NORDIC JOURNAL
of Science and Technology Studies

PUBLIC COMMUNICATION OF TECHNOLOGICAL CHANGE

Modest and Less Modest Witnesses

by Per Hetland

When journalists popularize a highly topical new technology, such as the Internet, they situate their popularization within technological expectations; when researchers popularize it, they situate their popularization within both a retrospective and prospective understanding of technological change. Following this, journalists are inclined to appeal to emotionally involved users or pioneers, and researchers are inclined to appeal to responsible citizens. Hence, journalists immodestly dramatize the future by boosting a new technology or turning its risks into threats, while researchers acting as "modest witnesses" pour oil in troubled waters, indicating skepticism about the journalistic approach. Consequently, the technology popularization field is structured in two dimensions: from public appreciation of technology via public engagement to critical understanding of technology in public, and from expectation-based argumentation to research-based argumentation.

Keywords: modest witness, popularization, technological change, expectations, Internet

Author: Per Hetland
Department of Education,
University of Oslo
per.hetland@iped.uio.no

Introduction

Science, technology, and public enlightenment are crucial elements of the modern project. As a forerunner of the modern project, academia includes education, scientific research, and the public communication of science and technology (PCST) as its three most prominent assignments. The third assignment, PCST, refers to all science and technology "mediation, interpretation, dissemination and explanation activities – the range of efforts, among others, to inform, sensitize and mobilize the public" (Schiele and Landry 2012[r], 34). Professional communicators, such as journalists, public relation officers, museum curators, and teachers play crucial roles in mediating science and technology to various publics. However, sometimes researchers choose a direct route, presenting scientific research to various publics via, for example, feature articles, textbooks, or public lectures (Bucchi 1998[r]; Bucchi and Trench 2008[r]; Cheng, et al. 2008[r]; Fleck 1935/1979[r]; Lewenstein 1995[r]). Thus, this article sets out to explore how researchers differ from journalists in the way they portray technological change when they popularize research about the Internet.

While science and technology journalists look for news value to attract their publics' attention or "increase relevance and comprehensibility" for non-scientists (Peters 2013[r], 14107), it seems that most researchers communicating their research act as "modest witnesses" to calm exaggerated expectations (Allan, Anderson, and Petersen 2005[r]; Dunwoody 1999[r]; Gunter, Kinderlerer, and Beyleveld 1999[r]; Haraway 1997[r]; Shapin 1984[r]; Shapin and Schaffer 1985[r]). There is much evidence to indicate that these differences are embedded in the respective occupational sub-cultures:

> The professional identity strategies deployed by scientists such as requiring journalists to adhere to scientific norms and discourse are firmly grounded in the material practices, literary style and social technologies of Boyle's "modest witness". These contrast sharply with journalists' attempts to deal creatively with esoteric knowledge in the interests of democratization, editorial approval and organizational constraint. (Reed 2001[r], 295)

Consequently, one may claim that these differences are part of two different "professional projects" depicted in the two faces of witnessing (Peters 2001[r]): direct experience of a sociotechnical practice, and discourse about the practice to publics not present. While researchers are scientific witnesses observing sociotechnical practices, journalists report on sociotechnical practices experienced by others. However, very few scientists "have 'seen for themselves' or 'directly witnessed' the experiments, the proofs, or even the raw data that support scientific claims. Scientific testimony, then, is usually a double-mediation" (Leach 2009[r], 183-184).

Within science and technology journalism in Norway, the Internet has been popularized according to two cultural master frames or master narratives: the utopian master narrative that contains the pro-innovation position (Hetland 2015[r]) and the technology-as-risk master narrative that contains the control position (Hetland 2012[r]). These two master narratives are well known in PCST (Perrault 2013[r]). However, seldom are the master narratives dominating science and technology journalism compared with the master narratives popularly used by researchers as authors. A study of how climate science is presented in Norwegian newspapers compared the master narratives of journalists with those of researchers and found that, while journalists dramatize, researchers try to avoid over-dramatizing (Ryghaug 2006[r]). Researchers find popularization important; however, they are troubled by journalists' preoccupation with sensationalism and being overly dramatic (Carlsen, Müftüoglu, and Riese 2014[r]; Gunter, Kinderlerer, and Beyleveld 1999[r]; Petersen et al. 2009[r]; Ryghaug 2006[r]).

The dominant view of popularization from the 1990s stated that it involved at best "appropriate simplifications" for the lay public (Hilgartner 1990[r]; Suerdem et al. 2013[r]). PCST is perhaps the area in which the linear communication model is most clearly reflected. This strong position of the linear model is likely linked to the scientist's role as a teacher and to the motive for educating the public (Peters 1995[r]). "Obviously, experts in many cases want to take the translator role on themselves while journalists assume this role to be theirs" (Peters 1995[r], 43). However, the relationship between science, technology, and the media is changing. The importance of the media in technoscience is intensifying, even if the media may have less influence on technoscience than on other parts of society. Consequently, the technosciences' media connection also has important repercussions (Rödder, Franzen, and Weingart 2012[r]).

Technoscientific issues that the public experiences as transformative will typically appeal to various publics and to different stakeholders and will most likely be used to test established boundaries. This is especially true when the technoscientific innovation reconfigures the human communication environment. The public's sensitivity to different technoscientific issues may also vary greatly. Some issues are "hot" even before they are placed on the mass-media agenda (Callon 1998[r]; Epstein 1996[r]). In a discussion about the "threat society" and the media, Nohrstedt (2010[r], 26, emphasis in original) claimed that "*when a risk is politicized, it tends to be formulated as a threat*." Threats therefore exploit people's uncertainty and anxiety. This distinction is interesting and gives the media an important role, elucidated by the concepts of *mediation and mediatization* (Ampuja, Koivisto, and Väliverronen 2014[r]). According to Nohrstedt, while mediation implies dissemination of information, mediatization implies "something more, namely, that the problem or danger is created *in and by* the media" (2010[r], 41, emphasis in original). The different master narratives and their accompanying positions may therefore also be examples of mediatization processes in and by the media. People are

often not aware of problems or opportunities before the media dramatize them and give them content. Mediatization of an issue "implies that its representation is changed into a form that suits media interest best, and that journalists as professionals are best at, namely to get public attention through emotional messages, dramatic angles and visual images" (Nohrstedt 2010[r], 26). This discursive practice also represents a move away from "reasoned argument" (Davies 2014[r]).

The public communication of scientific and technological knowledge will be studied with the overall aim of understanding how researchers differ with journalists in the way they portray technological change when they popularize research about the Internet. The first part of the article is a theoretical discussion that provides an overview of popularization and the implications of retrospective and prospective understandings of technological change, including technological expectations; it aims to combine the two using framing theory. The second part discusses the methodology and then analyzes the case of popularization when researchers write in the mass media about a new technology, such as the Internet, focusing on researchers' feature articles (*kronikker*) in two national newspapers in Norway. The last part of the article summarizes the analysis and links it to the broader discussion of PCST.

