educate the public, thus a typical knowledge deficiency approach where the goal is to increase scientific literacy. A second group used online arenas to carry out scientific discussions. Typically, this included discussions of ideas and preliminary scientific results between peers, not public deliberation. A third, but quite small group, actually considered the web to be a democratic tool, using online environments to communicate with laypersons and publics, to involve laypersons in scientific knowledge production (Schäfer 2012).

The relative absence of scientists online is echoed by Anna Marie Jönsson (2012) who studied the framing of climate change in new social media. This is also noted by Feldpausch-Parker, Parker, and Peterson (2012) who looked at public participation in the website 350.org. Both studies show that online communication is important to involve publics in deliberation, but also to mobilize people to concrete action offline, such as demonstrations. Jönsson's study, however, does not support the hypothesis of the web 2.0 as an *agora*. On the contrary, she finds that the discussions analyzed on new social media fail to bring in actors and publics who were not already heavily involved in the issue before they participated online.

While mainstream online media communication about the climate issue has been studied in detail, the blogosphere – where many skeptics find refuge, remains underanalyzed. An exception is Amelia Sharman's (2013) analysis of 171 climate skeptic blogs. She

identifies ClimateAudit, JoNova and Watts Up With That as the three most central sites internationally. Sherman finds these blogs to focus on what they consider 'pure' science, while many smaller sites have a much more open ideological agenda.

Two other studies that deal with the climate skeptical blogosphere is Brigitte Nerlich's (2010) analysis of what she calls the 'denialosphere' in the wake of Climategate and Rick Holliman's (2011) account of the relationship between social media and traditional media, also after Climategate. Nerlich analysed the content of denialist blogs and showed how the skeptics framed climate science in paradoxical ways. She found that climate skeptic bloggers saw mainstream climate science as a sort of secular religion: the problem was not scientific uncertainty. Rather, science was perceived as too certain and consensual to be the basis for political action. Current climate science should be replaced by what was considered real science, where norms like objectivity, falsification and accumulation of knowledge dominated. Nerlich found that while skeptics demanded this from climate scientists, they did not live up to these standards in their own argumentation. While there may have been inconsistencies in the skeptics' arguments, Holliman's (2011) study of the relationship between new social and traditional media indicates that skeptics reached far beyond their own blogs. Holliman suggested describing the blogosphere through the metaphor of 'the fifth estate'. The fourth estate is a metaphor meant to describe the relationship between traditional news media and government. The idea of the fifth estate suggests that the blogosphere can also take on a watchdog role; watching the media. Holliman used the Climategate incident to illustrate how central climate skeptic bloggers were highly competent in understanding the dynamics of mainstream media. For instance, through highlighting certain newsworthy quotes with perfect



timing, just before the high profile climate summit COP15, the blogosphere was able to set the broader agenda.

Nerlich's study (2010) gives us insights into how skeptics frame climate science and Holiman gives some suggestions about the blogosphere's relationship to traditional media. However, there is little in these two studies that indicate deliberation, in the sense of actual communicative exchanges between climate scientists and skeptics, or between skeptics and lay-persons. Rather, it appears

as if skeptics are trying to win other publics through various strategies, e.g. getting their blogged content into mainstream media outlets. Does this mean that we should expect scientists and skeptics to withdraw, attempting to control their version of climate change rather than engage in factual deliberation? Or will we find new, open and inclusive practices pointing towards more socially robust knowledge about climate change? Before we set out to answer these questions, a short comment on the methodology and data on which our analysis is based follows.

Methodology

In this paper we are interested in climate communication online. We have come to this interest through participation in several projects where the online sphere has been a tangential subject, and we believe that our data circling around this topic deserves further scrutiny. This means that we have mobilized relatively diverse sources of data. They are not necessarily directly comparable. However, they all potentially provide a variety of insights into either the content of online climate communication, or into the ways that actors argue and reason around their online communication practices.

Our first strain of data was the e-mails from the Climategate incident. This leaked material consists of 1073 text files containing e-mails. The first e-mails were from March 1996; the last was sent on November 12, 2009. We accessed the e-mails online and read the e-mails chronologically, while qualitatively coding the content along a number of central themes which emerged during the reading. For the purpose of this paper, we concentrated on emails discussing the internet and online communication such as blogs. The data provides a unique insight into how a large scientific network negotiates, think and make strategic decisions related to such issues. There are some ethical dilemmas involved in using this material. First, the scientists did not intend their emails to be researched, and they did not approve or disapprove of our examination. Some emails contain content of private character. For the purpose of this paper, it is not central to show who the authors of the emails are, but rather what position the author has. Thus, we have decided to anonymize these data, using pseudonyms. For a more elaborate analysis of this incident, see Ryghaug and Skjølsvold (2010).

Secondly, we mobilized interview data with Norwegian climate scientists gathered in two different periods (2005 and 2009). The corpus consists of sixteen interviews with scientists and research

managers from the six most central Norwegian climate research institutions. The interviewees were selected because they were amongst the most active climate communicators in Norway and because they were frequently targeted by the communication of skeptics.

Finally, we use data from a study on Norwegian climate skeptics.¹ This data consists of five interviews with high profile climate skeptics, participant observation in a climate skeptic gathering, as well as a content analysis of the commentary section of an online newspaper where climate skeptics actively took part. The interviews were conducted in 2011. All interviewees had an academic background from natural sciences. The interviewees were chosen because they had participated in media debates or because they had published climate skeptical content in popular science publications.

The informal skeptic gathering with around 30 climate skeptics took place in Oslo, and lasted around two hours. The participants knew that a researcher (one of the authors) participated and the purpose of his presence (to analyze their mode of argumentation). Field notes were taken in retrospect. The analysis of the online newspaper commentary section was based on debates in a national newspaper, *Dagsavisen*, where the commentary section was moderated by an editor and accordingly considered more serious than tabloid debates. The commentary section of all posts with climate relevant content in both 2010 and 2011 were analyzed.

Our data are diverse, and some might argue – incoherent. However, they do all together provide interesting insights about what happens when the climate issue is brought online.

¹ For an extensive analysis of the argumentation strategies of climate skeptics in Norway, see Swenssen (2010)

Climate communication online: who, why and how?

Both climate scientists and outspoken skeptics have been communicating online for a long time. Schäfer's (2012) review indicated that much of the scientist's online activity is an education project. This is recognizable in our data. While much literature around the

year 2000 praised the web for its democratizing potential, the Climategate e-mails from that time period suggests that it was mainly considered a traditional tool of dissemination, i.e. a channel that scientists could use to raise levels of scientific literacy. One



illustrative example came in an exchange between a junior and a senior climate scientist in the year 2000. The scientist was disillusioned by how little science influenced policy, and had decided to take matters into his own hands. He wrote:

Kyoto left me very disillusioned by the apparent lack of connection between climate science and policy - in the protocol there was not one sentence discussing what we need to do to stabilise the climate in the long term, based on scientific predictions. This made me wonder, what is the use of my intricate research on air-sea CO₂ exchange, if the policymakers ignore even the most basic knowledge? I left UEA and started working at home, developing interactive web graphics showing the link between per-capita emissions and global climate change (Climate scientist, year 2000)

Hence, this scientist strongly believed in the potential of the internet as a communication tool and policy instrument. It was considered a classical tool for dissemination where pure scientific knowledge claims could be communicated to a receiving audience. The encounter between this scientist and the web appears to have been very generative, in the sense that it catered for politically motivated communication. Fifteen years in hindsight, this pioneering venture might appear naïve, but as we know the internet has not lost its significance.