Theoretical and Conceptual Issues

Concerning popular science rhetoric, Perrault (2013[r]) claims that science and technology are popularized according to three different models: public appreciation of science and technology (PAST), public engagement with science and technology (PEST), and critical understanding of science in public (CUSP). The PAST model is characterized by a one-way flow of information from the scientific sphere to the public, in which science is a black box, reading is uncomplicated, knowledge is boosted, and a deficit exists only on the reader's side. The PEST model conceives of PCST as a conversation open to dialogue; however, this model still separates science and society and locates the center of gravity in science. The CUSP model of PCST considers all the elements of science-in-society, including their interactions, to be worth scrutinizing. The CUSP model offers four advantages: First, it has a "relational" focus; second, expertise is multiple; third, it focuses on the twin duties of PCST to inform and educate while probing and criticizing; and fourth, it matches the reality of the public's views of science, which combines public enthusiasm and public criticism (Perrault 2013[r], 12–17). These three models imply three different roles for science and technology popularizers: boosters, translators, and critics. In this context, the CUSP model is of special relevance. Modern society increasingly relies on researchers as experts. Peters states that researchers as public experts combine two interesting aspects: researchers as (policy) advisors and researchers as public communicators (Peters 2014[r]). Expert advice may take the form of public dramas (Hilgartner 2000[r]) or technological dramas (Pfaffenberger 1992[r], 285). Pfaffenberger claims that a "technological drama is a discourse of technological 'statements' and 'counter-statements.'" Through this means, experts provide general knowledge and usually aim for rational decision making (Peters 2014[r]).

As mentioned above, Internet journalism has used two master narratives: the utopian master narrative that contains the pro-innovation position (Hetland 2015[r]) and the technology-as-risk master narrative that contains the control position (Hetland 2012[r]). Regarding the former, the research questions ask how different actors or chaperones are enrolled in popular texts to substantiate a specific framing in the portrayal of the Internet by the Norwegian press, how a position is transformed into a bias, and how such a bias is constituted. Regarding the second master narrative, the research questions ask how the expectancy cycles related to the Internet fluctuate in the mass media and how the narrative of control contribute to the domestication processes of the Internet. This is a study of 2,772 newspaper articles written by journalists about the Internet from the print editions of the Norwegian newspapers *Aftenposten* (morning edition; 1,334), *Dagbladet* (813), and *Dagsavisen* (625) from 1995 to 2006. The criteria for selecting an Internet article were those used by Bader (1990[r]) in a case study of articles on research. One of Bader's (1990[r]) criteria was that roughly half of the article should discuss the object of the study. Correspondingly, one criterion was that the Internet should be a central theme of the article; in other words, at least half of the selected article should deal with one or more sets of potentials or problems concerning the Internet. The selection of articles was also based on the following criteria: 1) the article has a word count of at least two hundred, 2) the Internet is mentioned in the headline or the introductory text, and 3) the text was written by a journalist — all types of journalists, not only science and technology journalists. Excluded from the text corpus were short news reports, editorials, debates, and feature articles by researchers and longer feature articles by journalists with a mix of positions. Over the twelve-year period studied; the pro-innovation position characterized 68.7 percent of news stories, while 31.3 percent of news stories were characterized by the control position. The pro-innovation position was promoted through either praise or blame, while the control position was promoted through individual, social, technological, and institutional control. The master narrative of control is an interesting example of how risks are politicized, in that the media not only formulate the threats but also their solutions. The same is true for the pro-innovation master narrative; the media not only formulate opportunities, but also promote them. A third master narrative would have been possible: the dystopian master narrative containing the anti-diffusion position. This master narrative is well known from the study of other technologies, such as nuclear

power or genetic engineering (Bloomfield and Doolin 2012[r]; Bauer 2015[r]). In a study of how journalists portray the Internet, however, it was not possible to find this master narrative in its pure form (Hetland 2012[r]). When it appeared, it was a position for which "others" were spokespersons, such as more totalitarian regimes.

The three master narratives are linked to anticipatory action, thereby creating expectations (Brown, Rappert, and Webster 2000[r]). Expectations usually have a temporal pattern (Borup et al. 2006[r]), which is well illustrated by the popularization of the Internet (Hetland 2012[r]). Expectations are important in order to "mobilize the future into the present" (Brown and Michael 2003[r]), and there is even a business in promoting technological expectations (Fenn 2007[r]; Pollock, and Williams 2010[r]). However, while expectations are future-oriented, influencing the shaping of technology and innovation, the scientific discourse of technological change tries to understand what has happened or might happen. Technological change is either understood as continuous, characterized by an on-going evolution, or as discontinuous, characterized by smaller and larger revolutions (Basalla 1988[r]; Bragesjö, Elzinga, and Kasperowski 2012[r]; Kuhn 2012[r]; Rogers 2003[r]). Thus, while the journalists often situate their arguments within a prospective understanding of technoscience with strong elements of what might be called "folk theories" (Brown, Rappert, and Webster 2000[r]; Green 2004[r]; Rip 2006[r]), researchers will usually situate their arguments within a scientific discourse. This article will study how retrospective and prospective understandings of technological change influence the roles of researchers as popularizers and expert witnesses. Expert witnesses do not mediate sensory experiences acquired by presence; they mediate the results of intellectual work (Peters 2011[r]). Consequently, the media play an important role in the production and circulation of knowledge and interpretations of science and technology (Hjarvard 2013[r]; Väliverronen 2001[r]). One may even claim that the media have become what Latour (1987[r]) calls an obligatory passage point for researchers that act as public intellectuals, some even becoming "celebrity scientists" (Fahy 2015[r]; Goodell 1977[r]; Kalleberg 2012[r]). "Public intellectuals do not work solely within a *professional culture* of other credentialed experts. They also work within a broader *public culture* that includes experts from other fields, journalists, writers, critics, and citizens" (Fahy 2015[r], 12, emphasis in original).

To study how researchers portray their and/or others' research about the Internet, the model that William A. Gamson and his colleagues (Gamson and Lasch 1983[r]; Gamson and Modigliani 1987[r]) constructed was adopted. The purpose of the model is to analyze how this repertoire is used to describe particular aspects of a phenomenon (see also Hetland 2012[r]; 2015[r]). The model has two principal constituents: frames and positions (Gamson and Modigliani 1987[r]). Metaphors, exemplars, catchphrases, depictions, and visual images are framing devices, whereas roots, consequences, and appeals are reasoning devices for a more general position (Gamson and Lasch 1983[r]). Chaperones—spokespersons, users, celebrities, witnesses, experts, and authorities—are enrolled in the text to support claims (Hetland 2015[r]; Morgan 2011[r]). This article is concerned with two crucial master narratives within PCST that are used on a wide array of technoscientific issues with wide cultural implications. One may even claim that they represent two well-embedded cultural narratives (Ihlen and Nitz 2008[r]). The two different understandings of technological change are dialectic. As Gamson and Modigliani (1989[r], 6) stated, "There is no theme without a countertheme." This countertheme or counterframe attempts to undermine or redefine the interpretative framework (Benford and Snow 2000[r]). While many of the framing devices are important for understanding popularization, the reasoning devices for a more general position are important for understanding the researchers' roles as expert witnesses. The core frame is essential to establish a relational focus with the reader and to inform and educate. The core position outlines the role of expertise, which may be a multifaceted rather than a unitary construct. In this respect, the root analysis will represent the underlying approach to technological change. The core position will also represent the expert advice offered by researchers. In this regard, contextualization and the production of socially robust knowledge (Gibbons 1999[r]; Nowotny, Scott, and Gibbons 2001[r]) are important elements of the core position.

Consequently, while the journalists often situate their popularization of technology within narratives of expectations, technology popularization by researchers is often situated within a more general discourse on technological change, making the role of the researcher resemble what Haraway (1997[r]) called a "modest witness," a guarantor of scientific validity. This guarantor role also makes the modest witness vulnerable if the claims are proven false (Haran and Kitzinger 2009[r]). Witnessing is about taking risks, since: "Witnessing is seeing; attesting; standing publicly accountable for, and psychically vulnerable to, one's visions and representations. Witnessing is a collective, limited practice that depends on the constructed and never finished credibility of those who do it …" (Haraway 1997[r], 267).

Journalists use researchers as expert witnesses to comment on on-going events in a complex society. Usually, journalists act as the initiators (Wien 2013[r]). Presently, in both Denmark and Norway, researchers from the social sciences and humanities are the dominant expert witnesses in the media (Carlsen, Müftüoglu, and Riese 2014[r]; Wien 2013[r]). An earlier study from Norway showed that in 1966 PCST was dominated by the natural sciences. By 2006, however, there was a more equal distribution between different academic disciplines (Andersen and Hornmoen 2011[r]). A meta-analysis of studies on the media's coverage of science, studying 215 publications selected from the Social Sciences Citation Index among a preliminary sample of more than 4,000 publications found that scholars mostly analyze media coverage of the natural sciences and neglect social sciences and humanities (Schäfer 2012[r], 658). On the other hand, studies indicate that the gap

between the humanities and social sciences and the media is much smoother than the gap between the natural sciences and the media (Peters 2013[r]). Research about the Internet in Norway involves a broad array of disciplines; thus, we will at least avoid the bias of focusing only on natural science in the media (Trench and Bucchi 2010[r], 2). Public attention to science and technology—or rather the various media's attention to science and technology—fluctuates over time. This fluctuation varies according to changing societal contexts and endogenous factors in the operations of technoscience (Bauer 2012[r]); issue-specific fluctuations are also linked to the domestication processes of specific technologies (Hetland 2012[r]).

Data and Methods

This article examines popularization when researchers write in the mass media about a new technology, such as the Internet, compared with journalists' popularization. The journalists' portrayal of technological change is presented in two earlier articles (Hetland 2012[r]; 2015[r]). Consequently, the present presentation of data and methods concerns researchers' feature articles in two national newspapers in Norway: *Aftenposten* and *Dagbladet*. A previous study of eighty-five feature articles written by researchers from the University of Oslo in the period from 2002 to 2003 indicates that about eighty percent of the feature articles have "research-based argumentation" (UiO 2004[r], 9). The remaining feature articles were mainly related to university or science policy. Research-based argumentation incorporates one's own or others' research into the text to support the arguments (Latour 1987[r]), and it is also important to look at popularizations in a similar manner (Kuhn 2012[r]). Although the feature articles were connected to current issues, they were marked by the researchers' disciplines (Løvhaug 2011[r]). Thus, for the present study, feature articles with research-based argumentation were selected.

Subsequently, as a study of journalistic texts, this paper applied the criteria from Bader's case study of research articles (Bader 1990[r]) to establish the requirements for qualifying a feature article as communicating research about the Internet. For this study, the criterion was that the Internet should be a central theme in the feature article. This meant that, as a rule, at least half the feature article took up one or more sets of prospects or problems concerning the Internet. Studies of Norwegian PCST for the period from 1998 to 2000 have estimated that each university faculty member wrote an average of 2.1 self-reported popular articles and made 1.4 self-reported contributions to public debate (Kyvik 2005[r]). However, during the selection of feature articles for further study, it was more or less impossible to distinguish between popular articles and contributions to debate, since most of the articles were a combination of both. If shorter letters to the editor had been included, it would have been easier to identify contributions to debate that were not also popularizations (Hetland 2002[r]).

The database Atekst (Retriever) was used to select the feature articles. From the many Norwegian newspapers contained in this database, *Aftenposten* and *Dagbladet* were selected. *Aftenposten* is Norway's largest newspaper and has been described as having an independent conservative orientation. *Dagbladet* is Norway's second largest tabloid newspaper and has been described as being liberal. Each day, both newspapers have a feature article written by an author not affiliated with the newspaper. The features are long, in-depth articles in which the author may address an interesting topic in about 6,000 characters (including spaces). Of the feature articles selected for this study, fifty were from *Aftenposten*, and thirty-six were from *Dagbladet*. The two newspapers publish an estimated[1] 5 – 15 percent of the feature articles they receive every day. These newspapers were selected because they have national coverage aimed at the general public, allow the longest feature articles, and were digitized for the period between 1995 and 2012[2]. All relevant feature articles on research about the Internet during the period studied were retrieved. The study covers eighty-six feature articles from 1995 to 2012. The author wrote one of the feature articles; however, it was not included among those selected for more detailed study.

Feature articles from Atekst were retrieved in several steps, using a selection procedure to ensure that all relevant feature articles were included. The search string "internett AND (placement: kronikk OR articletype: kronikk OR placement: debatt OR articletype: debatt) AND wc: >200" for the mentioned sources and period produced 1444 articles in June 2013. To limit the number of articles, each article had to have a word count of at least two hundred. Then, each article was screened individually. If a feature article conformed to the criteria discussed above (the author/s as researcher/s, research-based argumentation, and the Internet as a central theme of the feature article), it was included in the final text corpus. All the eighty-six selected feature articles were then transferred to HyperRESEARCH, a program for Computer Assisted Qualitative Data Analysis (CAQDAS). HyperRESEARCH is useful for organizing, managing, and analyzing a textual corpus of this size. First, each feature article was coded in an experimental manner to "think-up" from the data and facilitate a repeating comparison of the texts gathered (Hesse-Biber and Dupuis 2000[r]). *After* this first coding, all the eighty-six feature articles were coded according the following coding scheme (Table 1).

1 Personal communication with the two editors.

2 Dagbladet is only partly digitized for 1995, and I had to do a manual search to retrieve all relevant feature articles for that year.

Category	Variables/Dimensions
Newspaper	Aftenposten/Dagbladet
Author	Gender/Discipline/Affiliation
Topic	Internet Only/Internet and Social Media/Internet and Gaming
Chaperones	Number/Type/Role
Master Narrative	Pro-Innovation/Control/Anti-Diffusion
Reader Engagement	Emotional Messages/ Reasoned Arguments
Internet Publics	Users/Producers
Actors and Artifacts	Boundary Distinct/Blurred
Approach to Technological Change	Continuous/Discontinuous
Approach to Popularization	PAST/PEST/CUSP
Approach to Policy Advice	Specific/General

***Table 1**. Coding Scheme*

It is crucial to remember that the thematic focus of the selected feature articles is a result of both the messages that the researchers wish to convey and the editors' selection process. In this article, the focus will be on the actual texts. Writing up the three presentations "Technological Change Communicated," "Technological Change as Continuous," and "Technological Change as Discontinuous" enabled the sorting of cases and selection of typical and illustrative text elements for the analysis. Consequently, these three presentations will also explain the content of Table 1 in more detail. In Norway, the concept of PCST includes communication of the social sciences and humanities. The author did all the translations from Norwegian to English.