However, it has changed significantly since the year 2000, one difference being the gradual implementation of features to promote interaction and collaboration, so-called web 2.0. This also reached the climate science community. In 2004, one of the leading climate science communication blogs – realclimate.org – was established. At the time, the main goal of the site was to balance what some in the climate scientific community considered unfair coverage of climate science in the mainstream media. Setting up a collaborative blog was seen as a way to provide readers with more fact-based information.

On the other hand, the establishment of this blog was a strategy to counter the increasing online activity of climate skeptics. Many climate scientists followed this development closely, and were concerned about how what they considered dis-honest communication would affect the audience. In this sense, a kind of cold war logic was established early on, where climate scientists would watch and monitor what climate skeptics did online, and vice versa. The Climategate e-mails provide some insight to the reasoning behind the establishment. In 2004, one of the Realclimate.org founders wrote the following to a large number of recipients:

Colleagues,

No doubt some of you share our frustration with the current state of media reporting on the climate change issue. Far too often we see agenda-driven 'commentary' on the Internet and in the opinion columns of newspapers crowding out careful

analysis. Many of us work hard on educating the public and journalists through lectures, interviews and letters to the editor, but this is often a thankless task [...] In order to be a little bit more pro-active, a group of us [...] have recently got together to build a new 'climate blog' website: RealClimate.org which will be launched over the next few days. (Climate scientist, 2004)

This email illustrates that the main goal was to establish a new site of collective dissemination. This was in part an answer to the problems that many scientists had with journalistically mediated dissemination, as well as a desire to provide correct information. Thus the goal appears to have been public education, in the sense of trying to raise levels of scientific literacy. Thus, it resembles a deficit model motivated approach to science communication, where the goal is to move fact claims from the source (science) to a (passive) audience. For several climate scientists, realclimate.org became an important tool both for disseminating work this way, and as a platform for stealth warfare against skeptics. As an example, a senior scientist described how the site was used to 'expose the fraud' of two prominent skeptics:

You've probably seen now the [scientific] paper by Wahl and Ammann which independently exposes [the two skeptics] for what it is--pure crap. Of course, we've already done this on 'RealClimate' (Climate scientist, 2004).

Realclimate.org was also a theme in our face-to-face interviews with climate scientists. One interviewee had become involved in realclimate.org at an early stage. He became involved to disseminate facts, something he saw as difficult when involving journalists in communication:

[one problem is] journalists who think they know better than me. And then I try to explain to them why they are wrong, and there is always something [that they are wrong about]. There is a culture between journalists and scientists, there is a barrier. So I can direct them to the website.

Thus, the blog was a way to circumvent what was considered a common problem with science communication. Climate science dissemination, he explained, was a calling and an obligation. Realclimate.org provided a platform that removed the difficulties in communicating with journalists and it provided a global audience:

It is better to 'play the field' at an early stage and communicate the knowledge with all of the world, and not just Norway [...]. The skeptics have their own blogs. We are trying to be scientific, to be as objective as possible, and to nurture knowledge. On our behalf it is important to have true knowledge, or as accurate knowledge as possible.

So far we have seen that climate scientists clearly saw the online world as an arena of dissemination. They did not, however, think about this as a way to involve new actors in scientific production.



Thus, communication practices were a poor match with the idea of the scientific *agora*. Instead, the lecture hall might be a fitting metaphor: online arenas were new sites for presentation of non-negotiable facts. In the words of Tøsse (2013), this might represent an effort to re-claim control over the way climate scientific facts were presented, rather than an effort to increase transparency. One of the ways that this was done was through bringing classical scientific demarcation criteria into this sphere. Realclimate.org was not only considered better than competing skeptic sites because they had better facts, it was seen as better because it was written by scientists, featuring arguments based on peer review. In this sense it was considered a vehicle to transport ready-made packets of truth to society, where they hoped it would be used to change policy. Our interviewees made similar points, stressing that the skeptical blogosphere could not be trusted, primarily because of the merits of those who write such blogs. As one interviewee stated:

There are networks and websites where you can find information that always highlight things which point in contrary directions or question the great consensus. They never communicate the other side. Many of those who are active there are not scientists.

Through their online communication, the scientists recognized the importance of winning the minds of lay-audiences. It was considered too important to just leave the web for the skeptics. However, their intention was not to hear the voices of lay people. The purpose was first to educate lay people, and second it served a purpose in the battle against climate skeptics.

Let us now look more closely at how the data can illuminate the relationship between climate scientists and climate 'skeptics'. As between scientists and other lay audiences, open communication and mutual knowledge production was absent from their relationship. The Climategate e-mails indicate that the relationship resembled the relationship between two cold war super powers. The groups carefully watched each other's online activities, constantly launching tactical responses. One illustration was found in an exchange between several climate scientists who were discussing the activities of high profile skeptics. The exchange began with a message from a climate scientist who had been monitoring a discussion on a climate skeptic blog:

[Fellow climate scientist],

found this posting on [climate skeptic's] blog. Something in the making, just to warn you if you did not see it yet.

The e-mail continued by referring to a lengthy blogpost criticizing the methodological merit of a high profile climate scientist. Another climate scientist replied to the e-mail. This resulted in some online scanning activities by other climate scientists, who uncovered more talk about the issue in the blogosphere:

[My climate scientist colleague] and I were just doing a quick search for ["Climate scientist error"] on google and it came up with this page: <http://www.climateaudit.org/?p=159> with discussion of modern sample bias and a link to [climate scientist's] PhD thesis, plus quotes from it, etc. (Climate scientist, 2005)

This activity occurred without communication between the skeptics and the climate scientists. Instead, the climate scientists forged a strategy based on silence, again much in line with the cold war metaphor. This was clearly a deliberate strategy on part of the climate scientists. In a follow-up email to the discussion, two scientists wrote:

[Fellow climate scientist],

Can you crossdate these two series (trw and mxd) for the Polar Urals? Particularly check the 1032 value when only 3 samples. Found this on the blog site that [climate scientist] sent round. Whatever you do, don't respond on the blog. Cheers

[climate scientist] and [climate scientist].

Thus, skeptical blogging had tangible impact on the activities of the scientists. While this was not to be acknowledged to the outside world, the climate scientists actually went back to crosscheck parts of their own work. We find it quite surprising that skeptical blogging had this impact. It indicates that the climate scientists saw the battle for truth both as real and important, but not as a fight to be picked in public. Thus, the skeptics might actually have served as a sort of informal second trial or round of reviews, or perhaps – as Holiman (2011) suggested – that skeptics carried out their role as 'fifth estate'. Since none of this activity was visible to the public or acknowledged, it is however difficult to interpret the climate scientists' response as a strategy for openness, transparency or a step towards making knowledge more socially robust. Instead, we read it as a struggle to maintain control, both over the appearance of the scientific production process, and the claims to facts.

This pattern was repeated frequently in the e-mail exchanges. Someone in the climate science community typically discovered something on a skeptical blog and emailed the issue to relevant scientists, which then resulted in a discussion leading to a strategic decision. In some instances the discussions revolved around what was considered annoying misunderstandings by the skeptics, which resulted in renewed hope for the possibility of educating them.

In one discussion two years after the quote above, a climate scientist aired his frustrations about the skeptical website climateaudit.org: "If these people would just read the papers – especially Brohan et al., rather than assume what [climate scientists] have done. One blogger [...] tried to defend us, but even he began to misinterpret later" (Climate scientist, 2007). Another climate scientist responded, and this time silence was not deemed the way to response. Instead, she suggested recruiting a 'good troll' to educate the skeptics:



I haven't seen ClimateAudit before; there is a lot about Had-CRUT3 there. It seems very like other climate message boards though in that it is more of a blog space for the user's particular issues rather than an open discussion forum. It does need a 'good' troll to direct readers to papers. (Climate scientist, 2007)