During the period studied, three large research programs from The Norwegian Research Council framed much of PCST activities deriving from information and communication technology (ICT) research. These programs have been crucial in setting the agenda for communicating research about the Internet and its relevance to Norwegian society. The first program was the *Social and Cultural Preconditions for ICT* (1998–2002). Among its objectives was "to develop knowledge and expertise improving public policy and the policy of industry concerning new ICT" (NFR 2003[r], 4). The second program was *Communication, ICT and Media* (2003–2007). This program called for research to be "action-oriented and contribute to policy making and public debate, providing input to the regulation, organization and coordination of ICT, telecom and media policy" (NFR 2002[r], 8). The third program was *Core Competence and Value Creation in ICT* (2005–2014). One of its objectives was to produce "research results that are used by trade and industry and that benefit the development of society" (NFR 2010[r], 5). All together, these three programs have funded close to four hundred projects, thereby strongly influencing the agenda of research about ICT and the Internet and, consequently, PCST within the same field.

Technological Change Communicated

The number of feature articles varied over time. Figure 1 illustrates the timeline pattern of feature articles communicating research about the Internet.

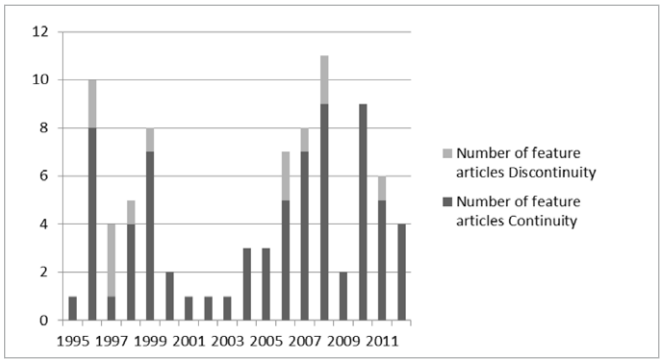

***Figure 1**. Number of feature articles from 1995 to 2012 (N=86).*

Two waves are identified. The first wave indicates the novelty of the Internet, while the second wave indicates the arrival of two new topics: social media and gaming. However, this article aims to study master narratives, not issue-specific narratives.

Popularization is done by presenting stories using a wide variety of elements. Some stories may contain all of these elements, and all stories contain some of these elements. The eighty-six feature articles have one or more authors and a total of 104 authors (counting repeat authors every time they appear). Ten of the authors have written more than one feature article. Of the total group of authors, 22.1 percent are from the science, technology, engineering, and mathematics (STEM) disciplines, including medicine; 68.3 percent are from the social sciences and humanities; and 9.6 percent are from law. Furthermore, 80.8 percent are men, while 19.2 percent are women. Finally, 77.9 percent are from the higher education sector, including all universities and university colleges,

while 22.1 percent are from the institute sector or other independent institutions. Chaperones are enrolled in the texts, and each feature article has an average of 3.6 chaperones. The chaperones mostly consist of references to scientific texts, in addition to research projects, policy papers, politicians, "the man on the street," and other participants in the public debate. Policy and politics are made relevant. However, it was clear from the first reading that, in general, researchers are rather soft-spoken when it comes to giving policy advice.

The following sections will examine how popularization is handled when technological change is understood first as continuous and second as discontinuous. The feature articles are classified into one of these two understandings, depending on how the authors framed technological change in the actual texts. About 85 percent of the feature articles framed technological change as continuous, while about 15 percent framed technological change as discontinuous.

Technological Change as Continuous

The first feature article in the sample that discussed the Internet was published in December 1995. In an article entitled "The Internet Is Far from Indispensable" (*Aftenposten*, 13.12.1995: 15), the two authors, both from the Department of Informatics at the University of Oslo, set out to "dispel the myth that if you as an individual are not connected to the Internet, you will be left behind in society." Authors adhering to continuity contrast their understanding with the understanding of technological change as discontinuous. One well-known participant in this debate stated in his feature article that, "In many comments, it may seem as if one perceives the Internet as a kind of volcanic land mass that blows up in international waters, a terra incognita where no law prevails, a kind of cybernetic counterpart to the lawless, Wild West. This is incorrect" (*Aftenposten*, 27.09.1996: 15). Within this understanding, the Janus face of technology is highlighted. On the one hand, the Internet represents new digital divides and facilitates different sorts of addictions and criminal acts. On the other hand, it is represented as important to use the Internet and to allow it to become a part of our literacy and institutions. The actors who use the Internet are understood as democratic participants, and there is a clear distinction between actors and artifacts. Some actors constitute a threat to democracy and to other users who follow social norms and Norwegian laws and regulations. However, these rules also apply to "villains" and the "addicted." New technology and digital literacy are increasingly used to regulate and control activities on the Internet and to handle different types of risks and challenges. All in all, it is the social life of "real life" that is important within the continuity perspective.

Within this frame, it is important that all citizens participate and have access to the public sphere and are not "duped by experts' fuzzy speech" (*Dagbladet*, 10.12.1996: 42). Open access to information is therefore vital. Since participation in public dialogue is important, several contributors emphasized that we are in no hurry to innovate because "as long as we try to be the very first in technological change, we have no way to take a break, and we end up as slaves instead of innovators" (*Dagbladet*, 25.08.1998: 3). The importance of expertise is often highlighted in the continuity argument, describing various challenges such as different types of addictions, crime, violence, parental regulation and control, access to information, information overload, commercialization, old and new monopolies, intellectual property rights, and user-unfriendly solutions. This view emphasizes the need to develop our expertise to handle these challenges both as users and as a society. Criticizing the technophiles is crucial, but public authorities do not do enough to face these challenges and to understand and solve the problems. On the one hand, the "Internet amplifies, makes invisible and promotes the power of the cultural elites" (*Dagbladet*, 27.11.1999: 52), while on the other hand, our politicians "confess a lack of knowledge" (*Dagbladet*, 19.04.2005: 38). New solutions should be user friendly; however, they are often the opposite. For example, the government is criticized for making its new public information service a "flop." One author claimed that the government "should find its place on Facebook" where the users are (*Dagbladet*, 13.10.2007: 48).

This view understands the risk of the Internet along a continuum from "the Net is not as dangerous as many believe" (*Aftenposten*, 02.01.2004: 12) to "the threat of a massive cyber-attack represents in many ways the quintessence of a global risk society" (*Aftenposten*, 13.12.2004: 8). Innovation, policy, and politics are often introduced as conflicting issues such as freedom and/or control, intellectual property rights and/or open access, and information and/or knowledge. Often, the author does not provide any concrete answer and instead appeals for more debate and more democracy. Society may also lack the necessary knowledge (or research) to make good decisions. Sometimes, the author provides more explicit policy advice, such as the need for more user-friendly technology, the need for more parental involvement, the importance of skilled use of cryptography, and the improvement of digital literacy. However, the policy advice provided is rather general and allows for a wide range of options. Underlying these proposals is the possibility of concretizing the policy options through a democratic process. Each feature article of the continuity type has an average of three chaperones enrolled in the texts.