This indicates that the climate scientists had two strategies for handling skeptics. On the one hand, climate scientists were handled by cold war surveillance and tactical responses, but on the other hand, educating through attempts at filling what was perceived as knowledge gaps were used as a strategy. Another example unfolded in 2007 through an exchange on a mailing list for dendro-chronologists, scientists analyzing tree-rings to understand past climate. Again, Climateaudit was at the core of the discussion. One dendrochronologist was tired of being criticized online and wanted his colleagues' strategic advice:

Dear All, I am not sure if you are aware of the Blog ClimateAudit by Steve McIntyre: <http://www.climateaudit.org/>. Dendrochronology (mainly dendroclimatology) is often criticised as a discipline for a variety of reasons. Against advice from many of my dendro friends/colleagues, I often delve into this world to try and defend dendro practices and correct misinformation. It is a thankless task and, to be frank, I doubt I make much difference as many of my criticisms of McIntyre get turned around and transformed into fairly aggressive attacks on my own work. See latest posts from just this past week.

So - should I (we) ignore this Blog?

Personally, I cannot do this. Although some of the criticisms and commentary are valid, some of it is simply wrong and misinformed, and in my mind, it is dangerous to let such things go. Some of the criticism comes simply from misinformed individuals who may not have access to relevant basic literature and I was wondering if it would be worthwhile putting a simple web page together with links to relevant PDFs. (Climate scientist, 2007)

While this scientist was tired of arguing with skeptics, he also believed in the power of providing the best facts. If they just read the 'basic literature', surely they would come around? This statement indicates that the scientists were aware of the importance of enrolling and convincing actors outside core science, but that this was a task that could best be carried out through rational provision of ready-made facts and basic literature.

The responses from the dendrochronologist's colleagues varied. One said: "I do not know whether or not it is worth engaging him on ground of his own choosing" (2007). Others dismissed the idea of engaging the blogosphere at all because science should not mix with politics. In this sense they strictly dismissed the notion that anything but 'true' science was relevant for policy making. For those who argued in this vein, the idea of socially robust knowledge would be absurd. Something was either a fact, or it was not a fact, and society should respond accordingly. As one of the scientists

wrote: "The job of a scientist is producing knowledge and reporting it (...) It is the job of politicians to draw conclusions from science" (2007). Others were more concerned about the potential social and economic repercussions of getting involved in what could be considered controversial issues. One scientist wrote:

Many of us on this forum make our living as academics, so we're required to write proposals, bring in grant money to our university, publish our findings in peer-reviewed outlets, and mentor the next generation of scientists. The reality is that delving into controversy and policy, for many of us, could wreak havoc on our careers. (Climate scientist, 2007)

In the final post of the discussion, a climate scientist tried to summarize the debate, and lay the foundations for a potential strategy:

[we have four choices:] 1. A one off 'guest' thread to RealClimate, carefully describing the basics dendroclimatology (e.g. see Andy Baker's spiel on speleothems).

2. Create our own Dendro Blog similar to RealClimate.

3. A new dendro FAQ, but addressing issues raised in ClimateAudit.

4. A wiki style webpage that is continually updated by individuals within the community.

I actually quite like the idea of the wiki style editing approach [...] This could be continually updated and edited when specific issues are raised, but would really focus on the dendro basics. (Climate scientist, 2007)

The resulting conclusion of this debate strengthens the image of a scientific community that saw public dissemination online as a strategy to educate lay people. This resembles what Michel Callon (2009) has called the public education model of involving lay people in scientific production. Here, true knowledge can only emerge from 'pure' science, and lay ideas are considered dangerous superstition which must be eradicated. Science should inform society, and only then would democracy be possible. In this example, this would be achieved through providing 'the basics' of dendroclimatology. Thus, democratic deliberation is without reach, as is actually genuine debate.

So far, we have only seen climate skeptics as topics in the climate scientists' internal discussions. The scientists in our data have shown us that the online world can be used for stealth battle, or for public education, but so far we have not been able to identify the kinds of discussions that we perhaps could have expected. We now shift our focus to what we can say about the skeptics. What are their strategies online?

Interestingly, the climate scientists and climate skeptics had quite similar strategies for online communication. Like the climate scientists, the skeptics believed in the dissemination of facts. Actually,



many skeptics in our data saw their main purpose as making climate debates more scientific. They did this through providing what was seen as relevant information, mostly in the form of links to other texts. Thus, for the skeptics, links served many of the same purposes that references to other work has traditionally served in science. One example was found in the commentary section of a newspaper. One skeptic wrote:

I have noticed that neither you, Swensen, Hermstad, Kaski or Håndlykken [referring to other participants in the debate] has come up with a single link that proves your claims. And that is in contrast to what I have done myself; I have come up with at least 10 different links, including two highly relevant links relevant for this debate. Two of the links refer to research done by professionals with relevant education, relevant work experience and relevant publications!

This quote was part of an exchange of views that followed in the wake of an article written by Audun Hjertager from the Green Party. This chronicle, posted in the online edition of the newspaper *Dagsavisen*, addresses the well-known arguments for why emission reductions are important. It generated 174 comments. The vast majority of these focused on Hjertager's reference to facts, as well as to the claims made by other participants in the debate about facts, and to what extent these were true or not. It is interesting how strong the focus was on the researchers' academic credentials. When commenters mention relevant education, work experience and publications, it indicates familiarity with demarcation criteria and what counts in academia. Another example from the same debate underlines the importance of arguing in what was considered a scientific way:

So you say that I am not convincing, Georg K.? Didn't you read the two papers I linked to? If you have read them, why didn't you count references? Only in the chapter "A zero-hypothesis for CO₂" (the second link in my last commentary) there were 41 references. Isn't that enough for your taste? I would rather ask you to come up with your own links!

As the quote points out, it was not only the quantity of 'links' to publications supporting the climate skeptic view that mattered, but also how serious the single publication appeared. That a paper had many references was seen as a symbol of quality and importance, thus taking on typical characteristic qualities of the scientific article. Thus, it appears as if a central strategy amongst climate skeptics was to mimic climate science, and through this educate those who have not yet been exposed to these types of facts. Thus, the underlying assumptions of the skeptics and the climate scientists appear very similar when it comes to the relationship between facts and social change. The sentiment seemed to be that facts are facts, and if people would just realize this, they would understand what the world really looks like.

A third way to convince others by making the debate 'more scientific' was to use the weight of history:

There is overwhelming scientific proof that the planet Earth, also after the last ice age, has undergone phases with way higher temperature increases than the current one, without an increase of CO₂. Already in the 1970s, there were more than 1000 publications about this.

Framing climate skeptic claims as facts that that have been established many decades ago, was a strategy forged in order to appeal to common sense and to underline skeptic arguments. Some of the climate scientists' communication strategies online displayed similar dynamics. The goal for both groups was to 'be as scientific as possible' and to provide as much true information as possible. We have seen scientist who wanted to post links to pdfs with 'basic literature', 'a wiki-style page with dendro basics' and a 'good troll' to provide correct information. Further, we have seen skeptics who saw merits in providing '10 links' and '41 references', or '1000 publications in the 1970s'. All in all, this illustrates the new strategic opportunities for developing arguments, mobilizing allies and being 'scientific' in online settings. The argument or fact-claim in itself was not seen to be enough: climate skeptic participants validated their claims with references, much as scientists have always done in order to mobilize credibility and argumentative strength. This two-sidedness of what we have seen of the online sphere could be interpreted as a step in the direction of a new and more democratic deliberation of facts, because we now have access to two different stories about what are the facts.