Technological Change as Discontinuous

Authors adhering to discontinuity contrast their understanding with the understanding of technological change as continuous. Within discontinuity, opposing views are examples of technophobia that "permeates Norwegian society, and makes us unable to meet the challenges of the digital revolution" (*Dagbladet*, 29.02.1996: 34). Young people play an important role within this understanding, as they represent change and the future, and although they may become seduced and addicted, they generally represent positive values and constitute a "media lab for the future" (*Dagbladet*, 17.02.1997: 41). Here, technological change is understood as a series of revolutions. The revolutionary aspect means that the frames of

reference and rules change significantly. According to one author, "Modernity's relatively stable representation of identity is no longer adequate when the subject is played out in cyberspace. It is not fruitful to adopt an extremely optimistic or pessimistic attitude.... Information technology is decisive and penetrating – but the man on the street uses information technology in his own way" (*Dagbladet*, 15.03.1996: 34). Enrollment of actors is done by statements such as, "We are becoming citizens of the new Net community. We are all cyborgs (a mixture of human and machine) in love with our prostheses: computers, the Internet, and virtual reality," and "Those who can navigate the electronic highways will be the winners in the information society" (*Dagbladet*, 29.02.1996: 34). Consequently, the boundaries between actors and artifacts become blurred, and the artifacts become prostheses for the actors. Opposing actors are perceived as "Gutenberg's agents," promoting out-dated understandings. Within this framework, social life unfolds in cyberspace, and the users make their own rules.

Within this framework, the users are the experts who acquire their expertise by being active on the Internet. They "are not only innovators, but cultural shepherds" (*Aftenposten*, 22.07.1998: 11). Expertise is constituted by use and activity. To understand technology use, one must look to young people. New types of expertise are crucial, and young people are the forerunners in this respect. The researcher's role is to interpret the challenges we are facing, and the establishment is the target of criticism. ICT research is too technically oriented, and we lack competent people to handle the interface between users and technology. It is therefore important to partake in the development of the new society "by speculating about the kind of society that emerges ... [as] there is less danger of being overwhelmed when the questions arise in their full potential" (*Aftenposten*, 31.08.1997: 11). The different sectors of the public are not only users, but also producers within this new regime, and new skills are becoming more important. Statements such as, '"We must learn to navigate the culture's digital field" (*Dagbladet*, 29.02.1996: 34), "the man on the street uses information technology in his own way" (*Dagbladet*, 15.03.1996: 34) and "learning in the information society should be oriented towards a communicative competence and emphasize transformation, change and complexity" (*Dagbladet*, 17.02.1997: 41) imply the responsibility and creativity of users and indirectly imply the importance of the users' "digital literacy." The incentive is that new skills and competence might create competitive advantages. Young people are innovators and are often made into pioneers in a (post)modern society in which participation is important. The authors' approach to innovation is marked by statements such as "www might be a killer application" (*Dagbladet*, 15.03.1996: 34). An average of 6.9 chaperones are enrolled in the text of each feature article of the discontinuity type.

Discussion

This article set out to explore how researchers differ from journalists when popularizing Internet issues. The most important conclusion is that researchers situate their popularization in research-based argumentation framed by two opposing understandings of technological change, while journalists situate their popularization in argumentation framed by two opposing understandings of technological expectations. So, while most researchers emphasize "facts" as modest witnesses, journalists emphasize expectations, as media witnessing is not only about reporting on observations, but also about interpreting them. These two different "world views" also lead most researchers to emphasize continuity, while most journalists emphasize what is going to happen. Consequently, researchers' communications about research are quite modest and strongly influenced by continuity. Most researchers seem worried about the narratives promoted by journalists (and some of their colleagues) and many see it as their mission to present a more sober picture of technological change. However, some of the researchers adopt more "journalistic approaches" in their popularization activities, particularly regarding the understanding marked by discontinuity. This might, however, also represent a move away from purely "reasoned arguments" and towards a more engaging discursive practice (Davies 2014[r]). In general, it seems that while journalists dramatize, researchers try to avoid over-dramatizing (Carlsen, Müftüoglu, and Riese 2014[r]; Ryghaug 2006[r]). However, this is too simplistic a portrayal of the difference. Following the earlier theoretical discussion, the findings might be illustrated as in Figure 2.

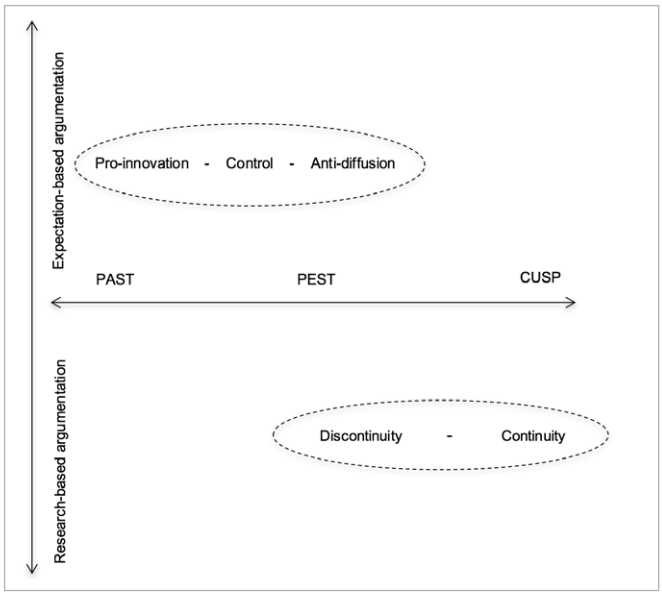

***Figure 2**. The technology popularization field.*

The technology popularization field is structured in two dimensions: (1) from public appreciation of technology (PAST) via public engagement (PEST) to critical understanding of technology in public (CUSP) and (2) from expectation-based argumentation to

research-based argumentation. While most journalists' contributions are situated closer to expectation-based argumentation, those of most researchers are positioned closer to research-based argumentation. Within the trichotomy of pro-innovation, control, and anti-diffusion, most journalists position their contributions close to the PAST model (the pro-innovation position), while some journalists position their contributions closer to the PEST and CUSP models (the control position). Along the dichotomy of discontinuity and continuity, most researchers position their contributions closer to the CUSP model (continuity), though some researchers position their contributions closer to the PEST model (discontinuity). One may consequently claim that mediatization processes are primarily driven by the media and not by researchers. Most researchers attempt to curb the mediatization processes acting as public intellectuals and do not aim for visibility for its own sake (Fahy 2015[r]; Goodell 1977[r]; Kalleberg 2012[r]); they are primarily concerned with communicating both reliable and socially robust knowledge (Nowotny, Scott, and Gibbons 2001[r]). Consequently, the role of the modest witness seems to be a crucial part of the professionalization of the research profession, and the "authority of the modest witness paradoxically stems from the appearance that authorship itself disappears" (Leach 2009[r], 189).