On the other hand, both sides mobilize a strategy that is firmly anchored in public deficit models, where increasing scientific literacy is what is considered necessary. The following implications regarding science-policy relationships are actually quite depressing. It stands to argue that knowledge is expected to flow from science to society, and thereby shifting policies, attitudes and behavior in desirable ways. However, the climate problem has not been resolved in this way, emissions are not declining. This suggests that a more reflexive understanding of the relationship between scientific knowledge production and societal change might be beneficial, and online arenas might certainly be a potential place to enact such reflexivity.

The ideals proposed by authors advocating socially robust knowledge and democratic deliberation in the *agora* imply transparency and public access to the debate. However, instead of opening up the climate field to a wider audience, it could be that the competition to appear most scientific through jargon-laden, technical, highly referenced online communication by climate change skeptics and scientists could serve to alienate outsiders further, and close the lid on the climate field.



Rational science 2.0: cold war and public education

Has climate scientific communication become more inclusive and transparent through moving online? Our discussion indicates that it probably has not. Instead, climate scientists have used online activities primarily for two tasks. On the one hand, online arenas are used for fighting out wars with climate skeptics. These wars, however, are not acknowledged publicly, but are conducted through silent monitoring of enemy territory, backstage discussions about strategy, and at times tactical responses through posts online. An interesting aspect of these cold war dynamics is the fact that the skeptical blogging at times serves as a generative activity for the scientists, who re-visit their own work in light of public criticism online. These dynamics are seldom visible to actors outside the core scientific group.

Sheila Jasanoff (2011) has shown similar dynamics in past work on the relationship between expertise and policy making, where she indicated that scientists tend to discuss the status of facts very differently 'front stage' than they do 'back stage'. This, she claims, is partly anchored in a desire to preserve the myth of rational and internally sound science, unaffected by social, cultural and historical contingencies, because this myth is necessary if science is to remain a central provider of policy advice. This interpretation seems sound in our case also, where scientists keep whatever effect the skeptical activities have on their work backstage. Another way to frame this argument is to say that the scientists do not worry about the social robustness of the facts produced. It is important for them; however, to remain in control of the fate of their own fact claims, they are concerned about facts being politically robust (Tøsse, 2013).

Secondly, climate scientists and climate skeptics, see the online sphere as a site of education, a site where ready-made facts can be transported from the source to recipients who are ill-informed about the facts. In this sense, what we have observed in this article closely resembled what Michel Callon has called the 'public education model' of scientific communication. In this model, communication between 'science' and 'society' is uni-directional, the goal

to increase scientific literacy of lay people. As Callon writes: "Once the emotions and beliefs clouding [the public's] minds have been dispelled, the citizens or consumers are in a position to take rational decisions" (2009: 84). In our data, this is for instance illustrated through strategies of directing lay people towards 'basic literature'.

Many of the scientists in our data were frustrated about the lack of impact on behalf of their scientific effort. They did not see the desired impact on policy or the what they perceived as an ignorant population. They sought to meet knowledge deficit through the provision of more scientific facts. Interestingly, the climate skeptics had adopted more or less the same strategy when communicating online. They mimicked scientific style through the provision of references, appealed to scientific authority, and through questioning the scientific and methodological rigor of opponents.

As a result we can observe two relatively homogenous online climate discourses, one produced and reproduced by climate scientists, and similarly, one produced and reproduced by climate skeptics. In both cases, highly technical and jargon-heavy language dominates; a strategy which probably hampers the potential inclusion of new groups in the production of facts.

Over the last years, much literature has emerged in STS, highlighting that current climate science communication and presentation, tends to lack local relevance, that there is a lack of translations between abstract global climate models and local-specific needs (e.g. Solli and Ryghaug 2014, Ryghaug and Solli 2012, Næss and Solli 2013). This is probably not only a question of how to disseminate ready-made facts in the best way, but also a question of how climate scientists could incorporate relevant, local-specific knowledge. The dream of web 2.0 as a scientific *agora* is most likely naïve, but in the years ahead of us, one might hope that the scientists aspire to use the capacities of the internet more ambitiously than as another arena to promote the prevailing cold internalistic image of rational science.

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