The strong standing of the role of the modest witness also makes the CUSP model the natural choice in science and technology communication. Including law, 77.9 percent of the researchers/authors are from the social sciences and humanities, and this certainly does not reflect the number of active researchers within the field. Either social sciences and humanities are more likely to be selected by editors, and/or they are simply more active in popularizing research and partaking in public debate, and/or writing feature articles is closer to their core activity. Another possible interpretation is that the modest witness has an even stronger stance within the natural sciences, and that being silent is the ultimate expression of this modesty. The fact that the social sciences and humanities, including law, are more active in science and technology mediation, interpretation, dissemination, and explanation activities is an important development in recent years. When it comes to communicating everyday technology compared with science, one aspect of witnessing may easily be overlooked. Both journalists and researchers are witnessing the diffusion of a new technology into society, and at the same time they are using the technology in question. This double perspective on witnessing may frame which questions are asked (Hetland 2002[r]) and how the two faces of witnessing are put into play. As mentioned, ten of the researchers have written more than one feature article. When interviewing six of the pioneer journalists within Internet journalism in Norway, several of them were concerned with the problem that some experts easily get "a season ticket from us and are allowed to speak again and again and again" (Hetland 2002[r], 118-119). One of the names mentioned was the late writer and law Professor Jon Bing, the only one of the feature article authors who had a name among a variety of publics and who was the closest to being a "celebrity scientist" (Fahy 2015[r]).

The two dominant understandings of technological change direct PCST along two different trajectories, and, as Pfaffenberger (1992[r], 285) claims, we experience a discourse of technological "statements" and "counterstatements." The most important distinctions between the continuity and discontinuity frames are found in their rhetorical approach toward technological innovations and their diffusion. While continuity emphasizes Internet participants as users and citizens in a deliberative democracy, discontinuity emphasizes them as pioneers and producers contributing, collaborating, or co-creating a new future. While continuity most clearly allows for a more critical understanding of technological change, discontinuity is usually positioned closer to public engagement with technology when it comes to understanding technological change. Green (2004[r]) outlined a model of the rhetorical theory of diffusion of innovations that emphasizes the number of justifications and the level of "taken-for-grantedness" supporting technological claims. Over time, the number of justifications decreases while the level of taken-for-grantedness increases (Green 2004[r], 656). One interpretation of this might be that when the "revolution" and "transition" become facts, what remains is normal science and puzzle-solving (Kuhn 2012[r]). However, this model must be understood in a given context. If, in their own view, the insiders promote an approach to diffusion of innovations that is controversial, the need for justifications is stronger. The discontinuity approach is more radical than the continuity approach, and resistance to it may be experienced as stronger. Insiders will therefore use stronger rhetorical tools to justify their claims by referring to more chaperones supporting the claims made. Thus, those arguing for continuity enrolled an average of three chaperones per feature article, whereas those arguing for discontinuity enrolled an average of 6.9 chaperones per feature article. A similar difference was found between the master narratives of pro-innovation and control in journalists' articles (Hetland 2015[r]), although it was not as distinct as the difference between the researchers' texts. In particular, those arguing for discontinuity present the readers of feature articles with arguments supported by a network of actors and artifacts. The chaperones bear witness to the claims made by both researchers and journalists.

As previously mentioned, utopian master narrative containing the pro-innovation position characterized 68.7 percent of the journalistic stories, and 31.3 percent of the stories were characterized by the technology-as-risk master narrative containing the control position. The dichotomy in researchers' portrayal of research about the Internet was instead marked by how to understand technological change. About eighty-five percent of the feature articles characterized technological change as continuous, while about fifteen percent characterized it as discontinuous. The third master narrative, the dystopian master narrative containing the anti-diffusion position, was not found in this study among either journalists or researchers. The conflict between continuity and discontinuity is most apparent when a new issue-specific frame arrives; consequently, discontinuity flourishes when it can ride a new wave of innovation. Researchers who adhere to continuity use discontinuity

as their counterframe, emphasizing that the competing master narrative represents a problem and/or misunderstanding and vice versa. Thus, the rhetoric used in the diffusion of innovations may also be perceived as an important element in what Rogers (2003[r]: 169) called the knowledge and persuasion stages. At the "knowledge stage," the individual is "exposed to the innovation's existence and gains an understanding of how it functions," while at the "persuasion stage," the individual forms a "favorable or unfavorable attitude towards the innovation." Apparently, the role of the less modest witness is more easily played both by journalists (Hetland 2012[r]) and by researchers at the knowledge stage, while the role of the modest witness is played at all stages and increases in strength toward the confirmation stage.

Competing for grants from The Norwegian Research Council, researchers may see the role of a modest witness as important for professional success, because feature articles not only communicate downstream (toward the more "popular" publics), but also upstream (toward fellow researchers and the actors shaping the scientific research agenda). According to Haraway (1997[r]), the modest witness offers epistemological and social power to those who embody it, including recognition and perhaps public funding for research. However, fifteen percent of the feature articles were framed in a less modest way. One reason for this may be that there is no consensus among researchers about the importance of the modest witness. Some researchers may perceive it as important to be less modest, simply because they find what they describe as "technophobia" problematic; they see the new technology as decisive and believe it is important to partake in the development process in a more radical manner. As with the rationale behind the modest witness, one can also claim that being a less modest witness might pay off for those competing for research grants and research contracts from other public entities as well as the private sector. This is especially true since the field of Internet and ICT research involves both more funding by actors outside the traditional academic arena and a greater variety of funding options within The Norwegian Research Council.

Finally, another aspect of popular science that "troubles" some of the authors is underlined by Fleck's (1935/1979[r]: 115, emphasis in original) understanding of "textbook science" as *"[c]ertainty, simplicity, vividness originat[ing] in popular knowledge"*. That is where the expert obtains his faith in this triad of knowledge. Therein lies the general epistemological significance of popular science." Popular narratives may consequently be perceived as a battle between different views about what is going to count as valid knowledge. Thus, some researchers are troubled by researchers acting as modest witnesses, since the role of modest witness also might exemplify a conservative element within present academia. "Modesty" implies a diminishment of the revolutionary aspects of technological change and the fact that some technological innovations are disruptive. Researchers adhering to both continuity and discontinuity focus on the twin duties of PCST to inform and educate while probing and criticizing (Perrault 2013[r]). However, the polarized framing of continuity versus discontinuity hardly informs and enlightens readers about Internet innovations and their consequences.

The two different understandings of technological change also guide the need for expertise along two different trajectories. Within the continuity frame, the need for expertise is perceived as less urgent. Policy advice is therefore often limited to encour aging debate and an active deliberative democracy. Within the discontinuity frame, users' roles are perceived as more important in shaping a new technology. Yet here, too, researchers are rather soft-spoken about specific policy advice; in this respect, they also adhere to the ideal of the modest witness. Being a witness is about taking risk, and this is most apparent when giving policy advice – thus both groups of researchers minimize risk taking. Reading the three research programs' emphasis on policy development, the space for being less modest is most likely larger than either groups of researchers experienced. The CUSP model aims to inform and criticize; however, sometimes the critical approach creates barriers to a more informed learning process. Consequently, the critical approach must be matched with a more constructive approach that gives the reader a better understanding of technological change in general.

Acknowledgement
I am most grateful to Joan Leach at the Australian National Centre for the Public Awareness of Science, as well as the two anonymous reviewers, for their helpful comments to earlier versions of this article.

Per Hetland (PhD) is Associate Professor at the Department of Education, University of Oslo. His research activities cover four research fields: a) public communication of science and technology, b) design, development, and use of information and communication technology, c) studies in innovation, research and education, and d) local employment systems and informal learning.

References

Allan, Stuart, Alison Anderson, and Alan Petersen. 2005. "Reporting Risk: Science Journalism and the Prospect of Human Cloning." In Risk, Trust and Uncertainty, edited by Sean Watson and Anthony Moran, 165–180. London: Palgrave.

Ampuja, Marko, Juha Koivisto, and Esa Väliverronen. 2014. "Strong and Weak Forms of Mediatization Theory: A Critical Review." Nordicom Review 35 (Special Issue): 111–123.

Andersen, Elisabeth K., and Harald Hornmoen. 2011. "Mediating Science in Norway: Practices and Transformations in Major Newspapers." Media Transformations 5: 88–104.

Bader, Renate G. 1990. "How Science News Sections Influence Newspaper Science Coverage—A Case Study." Journalism

Quarterly 1: 88–96.
Basalla, George. 1988. The Evolution of Technology. Cambridge: Cambridge University Press.
Bauer, Martin W. 2012. "Public Attention to Science 1820-2010—A 'Longue Durée' Picture." In The Sciences' Media Connection - Public Communication and its Repercussions, edited by Simone Rödder, Martina Franzen and Peter Weingart, 35–57. Dordrecht: Springer.
Bauer, Martin W. 2015. Atoms, Bytes & Genes—Public Resistance and Techno-scientific Responses. New York: Routledge.
Benford, Robert D., and David A. Snow. 2000. "Framing Processes and Social Movements: An Overview and Assessment." Annual Review of Sociology 26 (1): 611–39.
Bloomfield, Brian P., and Bill Doolin. 2012. "Symbolic Communication in Public Protest Over Genetic Modification: Visual Rhetoric, Symbolic Excess, and Social Mores." Science Communication 35 (4): 502–527.
Borup, Mads , Nik Brown, Kornelia Konrad, and Harro van Lente. 2006. "The Sociology of Expectations in Science and Technology." Technology Analysis & Strategic Management 18 (3–4): 285–298.
Bragesjö, Fredrik, Aant Elzinga, and Dick Kasperowski. 2012. "Continuity or Discontinuity? Scientific Governance in the Pre-History of the 1977 Law of Higher Education and Research in Sweden." Minerva 50: 65–96.
Brown, Nik, and Mike Michael. 2003. "A Sociology of Expectations: Retrospecting Prospects and Prospecting Retrospects." Technology Analysis & Strategic Management 15 (1): 3–18.
Brown, Nik, Brian Rappert, and Andrew Webster. 2000. Contested Futures. A Sociology of Prospective Techno-Science. Aldershot: Ashgate.
Bucchi, Massimiano. 1998. Science and the Media. Alternative Routes in Scientific Communication. London: Routledge.
Bucchi, Massimiano, and Brian Trench, eds. 2008. Handbook of public communication of science and technology. Milton Park: Routledge.
Callon, Michel. 1998. "An Essay on Framing and Overflowing: Economic Externalities Revisited by Sociology." In The Laws of the Market, edited by Michel Callon, 244–269. Oxford: Blackwell Publishers.
Carlsen, Benedicte, Ingrid B. Müftüoglu, and Hanne Riese. 2014. "Forskning i media: Forskere om motivasjon og erfaringer fra medieintervjuer." Norsk medietidsskrift 21 (3): 188–208.
Cheng, Donghong, Michel Claessens, Nicholas R.J. Gascoigne, Jenni Metcalfe, Bernard Schiele, and Shunke Shi, eds. 2008. Communicating Science in Social Contexts: New models, new practices. New York: Springer Science+Business Media B.V.
Davies, Sarah R. 2014. "Knowing and Loving: Public Engagement beyond Discourse." Science & Technology Studies 27 (3): 90–110.
Dunwoody, Sharon. 1999. "Scientists, Journalists, and the Meaning of Uncertainty." In Communicating Uncertainty: Media Coverage of New and Controversial Science, edited by Sharon M. Friedman, Sharon Dunwoody and Carol L. Rogers, 59–80. New York: Lawrence Erlbaum.
Epstein, Steven. 1996. Impure Science—AIDS, Activism, and the Politics of Knowledge. Berkeley: University of California Press.
Fahy, Declan. 2015. The New Celebrity Scientists: Out of the Lab and into the Limelight. Lanham: Rowman & Littlefield.
Fenn, Jackie, and Mark Raskino. 2007. Understanding Gartner's Hype Cycles. Gartner Inc.
Fleck, Ludwik. 1935/1979. Entstehung und Entwicklung einer wissenschaftlichen Tatsache: Einführung in die Lehre wom Denkstil und Denkkollektiv (Eng. tr. Genesis and Development of a Scientific Fact). Chicago: University of Chicago Press.
Gamson, William A., and Kathryn E. Lasch. 1983. "The Political Culture of Social Welfare Policy." In Evaluating the Welfare State: Social and Political Perspectives, edited by Shimon E. Spiro and Ephraim Yuchtman-Yaar, 397–415. Paris: Academic Press.
Gamson, William A., and Andre Modigliani. 1987. "The Changing Culture of Affirmative Action." Research in Political Sociology 3: 137–77.
Gamson, William A., and Andre Modigliani. 1989. "Media Discourse and Public-Opinion on Nuclear-Power. A Constructionist Approach." American Journal of Sociology, 95(1): 1–37.
Gibbons, Michael. 1999. "Science's New Social Contract with Society." Nature 402 (Supp): c81–c84.
Goodell, Roe. 1977. "The Visible Scientists." The Sciences 17 (1): 6–9.
Green, Sandy E. 2004. "A Rhetorical Theory of Diffusion." Academy of Management Review 29 (4): 653–669.
Gunter, Barrie, Julian Kinderlerer, and Deryck Beyleveld. 1999. "The Media and Public Understanding of Biotechnology: A Survey of Scientists and Journalists." Science Communication 20 (4): 373–394.
Haran, Joan, and Jenny Kitzinger. 2009. "Modest Witnessing and Managing the Boundaries between Science and the Media: A Case Study of Breakthrough and Scandal." Public Understanding of Science 18 (6): 634–652.
Haraway, Donna J. 1997. Modest_Witness@Second_Millenium. FemaleMan©_Meets_OncoMouse? New York: Routledge.
Hesse-Biber, Shalene, and Paul Dupuis. 2000. "Testing Hypotheses on Qualitative Data: The Use of HyperResearch Computer-Assisted Software." Social Science Computer Review 18 (3): 320–328.
Hetland, Per. 2002. "Unmasking the Net: When Technology Communication Turns to the Public." Nordicom Review 23 (1–2): 109–124.
Hetland, Per. 2012. "Internet between Utopia and Dystopia: The Narratives of Control." Nordicom Review 33 (2): 3–15.
Hetland, Per. 2015. "Popularizing the Internet: Traveling Companions Supporting the Good News." Nordicom Review 36 (2): 157–171.
Hilgartner, Stephen. 1990. "The Dominant View of Popularization: Conceptual Problems, Political Uses." Social Studies of Science 20 (3): 519–539.
Hilgartner, Stephen. 2000. Science on Stage: Expert Advice as Public Drama. Stanford: Stanford University Press.
Hjarvard, Stig. 2013. The Mediatization of Culture and Society. London: Routledge.
Ihlen, Øyvind, and Mike Nitz. 2008. «Framing Contests in Environmental Disputes: Paying Attention to Media and

Cultural Master Frames.» International Journal of Strategic Communication 2 (1): 1–18.

Kalleberg, Ragnvald. (2012). Sociologists as Public Intellectuals and Experts. Journal of Applied Social Science, 6(1), 43–52.

Kuhn, Thomas S. 2012. The Structure of Scientific Revolutions. Chicago: The University of Chicago Press.

Kyvik, Svein. 2005. "Popular Science Publishing and Contributions to Public Discourse among University Faculty." Science Communication 26 (3): 288–311.

Latour, Bruno. 1987. Science in Action: How to Follow Scientists and Engineers through Society. Milton Keynes: Open University Press.

Leach, Joan. 2009. "Scientific Witness, Testimony, and Mediation." In Media Witnessing: Testimony in the Age of Mass Communication, edited by Paul Frosh and Amit Pinchevski. London: Palgrave Macmillian.

Lewenstein, Bruce. 1995. "Science and the Media." In Handbook of Science and Technology Studies, edited by Sheila Jasanoff, Gerald E. Markle, James C. Peterson and Trevor Pinch, 343–359. Thousand Oaks, CA: Sage.

Løvhaug, Johannes W. 2011. "Overlæreren i rampelyset: Universitetet i mediesamfunnet 1970–2011." In Universitetet i Oslo 1811–2011, edited by John P. Collett. Oslo: UNIPUB.

Morgan, Mary S. 2011. "Travelling Facts." In How Well Do Facts Travel?, edited by Peter Howlett and Mary S. Morgan, 3–39. Cambridge: Cambridge University Press.

NFR. 2002. Kommunikasjon, IKT og medier (KIM): Programplan. Oslo: The Norwegian Research Council.

NFR. 2003. Samfunnsmessige og kulturelle forutsetninger for IKT (SKIKT): Programstyrets egenevaluering. Oslo: The Norwegian Research Council.

NFR. 2010. Programplan 2005-2014 (Revidert februar 2010): Kjernekompetanse og verdiskaping i IKT - VERDIKT. Oslo: The Norwegian Research Council.

Nohrstedt, Stig A. 2010. "Threat Society and the Media." In Communicating Risks: Towards the Threat Society?, edited by Stig A. Nohrstedt, 17–51. Gothenburg: Nordicom.

Nowotny, Helga, Peter Scott, and Michael Gibbons. 2001. Re-thinking Science: Knowledge and the Public in an Age of Uncertainty. Cambridge: Polity Press.

Perrault, Sarah T. 2013. Communicating Popular Science: From Deficit to Democracy. New York: Palgrave Macmillan.

Peters, Hans P. 1995. "The Interaction of Journalists and Scientific Experts: Co-operation and Conflict between Two Professional Cultures." Media, Culture & Society 17 (1): 31–48.

Peters, Hans P. 2013. "Gap between Science and Media Revisited: Scientists as Public Communicators." PNAS 110 (Suppl 3): 14102–14109. doi: 10.1073/pnas.1212745110.

Peters, Hans P. 2014. "Scientists as Public Experts." In Routledge Handbook of Public Communication of Science and Technology, edited by Massimiano Bucchi and Brian Trench, 70–82. London: Routledge.

Peters, John D. 2001. "Witnessing." Media, Culture & Society 23 (6): 707–723.

Peters, John D. 2011. "An Afterword: Torchlight Red on Sweaty Faces." In Media Witnessing: Testimony in the Age of Mass Communication, edited by Paul Frosh and Amit Pinchevski, 42–48. London: Palgrave Macmillian.

Petersen, Alan, Alison Anderson, Stuart Allan, and Clare Wilkinson. 2009. "Opening the Black Box: Scientists' Views on the Role of the News Media in the Nanotechnology Debate." Public Understanding of Science 18 (5): 512–530.

Pfaffenberger, Bryan. 1992. "Technological Dramas." Science, Technology & Human Values 17 (3): 282–312.

Pollock, Neil, and Robin Williams. 2010. "The Business of Expectations: How Promissory Organizations Shape Technology and Innovation." Social Studies of Science 40 (4): 525–548.

Reed, Rosslyn. 2001. "(Un-)Professional Discourse? Journalists' and Scientists' Stories about Science in the Media." Journalism 2 (3): 279–298.

Rip, Arie. 2006. "Folk Theories of Nanotechnologists." Science as Culture 15 (4): 349–365.

Rogers, Everett M. 2003. Diffusion of Innovations. New York: Free Press.

Ryghaug, Marianne. 2006. "Some Like it Hot" - Konstruksjon av kunnskap om klimaendringer i norske aviser." Norsk Medietidsskrift 13 (3): 197–219.

Rödder, Simone, Martina Franzen, and Peter Weingart, eds. 2012. The Sciences' Media Connection—Public Communication and its Repercussions. Dordrecht: Springer.

Schiele, Bernard, and Anik Landry. 2012. "The Development of Science Communication Studies in Canada." In Science Communication in the World: Practices, Theories and Trends, edited by Bernard Schiele, Michel Claessens and Shunke Shi, 33–64. Dordrecht: Springer.

Schäfer, Mike S. 2012. "Taking Stock: A Meta-analysis of Studies on the Media's Coverage of Science." Public Understanding of Science 21 (6): 650–663.

Shapin, Steven. 1984. "Pump and Circumstance: Robert Boyle's Literary Technology." Social Studies of Science 14: 481–520.

Shapin, Steven, and Simon Schaffer. 1985. Hobbes, Boyle, and the Experimental Life. Princeton: Princeton University Press.

Suerdem, Ahmet, Martin W. Bauer, Susan Howard, and Luke Ruby. 2013. "PUS in Turbulent Times II—A Shifting Vocabulary that Brokers Inter-disciplinary Knowledge." Public Understanding of Science 22 (1): 2–15.

Trench, Brian, and Massimiano Bucchi. 2010. "Science Communication, an Emerging Discipline." Journal of Science Communication 9 (3): 1–5.

UiO. 2004. Formidling som Teller. Drøftingsnotat om Insentiver for Forskningsformidling. Oslo: University of Oslo.

Väliverronen, Esa. 2001. "From Mediation to Mediatization: The New Politics of Communicating Science and Biotechnology." In The Politics of Public Issues, edited by Ullamaija Kivikuru and Tarja Savolainen, 157–177. Helsinki: Department of Communication, University of Helsinki.

Wien, Charlotte. 2013. "Formidlere af faglige fakta eller samfundsdebattører? Om forskernes rolle i nyhedsmedierne." Nordicom Information 35 (1-2): 21–35.